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"To disseminate knowledge of the military arts and sciences, with special attention to mobility in ground warfare; to promote professional improvement of the Armor Community; and to preserve and foster the spirit, the traditions, and the solidarity of Armor in the Army of the United States."

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COVER

"It is becoming increasingly evident that the awesome lethality of the future battlefield, coupled with the quantitative superiority of enemy forces, is making the design and development of U.S.land forces a most monumental challenge," says Clifford D. Bradley. In his article beginning on page 36, Bradley, Chief of the Exploratory Division, TACOM, discusses the Future Close-Combat Vehicle Program.

LETTERS

Defends Airborne Armor

Dear Sir:

Second Lieutenant Dinackus' article in the September-October *ARMOR* Magazine, "Airborne Armor and Cavalry," apparently was written by someone who has very little understanding of the airborne armor and operations. Having served 2 years in the 4th Battalion (Airborne), 68th Armor as a staff officer and a line company commander, I feel qualified to respond to the comments about the airborne armor.

First, I would like to point out that the *Sheridan* gun/launcher system does everything that it was designed to do. In the 82d Airborne Division, the vehicle uses the Low Altitude Parachute Extraction System (LAPES) for Infantry, Army Training Diagnostic Programs (ARTDPs), Capabilities Exercises (CAPEX), and other mission-type operations. The battalion has deployed vehicles by LAPES, moved them to gunnery ranges, fired missiles at 3,000 meters, and obtained first round hits. The number of missile subsystem check "GOs" has been extremely high—well over 95 percent of the number of vehicles landed by LAPES. The missile system is checked out before and after a LAPES delivery to insure functioning of the missile subsystem. During its last gunnery program, the battalion fired 52 of 54 vehicles. The two vehicles that did not fire were down for automotive reasons.

The battalion has maintained a 92 percent or better operational readiness rate for the past 2 years—an accomplishment that is outstanding when compared to conventional armor units. Currently, the battalion's *M-551A1* fleet has had a Product Improvement Package (PIP) applied that has improved the battle worthiness of the vehicles. The PIP includes the *M-240* machinegun. This is hardly the vehicle that is "plagued by a multitude of problems" as Lieutenant Dinackus states.

The vehicles ability to perform its antiarmor role is not one of "a limited antiarmor capability" but one when integrated with the 82d Airborne Division "Airborne Antiarmor Defense" (AAAD) accomplishes the mission with both main gun and missile at ranges out to 3,000 meters plus. In the AAAD, all shots fired are flank and rear as the Threat moves into and through the Armor Kill Zone (AKZ). Long range shots are fired, to attrite the attacking force, prior to moving into hull down, defiladed positions. The *Sheridan* compliments the division's other antitank assets, the *M-72* LAW, *M-47 Dragon* (MAW), and the TOW (HAW). Airborne armor is also very capable of performing the traditional roles of armor; offense, defense, exploitation, and pursuit—and probably better than other armor formations due to the inherent speed and agility of the *M-551*.

Lieutenant Dinackus states, "Light armor companies must either be committed without infantry support...or the *M-551* must be employed in concert with foot-mobile airborne infantry..." The concept of combined arms is the basis for all training conducted in the 82d. The companies of the battalion train with the airborne infantry, and there are times when the tanks are restricted to the pace of the foot-borne infantry. If the mounted attack is the sole scenario for the offense, we are operating with a deficiency. But since most final assaults are probably going to be conducted with dismounted infantry sweeping the objectives, consolidating, and reorganizing on the objective along with tanks, then doctrine is being followed. Airborne infantry, mounted on the tracks moving by stealth and carried to the dismount point, are mobile. Armor training and airborne infantry operations are conducted by combined arms teams.

As to whether the battalion would be deployed as a unit, the possibility and probability do exist for complete deployment, i.e., when the division deploys, the armor battalion would be deployed as the division's airhead reconnaissance and security line and covering force. It could be deployed with one of the three infantry brigades forming a fourth task force. There are numerous situations in which the battalion would be deployed as a unit either with other forces or even separately.

Had Lieutenant Dinackus addressed the real problems of the airborne armor battalion he would have had a more relevant article. The battalion is faced with a shortage of personnel, PVTs thru SP4s, in MOS 19G and H, forcing the battalion to take 19D and 19E and train them to operate the *Sheridan*. Second, support personnel for the battalion, such as automotive mechanics and turret mechanics, are scarce. Fort Knox is not training personnel for the *M-551* anymore. Third, no questions were addressed to the shortage of airframes to move the battalion or any future formations. Finally, what about the Army's, or even the division's, ability to maintain an adequate flow of repair parts to any battlefield in any region of the world to support the armor battalion. If these questions had been addressed, this article would have had more bearing on the existence of the airborne armor battalion, or, for that matter, any future configuration that the author dreams up.

Considering the world's instability and unrest, especially in Latin America, Africa, and the Middle East, the first U.S. shot fired in the next conflict will more than likely be one fired from an *M-551A1 Sheridan* of the 4th Battalion (Airborne), 68th Armor of the 82d Airborne Division and not from some conventional armor or cavalry formation. "Airborne, All the Way."

TIMOTHY D. McCONAGHY
Captain, Armor
HHC, 82d Airborne Division

A Clarification of Airborne Armor

Dear Sir:

The article on "Airborne Armor and Cavalry," by Second Lieutenant Thomas D. Dinackus in the September-October edition misrepresents the capabilities, potential, and worth of the only airborne armor battalion in the free world.

His comment, " . . . the U.S. Army has yet to organize an effective armor element in the airborne division," is an outright falsehood, possibly driven by Lieutenant Dinackus' lack of knowledge regarding tested and proven airborne armor employment. As an airborne armor company commander, I feel qualified to respond to Lieutenant Dinackus' inaccurate assessment of an armored battalion that maintains a 92 percent, or better, operational rate and that can deliver armor and troops to any battlefield in a matter of hours!

If Lieutenant Dinackus would have pursued his research past a cursory glance at a Table of Organization and

Equipment he would have found hard facts concerning the success of 97 out of 99 Low Altitude Parachute Extraction System (LAPES) drops conducted by this battalion in the past 2 years. Of these 97 successful LAPES, 85 were found to retain both conventional and missile weapon systems in the "green" discrediting Lieutenant Dinackus' assertion that "the *Shillelagh/Sheridan* combination has been plagued by a multitude of problems." The reliability of the *M-551A1* has been further highlighted by the Product Improvement Package (PIP) recently installed in the fleet. The addition of the *M-240* coaxial machinegun and numerous improvements to the engine, suspension, and turret enable the *Sheridan* to remain a potent airborne assault vehicle.

He would have found also that his solution of "assigning responsibility to the... companies... equipped with the TOW missile," has serious drawbacks. Not only is the ¼-ton truck with TOW unsuited to offensive action, but it is highly vulnerable to Threat artillery barrage. The *M-551's* armored protection and convention as well as a missile capability make it a natural antitank as well as offensive weapon. The *Shillelagh* missile, with its 3,000-meter-plus range, has been found to be more effective against improved Threat armor than the *Dragon* or TOW missiles; hardly the "minimal contribution to the airborne combat capability" spoken of by Lieutenant Dinackus!

With a little more study, Lieutenant Dinackus would have realized that his proposed airborne cavalry squadron would overburden an already frail airborne availability and would also encounter unmanageable command and control problems. The capability of combined arms exists right now! Each of the three airborne armor line companies is aligned to one of the airborne infantry brigades as a part of the force augmentation package. The role of airborne armor is flexible enough to permit execution of missions encompassing everything from a covering force to screen line, in the offensive or defensive, while providing the brigade commander with a surprise punch on the flanks in the counterattack or pursuit role.

Lieutenant Dinackus would have found that his solution of substituting armored cars for the *M-551A1 Sheridan* also has serious drawbacks. In the offensive, an armored car lacks mobility in adverse terrain and lacks sufficient armor protection. One could validly question the worth of the untried 75-mm cannon against improved Threat armor. There is no doubt that the *M-551A1* has one of the best suspension systems ever made; that, combined with the improved engine cooling system, makes it even more maneuverable, dependable, and durable.

He would have been greatly surprised by the astounding flexibility of the 4th Bn, 68th Armor as proven during a recently conducted emergency Deployment Readiness Exercise, DRAGON TEAM 3-80. Acting as the opposing force against the 4th Inf Div (Mech), an airborne armor company air-assaulted into a desert environment and drew prestocked *M-60* and *M-113* series vehicles exercising the POMCUS scenario in a armor-rich Threat environment.

The role of the only airborne armor battalion is demanding as well as unique, consequently drawing a high caliber of trooper. It has proven its worth in countless evaluated situations and exemplifies the immediacy of armor. As an ex-cavalryman with the 3d Armored Cavalry Regiment, I recommend that Lieutenant Dinackus concern himself with operational, transport, and mobility problems with that unit, rather than one with which he is totally unfamiliar.

BOB D. MACKENZIE
Captain, Armor
B/4-68 Armor

Cavalry's Traditional Role Endangered

Dear Sir:

Why are divisional reconnaissance elements the heaviest units in the division, with (36) tanks, (18) TOW vehicles and (18) *Dragon* tracks?

Divisional cavalry squadrons now possess almost as much firepower as an Armor battalion and an Infantry battalion combined. With these assets available, the urge to stand and slug it out becomes extremely hard for commanders to pass up. As defined in FM 17-95, "The Cavalry's Basic Task is Reconnaissance and Security."

Why are we being saddled with a 60-ton tank and a *CFV* that is as tall as a barn, when all we need are the *Sheridan*-type light tank and a small scout vehicle. I believe that by upgunning the Cavalry, we are slowly being wooed away from our traditional role as "Snooper Poopers," into the role of the "Enforcer" of the division. If this is the case, the Army is losing a vital asset that will be hard to replace in the battle to come.

RANDY D. TATUM
Captain, Armor
C/3-7th Cavalry

An Author Replies

Dear Sir:

I would like to make the following points regarding Mr. Dave Marash's reply to my article on his treatment of the *XM-1* tank on the ABC News program, "20/20."

I watched the program very closely and took copious notes while the program was in progress. I believe that I quoted Mr. Marash accurately. However, I readily accept the blame for misspelling his name.

It is true that Mr. Marash said a number of good things about the tank, but the tone of the program seemed negative on the whole. Your readers are the experts and as far as I am concerned they are the best judge as to which of us attempted to present a fair and objective view of the *XM-1* issues.

I won't try to debate points with Mr. Marash. To paraphrase him, he had his sources and I had mine. Mine were officers and noncommissioned officers with firsthand knowledge of the *XM-1*. As for the officer who was quoted about Mr. Marash having "his generals," that source was an Infantry lieutenant colonel who has since retired—an officer I know well and one whom I respect and believe.

What makes his (Marash's) letter objectionable is his accusation of a sneak attack. My article was responsive to his program. Who attacked whom?

DAVID C. HOLLIDAY
Lieutenant Colonel (Ret), Armor
Elizabethtown, KY

Correction

Dear Sir:

Request the following correction be printed concerning the French Armored Division that was described in your September-October 1980 issue. The material beginning at the top right of page 23 should read:

...these units will be formed from active army divisions and four will be created from service school personnel. This is done by retaining 85 percent of the *active* personnel in the *active* divisions and filling them with reservists who train with the division's subordinate elements in peacetime. Ten *reserve* divisions are formed with 15 percent *active* personnel from 10 *active* divisions and 85 percent reservists who have trained with the divisions in peacetime. The 10 *reserve* divisions in turn provide 15 percent of their reservists to the 10 *active* divisions.

This correction is necessary because the term *"active personnel"* includes not only careerists but also draftees who are serving their 1 year mandatory tour of active duty.

ARNAUD P. LOUBENS
Colonel, French Army
Liaison Officer to the USAARMC

World War III: 1985

Dear Sir;

As a National Guard officer and a past RA officer, *ARMOR* Magazine has certainly become a large part of my continuing education. I read each issue cover to cover and generally reread some sections. Keep up the same general format and diversification of material.

Also, I would like to hear some opinions from some of the ranking Armor officers about the book, *The Third World War; August 1985.* I think the hypothetical evaluation from the present to 1985 was extremely well done, believable, and fearfully, probably accurate. But, I would like to hear from some more fully informed people.

Keep up the good work!

ALBERT M. MCCAIG, JR.
Captain, Armor
Texas Army National Guard

Armored Vehicles for Rapid Deployment Forces

Dear Sir:

A series of articles in the September-October 1980 edition of *ARMOR* on light tanks and the Rapid Deployment Force caught my eye. Considerable controversy has been generated in the last few months concerning the need for an RDF, and the possibility of the inclusion of light armored elements in this force. The reasoning behind the introduction of the RDF armored element is simple. Since the RDF will encounter a potential enemy's armored units at some point in its deployment, the force must be prepared to counter this with the introduction of an air-transportable armored vehicle of its own.

We are aware, or should be aware, of the consequences of inserting a friendly air-transported force into an area dominated by enemy armored units. From WW II, we have the terrible lessons of what happened to the British First Airborne when it was dropped in the middle of the German II SS Panzer Corps rest area. The troops were landed without adequate antiarmor assets, poor communications equipment, and extremely faulty intelligence. Nevertheless they showed that they still could give a good account of themselves. Yet, the battle was decided from the moment the British arrived—without antiarmor assets in some form, light units cannot survive on the battlefield. The conclusion to be drawn is that the RDF must have a credible antiarmor force. The question then arises as to what type of antiarmor assets should be deployed.

The current *Cobra* gunships simply do not have the flying range to accompany troops that are being deployed in fixed-wing aircraft. Yet these same helicopters can provide just the type of mobile, accurate, antiarmor firepower needed in Threat environments of all intensities. A possible solution for providing the range of antiarmor helicopters could be the installation of in-flight refueling probes.

All the small tanks ever designed have suffered from one major problem that simply cannot be licked, given the trade-offs that are a necessary part of all armored vehicle designs, namely that of the number of crewmembers. Pity the poor commander of a two-man AFV who has to command his tank, act as gunner, and probably act as radioman as well. Multiply this a number of times when you consider the tank commander who is also the platoon commander, then multiply this, pity even more, when the vehicle is also the company command vehicle. The introduction of a third crew member would lighten the commander's tasks considerably, and a fourth crew member would make the job considerably easier. Unfortunately, for every crew member added, the weight, cubage and complexity of the vehicle takes a quantum jump in requirements; and, given the tendency to always add a little extra to make the vehicle more viable, it is almost certain that more complex and weighty equipment would be added to the vehicle until finally it approaches an MBT in complexity and weight.

The development of a modern light battle tank (LBT) *ab initio* would take a very long lead time, perhaps an unacceptably long lead time. It may prove to be more effective in the long run to develop an improved, interim version of the *T-92* (designed in the late forties and early fifties), with upgraded armor (chobham?); improved, but still uncomplicated sights, and other modern innovations to improve the basic design without exceeding by more than 10 percent the existing design parameters. Such a vehicle would benefit from an already completed design program, and upgrading by using similar components. The savings in both time and R&D costs would be large, and an effective vehicle would be in the RDF's inventory long before a purpose-designed modern LBT could become available.

A novel method of delivering the vehicle to the battlefield could involve the development of the "flying tank" concept that the Soviets experimented with before WW II. Basically, this consisted of a special framework and wing assembly that the tank fitted into. A TOW aircraft got the tank aloft, while the driver/pilot controlled the glider/tank combination from inside his vehicle. When the assembly was to land, the driver would rev his tank engine up, start the tracks turning, and land. According to various reports, the Soviets reached the test flight state for this combination and had staged a number of successful flights when WW II broke over the program, halting it.

On the subject of gliders and glider assemblies, we should also consider the development of special skeletonized gliders that would accept a standard module (say a 40-foot trailer body) that could be delivered to the battlefield and dug in with relative ease. Such modules could carry cargo, neatly preloaded and ready to go, workshops, command facilities, hospitals, and so forth. Once detached from the lifting assembly, the van bodies could be towed to their destinations or emplaced in pre-dug shelters. The lifting assemblies could then be recovered by use of the "snatch" technique that was developed during WW II and reinserted at a later date. The same lift assemblies could be used to extract high-priority van bodies in the event of an emergency (i.e., the shops, command centers, and so forth) in the same manner.

Perhaps this letter will stir up some comments on the material I have covered—I hope so.

ROBERT C. SMITH
Pennsauken, NJ

Lighter Than What?

Dear Sir:

The ground swell for light, fast armored vehicles is upon us again. The important question is, "Lighter than what?" Are we opposing light, fast armored vehicles or are we fighting *T-64s, T-72s, T-80s* or *T-90s?*

In the past, one of the arguments for the *M-551* was that it was air-transportable, air-droppable, and easier to move around the world. Unfortunately, few looked at a tank engagement range of 1,000-2,000 meters to see how the *M-551* stood up—not well! Terrain not weapon capability often dictates engagement ranges. We did a lot of fancy shuffling saying it was not a tank but an armored reconnaissance/airborne assault vehicle (AR/AAV). However, it looked like a tank, smelled like a tank, was manned by tankers, and attempts were made to employ it as a tank.

Various people look to light armored vehicles for their own purposes. DOD looks to strategic mobility and low cost. The fastest and easiest way to support worldwide commitments is to deploy infantry armed with spears. Unfortunately, this is only effective against other infantry, in not too large numbers, also armed with spears. Bows and arrows and crossbows would also be effective in some parts of the world. However, if I understand the areas of vital interest to the U.S., there are large enemy armored/mechanized formations located in them or nearby.

Someone's bright idea to solve the German tank problem in North Africa in World War II, was to field a ¾ truck with a mount and 37-mm antitank gun. It was cheap, fast, and totally ineffective. Also in WW II, some of the Polish cavalry on horseback were able to strike their sabers and lances on German armor. The cavalry was brave, light, relatively fast, and cheap, but likewise ineffective.

Any battle against the Soviets or their agents will be won by a combination of *firepower, mobility, armor protection,* and *supportability*. Like the principles of war these factors cannot be ignored without serious consequences.

The Soviets and their agents have a great deal of armor, artillery, and combat personnel. Our forces must be able to survive their direct and indirect fire. A popular theory going around before WW II was that the armies were going to fight a short war in a small, light, highly mobile fashion. The war was long and the winners were large, moderately heavy, reasonably mobile, and the war was won by logistical superiority.

We cannot afford to *lose* the next war *cheaply.* Our goal is to win by expending sufficient resources. One question we must ask concerning our mechanized force equipment is, "Lighter than what?" Please no more *M-551s.*

DALE K. BRUDVIG
Colonel, USA
Fairfax, Va

A Request for Information

Dear Sir:

I am a freelance writer who retired from the British Army in 1977 and I am currently writing a book about American tanks during World War II. The book entitled, *United States Tanks of World War II,* is to be published in the United Kingdom and United States by the Blandford Press of Poole, Dorset, U. K.

I have been commissioned to write the book in conjunction with the well-known artist, John Batchelor, whose works appear regularly in widely-circulated books and periodicals. The book will cover the major tanks and tank destroyers used in the war as well as tank production, basic organizations, and the employment of American tanks by Allied soldiers.

In addition to technical information about design and development of armored fighting vehicles, I will cover battle experiences, crew duties, maintenance, repair, and training. I intend to give the reader the most graphic impression possible of what it was like to be a member of a tank crew in battle.

I would like to correspond with ex-tankers of U.S. armor units, including those of the U.S. Marine Corps, regarding their battle experiences in any theater of war. Any help that ARMOR readers can provide will be very much appreciated.

LTC (RET) GEORGE FORTY
Barn Cottage
5, Briantspuddle
Dorset DT2 7HR
United Kingdom

"Flying Tanks"

Dear Sir:

I just completed reading the July-August issue and was extremely interested in the article "Flying Tanks" by Colonel Battreall and Major Riggins. Back in 1962, when *ARMOR* was running a "tank of the future" design contest I submitted a design similar to the concept now being discussed by the authors of the article.

The design was based on an elliptical hull pattern and featured several innovations now coming into vogue. It had twin lift fans, vented through armored louvers into a plenum formed by a ballistic nylon skirt, and featured externally-mounted, remotely-controlled armament with a dual feed automatic loading system. Coaxial armament was a .50 located between the ammunition feed chutes, which also formed the mount and elevating mechanism. Admittedly, the main armament, a 106-mm recoiless rifle, would not be effective now. However, at the time it was effective.

Fire control was by a direct-view optical system with ballistic graticules slaved to the elevation system and a remote sensor system fed through a television link.

I chose the recoilless weapon to reduce the recoil loads and enhance the stability of the platform. Because of the problems inherent in firing and moving cross-country through vegetation or on side slopes, my design had a set of retractable light tracks that could be lowered and utilized where forward thrust provided by vectoring of the armored grilles, or the side slip problem attendant to hilly areas would make suspended operation impractical. For stability and movement in the defense, to increase accuracy and lower visibility, the vehicle could also operate on the tracks.

Because of enhanced fire control detection means, and the technical problems inherent in an air cushion design, it will probably remain impractical to create a main battle tank based on an air cushion design. But, a lightweight, heavily-armed, lightly armored air cushion design could become a significant weapon system for recon elements of either the armored or infantry battalion. The high speed with which it could operate in favorable terrain, ability to engage heavy targets, and the ability to cover the gaps inherent in the "active defense" make it something to consider.

I am pleased that the Armor community has not totally abandoned the idea, particularly now that armor technology and advances in lift-fan and vectored thrust engines appear to have matured to the point that such a design is producible, given a mission statement and the desire to do so.

PHILIP C. GUTZMAN
Major, Armor
Belton, TX

Power to Weight Ratios

Dear Sir:

After reading Richard Ogorkiewicz's article in the July-August *ARMOR,* I have a few comments concerning the power-to-weight ratio of tanks.

My limited personal experience, going back to 1973, has convinced me of the need for quickness and agility in tanks. In a series of tests conducted by Combat Developments Experimentation Command (CDEC) in 1973 at Fort Hunter Ligget, CA, the 2d Battalion, 67th Armor tested various antitank guided missile systems, including TOW, *Dragon,* and *Swingfire.* Empirical evidence did not conclusively establish the need for a tank to go from "slow" to "fast" quickly, but it was the general consensus of those participating that the *M-60A1s* being used in the test were slow starting even though they had good battlefield mobility.

For a tanker to see an ATGM being launched or in flight is possible. Also, chances are good that a tank will run up on one of the smaller ATGM systems that has been placed well forward of enemy positions. In these and similar situations, the tank and the crew must react quickly or evasive actions will be ineffective and the tank and crew will be taken out of service.

I am firmly convinced that the quicker a tank responds to throttle pressure, the better the chances the tankers will have of surviving encounters with enemy missile systems.

The hydraulic [torque] converters and

fluid couplings presently in use in tanker transmissions do not lend themselves to rapid starts. However, a greater power-to-weight ratio and engines that can rev up faster can certainly help make up part of this limitation. Otherwise, I think we will be dealing with slow-motion reactions to fast-ball pitches.

ALBERT M. McCAIG, JR.
Captain, Armor
Texas Army National Guard

Light Antiarmor Weapons

Dear Sir;

In response to Mr. Backofen's article, "Shaped Charges Versus Armor—Part II," in the September-October 1980 issue, I would first like to commend him on the research that he obviously did for the article. However, I differ with his praise of light, antiarmor weapons requiring designated or dedicated gunners (i.e., *RPG-7s, Strim Fl, Carl Gustav M-2s,* etc.).

Since the military draft curtailment, the current manpower drawdown in our Army requires multiple functions of personnel, now more than in the past. An infantry squad cannot afford the loss of that lone rifleman who must act as an antitank gunner, or the additional burden of maintaining the extra associated equipment. Having a dedicated gunner could leave a squad with next to nothing against armor if that gunner becomes a casualty.

Disposable-launched weapons with simple training allows anyone to be a tank killer. There is no maintenance, and no burden after the expenditure of the round. The only real drawback with any of these weapons, and this includes the reusable type, is that they all have firing signatures which are so large that the user almost fears to use the weapon because it draws attention. When firing at ranges of 200 to 300 meters, that can be fatal. The only weapon which comes close to countering the signature problem is the German-designed *Armburst.* There is no flash, no smoke, and the noise level rivals that of a pistol shot, with little behind-the-weapon disturbance. This could go a long way in giving an infantryman the confidence to fire at a tank only 200 meters away by offering him a better possibility of going unnoticed. The *Armburst* may or may not be the ideal weapon, but it is a step in the right direction.

If a dedicated gunner must be chosen, the *M-203* grenade launcher is the best bet for light-armored targets though it could be improved. The *M-433* HEDP round still leaves something to be desired in the way of armor penetration and range, but it can handle BMPs and other thin-skinned vehicles. The range could be extended if a rocket-assisted projectile (RAP) were developed. I understand a 30-mm grenade launcher is being studied that can match the 40-mm grenade series' performance. If so, I would still opt for a RAP round allowing flatter shooting at mid-ranges, say 300 to 400 meters. The flatter trajectory is much more forgiving of range estimation errors and would increase the hit probability on point targets. Some of the better features of the current grenade launcher and hopefully, its replacement, are a very small firing signature, operating simplicity, and no reduction in the number of riflemen available in any unit to which it is assigned.

One final note—the weapon pictured at the bottom of the illustration on page 19 is a *Carl Gustav M-2,* not a *Panzerfaust.*

ALVIN L. SCOTT
Staff Sergeant, USA
HQ, U.S. Army Western Command
Fort Shafter, HI

SSG Scott is correct in his identification of the Carl Gustav M-2 developed by Sweden. However, ARMOR is also correct, in that this weapon is also used by FRG Army and is referred to as the Schwerer Panzerfaust (Heavy Antitank). Ed.

Another Wrong Vehicle

The wrong vehicle has influenced misuse of our recon units. We have given M-60s and TOW vehicles to our divisional cavalry units.

This gave them more firepower than their conventional armored cousins. The question is "What commander will pass up the firepower these new units offer and use them properly as cavalry, or yield to the temptation to use them as a regular armor battalion?" The answer is extremely few!

When this happens and the divisional cavalry squadron is engaged and takes casualties; the division commander has lost a vital intelligence gathering organization because it is otherwise committed. This will cause the squadron's reaction time to be much greater and result in its ability being downgraded by the casualties it has suffered.

The *M-60* and TOW vehicle brought on this tempting misuse of the divisional cavalry squadron; the *M-3* Cavalry Fighting Vehicle with its increased firepower, particularly its retention of the TOW missile system will only increase the temptation to misuse the divisional cavalry squadron. It is just another step in the wrong direction for the Cavalry.

DALE T. EWING
SSG
Troop A, 3/12 Cavalry

Questions "Nukes for Tanks"

Dear Sir:

As an artilleryman in the only Field Artillery battalion on Fort Knox, I look forward with great anticipation to receiving a copy of the *Field Artillery Journal.* Now for the first time, I've had a chance to read a copy of *ARMOR* magazine and I'm very impressed.

I found the July-August 1980 issue to be very informative and enlightening.

The article entitled, "Nuclear Rounds for Tanks," was a creatively concocted vignette obviously designed to elicit chuckles from any artilleryman.

I fully realize that the thrust of the article was technical and not logistical. But even if a milled-down 155-mm howitzer round could be made, and I'm not too sure it can, the management of the nuclear surety program as outlined in AR 50-5 and FM 100-50 would put prohibitive constraints on any Armor unit. The basic two-man control requirement would involve qualifying two men on every tank carrying nuclear weapons in the Personnel Reliability Program (PRP). Speaking from some experience in the PRP, I don't think that requirement could be met. Having to carry sealed authenticators and all the associated code books, checklists, inventories, and safes inside an already crowded tank presents so many problems as to preclude serious consideration of the idea of "Nukes for Tanks."

ROBERT L. GRUNERT
Sergeant First Class
Fort Knox, KY

They Like Armor

Dear Sir:

I inclose my payment for a 1-year subscription to *ARMOR* magazine. I also wish to congratulate you on the fine job you're doing. *Armor* magazine in my opinion, is one of the finest military publications in existence and always shows great concern for the military profession.

As one who's going into the Army soon and interested in being up to date in military affairs, your magazine provides me with an invaluable source of information and stimulation.

Keep up the excellent work!

PEDRO SANTIAGO GOMEZ
Puerto Rico

Dear Sir:

Though I am only 15 years of age, I am a 100 percent war-buff and consider a military career a much better choice than the regular way of life. Since I am trying to decide which branch of service to go into, I think your magazine would show me the equipment, way of life, and aspects of one form of the military.

BRIAN GILLIAM
Puyallup, Washington

COMMANDER'S HATCH

Louis C. Wagner, Jr.
Commandant
U.S. Army Armor School

In the July-August issue of the "Commander's Hatch", I outlined goals for the Armor Center and Armor School during my tenure. During my first 6 months here, I have been extremely impressed by the professionalism and hard drive of all personnel assigned to the Home of Armor and Cavalry. Unfortunately, we are unable to accomplish everything desired because of a severe shortage of personnel in nearly every area of interest at Fort Knox. This is not just a problem at Fort Knox, but at all TRADOC posts, and is the result of the ill-conceived reduction of military and civilian training personnel during recent years. The loss of personnel has caused a severe reduction in the institutional training that we can provide to basic Armor and Cavalry trainees, noncommissioned officers, and officers at Fort Knox.

It is interesting to note that the United States Army provides only about 25 percent of the institutional training for Armor noncommissioned officers compared to that provided by some other NATO countries for their NCOs. It would be nice to say this is because we are smarter trainers. Unfortunately, such is not the case. It is strictly a matter of personnel and dollar resources. The same can be said of our initial entry training, and basic and advanced officer courses. As a result, we are turning out enlisted men, NCOs, and officers who are not as well trained as units in the field would desire or that we, the trainers, would desire.

During my recent visits to CONUS units and to Germany, I had the opportunity to observe soldiers who were trained in our School system and talk to their commanders. All-in-all, I have been very excited by these visits. With few exceptions, commanders are enthusiastic about the capability of our units. There is a universal feeling that the Armor and Cavalry units can do their job and do it well, wherever and whenever called upon. The training I have observed in units is better conceived and executed than I have ever seen, including the time I was a platoon leader, company and troop commander, battalion commander, and brigade commander. In spite of the constant criticism of the Volunteer Army and our forces today by the uninformed, a lot of dedicated people are doing things better and better every day.

It comes to my attention frequently that receiving units expect more of graduates from the Armor School than we can provide. Unfortunately, we are unable to live up to your expectations in all areas, primarily because the lengths of courses at Fort Knox have been reduced. Given the available resources, I believe we are doing as well as reasonably possible to provide a graduate qualified to perform his job. Commander's manuals outline those tasks which must be taught by the unit to provide fully qualified tanker or cavalryman. We will be updating those manuals, including changing the title to "Trainer's Manual," in order to define clearly what is and what is not taught at the Armor Center and School.

To allay the fears of many who have been told that Advanced Courses were to be stopped as a result of the Review of Education and Training for Officers (RETO) study, I am happy to announce that General Meyer, Chief of Staff of the Army, has decided to let all Branch School Advanced Courses continue—at least until the entire school program is reevaluated in more detail. (An article regarding RETO begins on page 63. Ed.) There will probably be some changes in the program of instruction, but the course will continue as a permanent change of station assignment. After talking to students, instructors, and graduates of the Advanced Course, I have directed that an evaluation system be initiated to designate Honor and Distinguished Graduates for each class attending the course. The "GO—NO GO" concept for overall course completion had advantages, but just didn't provide the incentive and degree of competitiveness that I believe produces a better trained graduate. Students, and instructors in particular, favor an evaluation system. As soon as possible, we will also introduce a similar evaluation system in other courses. Eventually, I would like to reinstate a system of class standing—one that would at least tell a graduate in which third of his class he stood. I do not believe a competitive atmosphere has ever been a detriment to learning.

There are so many changes occurring in training, doctrine, tactics, and materiel that I cannot keep you up to date on everything through the medium "Commander's Hatch" articles because they appear only every 2 months. As a result, in January, I plan to begin sending Armor Center and School information letters on a monthly basis to leaders of mobile warfare units worldwide. These letters will cover a wide range of subjects, which I hope will be helpful in improving our units and aid in the implementation of the Chief of Staff's directive to standardize training, doctrine, and tactics.

Forge the Thunderbolt!

DRIVER'S SEAT

John W. Gillis
Command Sergeant Major
U.S. Army Armor Center and Fort Knox

Recently, I read a paper titled, "Reestablishment of NCO Power."

The title immediately aroused my interest, because I thought that, finally, someone had written something intelligent about accomplishing the reestablishment of NCO power, rather than about the continual, and still popular, rhetoric of how Vietnam had destroyed the *prestige* of the NCO corps; how our authority or power had *been taken* from us; how the Volunteer Army had continued this atrocity; and all that other verbage that I am absolutely sick of hearing and reading.

Much to my dismay, the opening paragraph made it obvious that this was not true. The paragraph read:

> "The widespread perception that NCOs are lacking in authority and are not utilized in responsible positions, acts like a cancer on the effectiveness of the present NCOs. The end result of this attitude leads to a rejection of the former responsibilities that the NCO performed in the pre-Vietnam era. After all, why should the NCO take the initiative when he feels that this is not expected of him. To reverse this trend, it is necessary to change the internal image that the NCO has of himself and rebuild his confidence as a leader who is responsible for the troops under his supervision."

My emotional response to the statement was unprintable . . . let me just say that I was extremely irritated. I also became extremely interested in the identity of the author of this brilliant piece of writing. It should surprise no one that the paper was published under the auspices of a big-time "Think Tank" and written by an expert on military matters who had no military service.

However, the paper had one redeeming factor. After reading it through, it reinforced my belief that the leadership of the United States Army and particularly the NCO Corps does not realize where we are *today* in dealing with the authority and responsibility of the noncommissioned officer. Consequently, these remarks will deal with that topic but not in the usual way. I am not going to preach about the authority that NCOs have, nor am I going to try to define their responsibilities. What I am going to do is tell you where I think we are after at least 5 years of attempted improvement in both areas.

If there is an NCO anywhere in the United States Army who does not know he has the authority he needs to perform his duty, he has been living in a cave! It is time NCOs rid themselves of their fixation with the idea that their authority is in jeopardy. It was true, but the key word is *"was"*...signifying the past tense—which is exactly where the lament for the NCOs lack of authority belongs—in the past.

The entire leadership of the Army, including brand new second lieutenants, preach the return of authority to the NCO; so much so that whether some NCOs want to believe it or not, they can't help but understand that they now possess that authority. The fact is that, today, complaining about the "NCO's loss of authority" has evolved simply into an excuse for failure. Notice I have tried to point out the NCOs *have* authority, but are not *using* it effectively. *Having* it and *using* it are two different things. However, having it is progress, and it is progress that should be recognized.

Permit me to discuss what I think keeps NCOs from effectively using their authority.

Everyone, at one time or another, has encountered the contention, stated in varying terms, that the lack of respect and distrust for authority that permeates America's society is also exhibited by its soldiers. I happen to believe that to be a fact.

However, I do not agree with the solution proposed by that segment of society who, though lacking in military experience, seem always to have the answer to our problems. That solution is founded on the belief held by psychologists, systems analysts, and management experts that authoritarian leadership is no longer an effective tool. Therefore, it is argued that in order to cope with the loss of respect for authority, NCOs must be taught to use persuasive leadership and communication methods that stress psychological principles.

We have been exposed to this theory for so long that some are beginning to take it as gospel. Consequently, NCOs are not using the authority they have because they are unsure as to whether authoritarian leadership is still an option.

I believe that today's soldier is looking for an authority figure and discipline. He is looking for the "NCO of Yesteryear" to follow. With this in mind, authoritarian leadership is an effective tool, *when used properly*. I have yet to meet a good squad leader, tank commander, or section sergeant that thought of their success with soldiers in terms of *authoritarian* leadership, *persuasive leadership,* or *psychological principles.* In fact, they have learned all three, in many cases without realizing it, because they are leading their soldiers in a manner to which each individual soldier responds.

There is something else that deters NCOs from effectively using their authority. Advances in weaponry have caused a trend in military education that has turned the NCO into a technician. This trend has permeated the bulk of the NCO corps. If you don't believe this, think about the authority the NCO exerts as a specialist in some weapon system, versus that which he exerts in demanding basic soldiering, discipline, and in fulfilling all those other leadership requirements of a noncommissioned officer. I think the comparison will help the reader understand the point I am trying to make.

I have emphasized a year-round skill qualification training program since 1977. One of the important reasons for doing this is to combat this "technician trend" by enhancing the instructional ability of the NCO. The instructional ability of the NCO is going to be determined by the success he has in training his soldiers. When the soldier looks to *his* NCO as the trainer that has taught him what he needs to know to pass his SQT test, he will also look to his NCO for all the other *instruction* he needs, or is looking for in his unit. An NCO's confidence that he can do what has to be done—and do it right—will result in returning the NCOs to the status of being NCOs first and technicians second and will improve their effectiveness in utilizing their authority.

My last example of why NCOs may not use their authority effectively concerns the often-voiced dissatisfaction in the Army about the present centralized promotion system. All of us have known the NCO who has said, "The hell with it," because big, bad DA did not select him for promotion. Much is said about the "bright" young NCOs who show greater potential than their older comrades but leave the Army because they are not willing to wait for years without an opportunity for advancement.

Spokesmen for the general public have said that we lose highly qualified NCOs while promoting the mediocre, that the worst part of centralized promotions is the time in service requirement, and that the system is not cost effective. These critics of the promotion system hold that the ability to perform should be the only criteria for advancement. What does this have to do with exercising authority? Plenty! Although the criticism is leveled by those who are often poorly informed about military matters, the young NCOs believe it—and who among them is going to step forward and exercise his authority if he holds such beliefs.

The system we have now does have inequities, but it is a lot better than the old one! I do not believe that the centralized system "often promotes the mediocre." First of all, it doesn't promote anybody. It only selects those for higher rank from among candidates whom the Army leadership has designated as being highly qualified. That leadership is us!! Secondly, all of us, in our infinite wisdom, look over each promotion list when it is published for names of those whom we know. If we know 10, one of whom we "know" to be a dud, all we talk about is how "DA promoted that turkey." Nobody talks about the selection of the other nine that we agree with; or at least say, "DA did a pretty good job, 9 out of 10 isn't bad."

The system does allow for promotion of the "bright NCOs who show greater potential than their comrades." It's called the secondary zone. I believe that the leaders at the decentralized level of promotions insure that these "bright" NCOs are promoted quicker when they reach the centralized system. We do a pretty good job of getting them promoted quicker than others when they deserve to become specialists 4, sergeants, and staff sergeants. As a result, they are considered sooner at DA than many of their "older comrades." "Ability to perform" should not "be the only criteria." Ability to *consistently* perform should "be the only criteria." This makes time in service a necessary requirement for earning promotion. Considering "cost effectiveness" for promotions is absurd. What is "cost effective" has absolutely nothing to do with promoting a leader who has the demanding responsibility for killing the enemy while carrying out the greatest responsibility of all—protecting the lives of his soldiers.

Confidence of NCOs in themselves, and the fact that they have the greatest impact on their own promotions, will revive their desire to use their authority.

I believe the NCO is now saying, "OK, I've got my authority back, I'm in a responsible position, so why don't they let me *do* what I'm responsible for?"

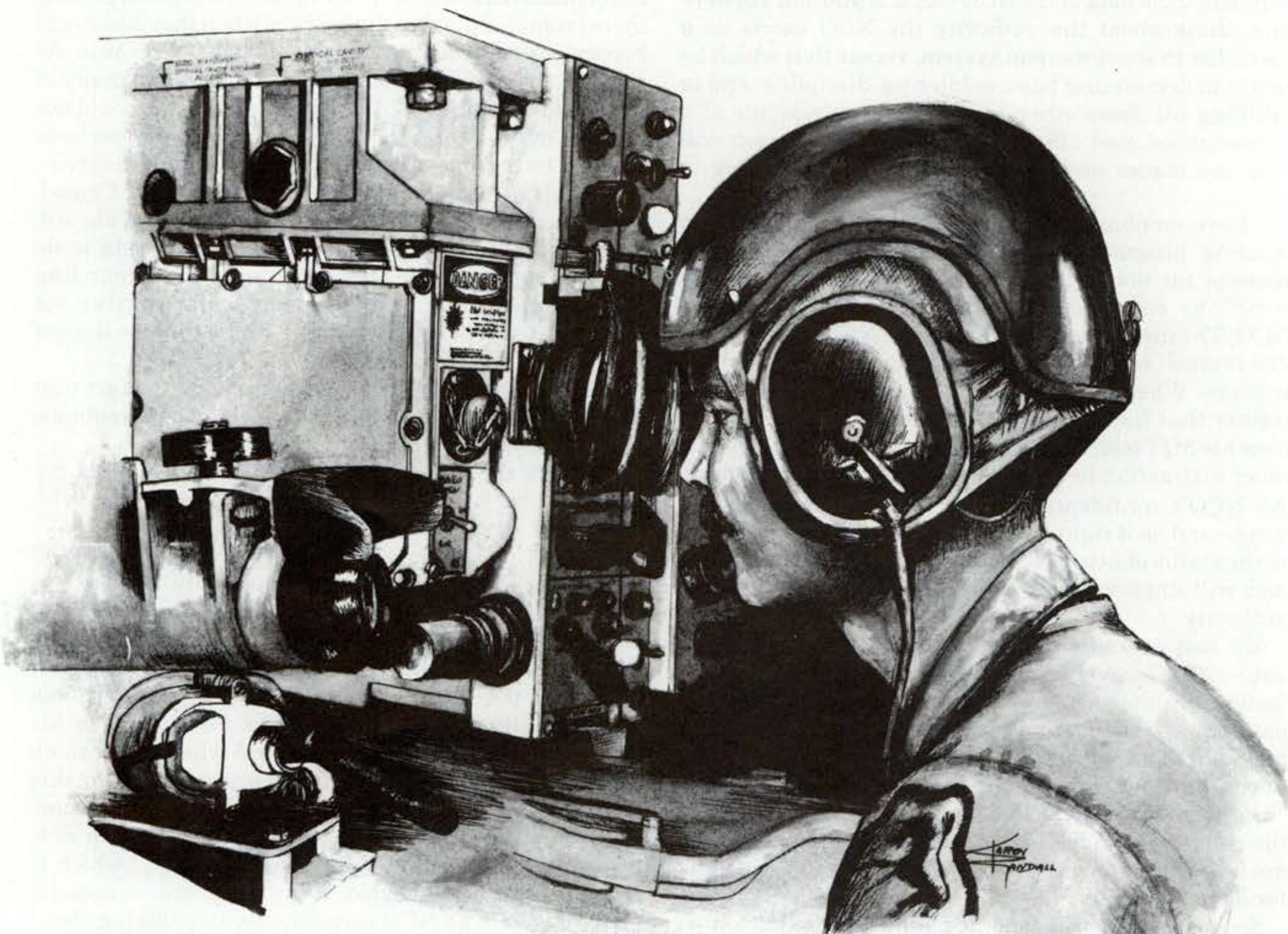
There is no longer a real or perceived loss of NCO authority. The NCO knows the authority is there. He knows he has it. The only truth today is that he may not be using it. So, we get him to use it by demanding that he fulfill his responsibilities. We put him in a position where he must use his authority to accomplish his responsibility, so the result will be *his* success or *his* failure and he knows he will control which. We can do that. In fact, we are at a very exciting point in this "reestablishment of NCO power." We have overcome the intangible "NCO loss of authority" and can now deal with the tangible "NCO responsibility," which is real and can be measured. That is a giant, successful step forward. The NCO corps should stop talking about where it was. It should stand up and be proud of where it is *today*. It should do so because no one gave its authority back, the noncommissioned officer corps took it back!

The NCO corps is proud. It should be. It's good!

John W Gillis

This is the first in a series of articles by the Command Sergeant Major, U.S. Army Armor Center that will appear as a regular department of Armor. "The Driver's Seat" was chosen as the title of the department because it is symbolic of the position noncommissioned officers occupy in matters pertaining to the training, morale, and discipline of the soldier. Ed.

MASTER GUNNER'S CORNER



The King-Carter Device

The 1st Battalion, 198th Armor, 155th Armor Brigade of the Mississippi National Guard is located in Amory, Mississippi. Approximately 250 miles from where the nearest range on which the tank commander's *M-85* .50 caliber machinegun can be fired. In the past, mechanical proficiency with the *M-85* was maintained by periodic disassembly, assembly, maintenance, and functional training. However, the unit experienced difficulty with gunnery technique such as simultaneous engagements, simply because tank commanders and crews lacked experience in realistic crew drill in using the .50 caliber.

The unit's weekend training site is much closer than Camp Shelby, but it lacks the depth for firing of the .50

caliber. Small arms fire is permitted, however, so the facility is used to fire annually individual weapons qualifications and tank Table V.

The unit solved the problems of low, or no, allocation of .50 caliber ammunition and lack of experience with the cupola mounted machinegun engagements with a subcaliber device that mounts on the *M-85*. Operational readiness specialists (ORS), King and Carter, developed the simple device, that bears their names. It is an *M-16A1* rifle mounted upside down with muffler clamps on the barrel of the *M-85*. The weapon is rigged to fire automatically, and uses the same *M-16* solenoid used with the *Brewster Device*. The solenoid is wired into the tank commander's .50 caliber electrical lead; therefore, the commander uses the same electrical firing controls that he would use to fire the *M-85*.

The *King-Carter Device* enables the unit to "enrich" Table V by adding simultaneous engagements. This gives the tank commander practice with the machinegun controls and drill in engaging more than one target. By firing on 1:20 scale targets and mixing tracer with ball ammunition in 30-round clips, scoring is accomplished easily. The device is easy to boresight with the tank commander's *M-36* periscope. In effect, the enriched Table V is nothing less than a modified Table VIIC.

The training advantage provided by Table VII that the enriched Table V lacks is mechanical experience with the machineguns. However, much of this experience is gained later while firing Table VI. By firing the enriched Table V followed by Table VI, the unit is better prepared to tackle Table VII, with or without having fired Table VIIC. Target engagement opening time by unit crews on Table VII has improved significantly since development of the *King-Carter Device*.

ORS personnel of the 1/198th Armor are responsible for other gunnery training innovations. Earlier fabrications include a 1:60 scale mini-range that enables crews to fire tank Tables I-IV inside the armories. This range complex was economically fabricated, using ammunition cans half filled with concrete for pop-up targets, painted target cloth and scrap lumber for the terrain model, and a used electric motor with a small reduction drive for the moving target pull mechanism.

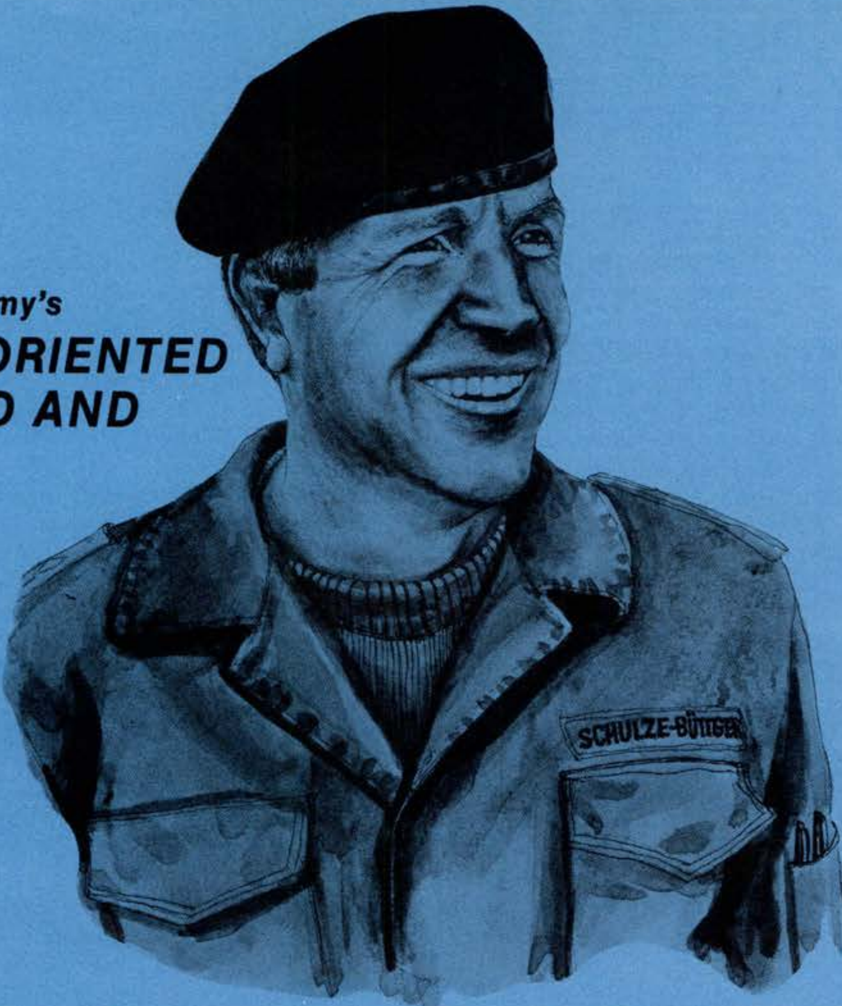
Reflective targets permit day and night firing with the *M-55* laser trainer mounted on the Brewster Device. Night firing is accomplished by blacking out the drill hall (where the firing tank is positioned) and using tank headlights for white light and infrared engagements.

The unit's shell illumination simulator is made of lightweight pipe in the form of a "T" with hanging drop lights. The lights are unshielded and unreflected to provide the battlefield illumination effect. Each drop light is controlled separately by a switch on a control board, and decreasing intensification is accomplished with a 110V AC dimmer switch. To avoid the hazard of carbon monoxide and the discomfort of exhaust fumes that would be generated by running the tank engine in the drill hall, the unit positioned a 4.2 KW (300 amp) generator (from an *M-577*) outside the armory and ran power for the turret through a cable to the tank slave receptable.

DANIEL E. REEVES
Captain, Armor, MSARNG
O & T Specialist

The German Army's

MISSION-ORIENTED COMMAND AND CONTROL



In the history of the German Army, *mission-type control* has always played a very significant role which has remained unchanged over the years. Field Marshal Erich von Manstein writes in his book *Verlorene Siege (Lost Victories):*

> "It has, at all times, been the special strength of the German military leadership to rely on the willingness of the leaders of all levels to assume responsibility, as well as on their self-reliance and initiative, and to promote these wherever possible. It was for this reason that the "directives" issued at the higher command level, and the orders given at the intermediate and lower command levels, contained, as a matter of principle, missions for the subordinate units. It was essentially due to this manner in which command and control was exercised that the German Army was able to score successes against its opponents, with whom any action to be taken by junior military leaders was, in most instances, defined by order down to the last detail."

Today, mission-oriented command and control is the determining command and control doctrine used within the German Army at all levels of command in both peacetime and war. This presentation will focus on illustrating what we understand by the term *mission-type control.* I will conclude my address by making some comments on the prerequisites for this command and control doctrine, its inherent risks, and the conclusions to be drawn therefrom.

In our view, mission-oriented command and control, i.e. *mission-type control,* is the most important intellectual foundation for enabling military leaders and the men placed under their command to exercise command and control and take action. German Army Regulation (HDv) 100/900 defines *mission-type control* as the tactical term *mission-oriented command and control* as follows:

> *"A command and control procedure within which the subordinate is given extensive latitude, within the framework of the intention of the individual giving the order, in carrying out his mission.*
>
> *"The missions are to include only those restraints which are indispensable for being able to interact with others, and it must be possible to accomplish them by making use of the subordinate's forces, resources, and the authority delegated to him.*
>
> *"Mission-oriented command and control requires uniformity in the way of thinking, sound judgment and initiative, as well as responsible actions at all levels."*

In this principle of command and control, the individual giving the order establishes, beyond all doubt, objective, direction, and restraints governing the action to be taken by the subordinate. He thus creates a framework within which the subordinate must discharge the command function vested in him on account of his substantive competence, and is supposed to make full use of it.

Exercising mission-oriented command and control constitutes a special challenge to the subordinate's willingness to share responsibility as well as to his creative ability and initiative.

Constraints affecting the freedom of action are imposed only to the extent they become necessary due to interaction with others. This requirement has been derived from the idea of combined arms combat in which the military leader is to employ units and weapon systems in accordance with their special features in order to achieve the maximum effect, using the forces in their entirety. The concept of combined arms combat requires that restraints and limitations be imposed on the next lower level of command, especially as far as territory and time are concerned.

Before establishing any objectives, i.e., assigning missions,

the individual giving the order must make a realistic assessment of the accompanying circumstances which are relevant to the subordinate, and must further examine whether forces, resources, and the authority delegated are adequate for the purpose of accomplishing the intended mission. Thus, it is an essential criterion of *mission-type control* to allow as much latitude as possible for accomplishing the mission.

This command and control principle becomes more intelligible if one pictures the objectives of the principle which constitutes the opposite way of thinking, i.e., detailed-order tactics.

Detailed-order tactics, consequently, are characterized by the fact that as little latitude as possible is granted in order to accomplish a mission in that all details of executing the mission are established by the superior level of command.

The advantages of detailed-order tactics might be seen in the central coordination of actions of even different levels of command, as well as in a presumed saving of time by precisely stating the course of action to be taken, and by achieving better control and a higher degree of influence at the intermediate stages.

In combat where situations change rapidly and a large number of incalculable factors prevail, we feel that the disadvantages outweigh the advantages. These disadvantages include:

- Erroneous planning due to the lack of substantive competence for the levels of command below the next lower one; not being familiar with the situation as it really presents itself.
- Little initiative displayed by the subordinates.
- Lack of flexibility.
- Time-consuming preparations in order to translate a new decision into action.

Thus, it is only sensible to remain true to the principle of mission-oriented command and control, i.e., *mission-type control,* and to make use of its following advantages.

- The subordinate shares in the "thinking process" within the scope of the next higher level of command.
- Provides education and training in developing the capability to act independently within the scope of the intentions of those giving the orders.
- Requires only a short period of time in order to translate intention and mission into action when passed down from one level of command to the next.
- Motivates the subordinate to show initiative and performance.
- Displays the substantive competence commensurate with the respective level of command.
- Having the opportunity to make full use of favorable developments in combat without delay—i.e. without having to wait for orders.

Permit me, now, to illustrate the basic concepts of *mission-type control* by using a tactical example.

Let us assume that "Divisonal Order No. 1 for Defense" is transmitted orally directly to a brigade commander in a division command post (CP). This order is subsequently forwarded in writing together with a graphic enclosure.

In this divisional order, the *mission* of the brigade is described which is the most essential aspect to be considered by the brigade commander in evaluating the situation and arriving at a decision. The mission is the very core of any order. It establishes the objective to be attained and must be worded in such a manner that it cannot be misunderstood. Even if the situation should have changed as compared to the situation which prevailed at the time when the order was given, the order given remains the guideline for any action to be taken by subordinates.

The second very significant aspect to be considered by the brigade commander is the *intention of the individual giving the order.* In paragraph 3(a) of the order (intention, including a briefly worded operational plan), the division commander has formulated his decision and briefly described the operational plan. In addition to stating the mission, i.e., the objective, he lays down, in expressing his intention, the operational framework for the brigade within which the major formation is supposed to operate.

Thus, the order, the intention of the leader, and his briefly-worded operational plan do not constitute "battlefield lyric poetry," but rather are the supporting pillars of *mission-type control.*

In future combat situations where high mobility and rapidly changing situations will prevail, the unforeseen will be the rule. No operational plan, no matter how detailed it may be, can fully take into account all imponderabilities of combat. What is all the more important, then, is the freedom of action which every level of command is allowed. Thus a subordinate, after evaluating the situation on the spot *and* being well aware of the intentions of the superior leader, can take rapid action even if communications break down and it is impossible to obtain approval to depart from the original operational plan.

A further basis to be considered by the brigade commander, thus, would be the restraints ordered by the division which are indispensable for an appropriate interaction with others.

In the tactical example set forth above the following restraints are important:

- The absorption of a delaying force starting from a certain point in time.
- Keeping certain roads clear for the covering force to be absorbed.
- Taking over the barriers of some other major formation.

In his divisional order, the commander has:

- Established the objective and principles of the operation planned for the division.
- Set the objectives to be attained by the major formations placed under his command by defining the missions.
- Ordered the restraints necessary for the appropriate interaction of all elements concerned.
- Established beyond all doubt the responsibility for the territory.
- Analyzed and ensured that the missions can be accomplished using the forces and resources available to the subordinates (according to tactical grouping).

What is important to the brigade at this point is to make full use of its freedom of action, thereby taking into account the tactical objectives specified, as well as the restraints and limitations ordered.

After having evaluated the situation and having made a decision, the brigade commander establishes the principles of the planned operation; sets the objectives, by defining the missions, which are to be attained by his forces; and again orders only those restraints which are absolutely indispensable for the units placed under his command or for cooperating units.

During combat, the brigade commander will exert influence on the conduct of operations of the battalion only to the extent that he sets new objectives, makes available new forces and resources and/or reduces these, and orders coordinating measures necessary in order to direct successfully combined arms combat as a result of the best possible interaction of forces and resources.

Also, orders given to combat support units, such as artillery and engineer units, are restricted to giving the objectives which are to be attained. The manner in which they are to be carried out is left to the discretion of the subordinate leaders.

The true art of military command and control, then, consists in maintaining a difficult balance. On the one hand, to realize the intentions of the military commander within the meaning of the interaction of all forces in the rapidly progressing combined arms combat by clearly setting objectives, and to establish unequivocally restraints and restrictions. On the other hand, to let the subordinate retain the largest possible latitude of action within the scope of which initiative and creative power can be fully brought to bear. Here, it becomes apparent that military command and control goes beyond the mere management of forces, weapon systems, and weapons.

Mission-oriented command and control presupposes both uniformity in thinking (that is, regarding the method, not the thoughts), and reliability in taking action. This applies to the highest military commander as well as to the tank commander. However, it will only be possible to attain both prerequisites through an educational and training process geared to uniform objectives which is, in most instances, lengthy and continuous. The diversity of battle action precludes that there can be recipes and formulas in the area of tactics as how to conduct operations. If the military leaders are to take independent action, within the scope of missions, however, this would presuppose a uniformity of basic tactical concepts, and they would be required to possess knowledge of and the ability to apply operational and tactical doctrines. Brief texts formulated in the command language make a framework of tactical terms mandatory which, while limited in number, are very clearly defined.

The less uniform views on tactical concepts there are in existence, the more details must be spelled out in the orders, and the more frequently given information contained in orders must be formulated more comprehensively in order to limit the risk that erroneous action is taken. Relying on the right action to be taken presupposes having confidence in the abilities of subordinates. Taking a certain chance is part of *mission-type control.*

In a battle which is progressing rapidly, hesitating and making sure by checking back is often more detrimental than taking the wrong choice in selecting the means.

Complicated command and control procedures can be conducive to nipping *mission-type control* in the bud. They distract from the real command and control task, while being time-consuming and requiring extensive training. A swift response and the translation of missions into action require the

ability to apply time-saving command and control procedures.

A further essential prerequisite for a smooth operation of required *mission-type control* would be to establish command and control responsibility in an unequivocal manner. This includes, particularly, a clearly defined chain of command within every level of command, a definite responsibility for the territory, and the influence of the superior leader which, as a general rule, is restricted exclusively to the next lower level of command. It would be inconceivable, even in a critical tactical situations, that the division commander, the brigade commander, and the battalion commander bring their influence to bear on a company commander either simultaneously, or by taking turns, in order to make him undertake a certain tactical action.

Mission-oriented command and control, in the final analysis, requires military leaders who are prepared and capable to assume a high degree of responsibility and to take action in an independent manner.

It would be unrealistic to overlook some of the risks which are inherent in the principle of *mission-type control.* I would like to limit my comments to these areas only:

- The effects of technology.
- Insecurity and lack of confidence in the abilities of subordinates;
- *Mission-type control* used as a slogan, as well as a fig leaf to cover incompetence.

The first risk manifests itself in higher levels of command having the opportunity to take advantage of improved technical resources, such as helicopters, television, electronic data processing equipment, information systems, command and control systems, and fire control systems in order to exercise direct control of, and bring their influence to bear on—not only the next lower level of command—but rather all levels of command.

Thus, it may perhaps not be unusual in peacetime exercises, but it is a violation of the principle of mission-oriented command and control if the direct expression of the intention of a high-level superior literally descends on the head of a soldier in a foxhole by the superior's sudden appearance in a helicopter, without such expression being warranted and in line with the situation.

This would result in the leadership authority of the intermediate superiors breaking down, as well as in stifling the initiative, the sense of responsibility, and the imagination of the individual concerned.

A second risk would be evidenced in insecurity budding at higher levels of command, in a feeling of "misgivings," whether the uniformity in thinking and the dependability in taking appropriate action can be assumed to exist really at the subordinate levels of command.

It induces individuals to want to have a share in governing side-by-side with the cognizant superiors in charge, i.e., to give in to the inclination to spontaneously intervene on the spot without themselves having knowledge of the specific details of the action observed. This can also be clearly considered a blow against mission-oriented command and control.

This attitude can partly be attributed to a feeling of distrust toward both environment and subordinates, and partly to an overestimation of one's abilities.

The superior feels that he must establish the facts quite clearly because he fears that by giving many details, the overall objective might be in danger of being smothered, or the higher intention might have been forgotten. He is not convinced that his own orders are clear, unequivocal, and can be carried out.

A classical example would be the extension of the information and order channels to the location where he is spending his vacation by having a special Telex terminal installed, even though it is the institution of a competent deputy in particular which is to ensure the continuity of command and control.

A third risk would be to use the term *mission-type control* as a slogan and fig leaf to cover incompetence. The borderline between deliberately foregoing the disposition of details, and the inability to define clearly both objective and direction of the action to be taken and restrict it through relevant restraints, then becomes fluid.

Even though it is the essential task of command and control to establish quite clearly what the objective is, all you find is a large number of diffuse words. If a mission is assigned in an unsatisfactory manner, it is the result of a vague concept of the objective.

Undoubtedly, it will become necessary from time to time to reestablish objectives and to formulate them more extensively depending on the personality of the individual in charge, as well as to define the restraints more clearly.

What must be assured in all instances, however, is that the individual in charge is able to feel confident and unrestrained, and that the potential of diverse abilities of subordinates which, in many cases, has not been recognized, is utilized and/or developed, i.e., improved upon.

Conclusions

The maxims of *mission-type control* are uniformity in thinking, dependability in taking appropriate action, and, as unimpeded as possible, the unrestrained development of abilities. If these characteristics are to play a determining factor with respect to our command and control doctrine in wartime, then the respective capabilities must already be developed and practiced in peacetime. Mission-oriented command and control constitutes, especially in view of the temptations held out by modern technology, a constant challenge to the military leaders of all levels, i.e., an unending task within the educational and training processes. It requires continuous and relevant command supervision.

This means that the superior is required to:

- Apply a larger amount of effort, time, and patience to weigh both objective and restraints of a mission.
- Clarify the circumstances for himself and his subordinates.
- Order only what is required for the purpose of accomplishing the mission.
- Respect the competence of the subordinate, and, if necessary, apply himself in order to assure the latter's latitude of action.
- Put up with risks, mistakes, and failures.

We must have the courage in peacetime to be prepared to learn from our mistakes and mistakes must be permitted!

A failure which we have experienced constitutes more of a learning effect than a lot of well-meaning advice, or interference out of concern.

This means that the subordinate is required to:

- Flesh out his latitude of action by applying initiative and expert knowledge, and
- Employ his own qualifications for the benefits of the overall concern.

Mission-oriented command and control means to dismiss the concept that subordinates are to be ordered in detail how to go about carrying out their responsibilities. *Mission-type control* does not, *a priori,* entail immunity from mistakes and failures. It is, however, in accordance with the protected interest of free development of one's personality which is a matter of course in a democracy, and, to an extraordinary extent, also meets the requirements of our modern industrial society which is in need of the intelligent, independent co-worker.

Mission-oriented command and control, i.e. *mission-type control,* constitutes the binding leadership doctrine for the German Army and has proven its value without qualifications. It will make it possible, more than anything else, to cope with the demands placed on military leadership in tomorrow's mobile battle. It may well be a difficult task in the near future to integrate, in an appropriate manner and only as a tool, the extremely rapid technical development in the area of command, control, and information systems, together with the tremendous possibilities offered by electronic data processing, into the leadership doctrine.

The foregoing presentation was made by a representative of the Federal Ministry of Defense, Army Staff (Fue H III 2) at the 17th German/U.S. Army General Staff Meeting held in Munich, Germany.

We Might Still Be Using Bows and Arrows

Evolutionary Weapons Development

by Captain Rodney B. Mitchell

The U.S. Army is currently undergoing its most intense period of force modernization since WW II. The armor force is one of the focal points of this modernization and dedicated efforts are required to make the most of this upgrading of our combat potential. However, the process cannot stop with the fielding of the *XM-1 M-2/3,* attack helicopter, etc. As these systems enter the field, we must begin to develop their successors if we are to prevent stagnation further down the line. There are two basic philosophies which can be followed in developing these follow-on systems. These alternatives are to proceed in either an evolutionary or a revolutionary manner.

The evolutionary process has advantages in terms of cost, manpower expenditure, and, in certain instances, a reduction in the time involved to field a system. The progression of the current main battle tank from the *M-48* thru *M-60, M-60A1, M-60A1 AOS, M-60A1* RISE, *M-60A3* variants is a good example of the evolutionary process.

The revolutionary process can be viewed as being one which has high risks in terms of the resources required but offers the opportunity to larger potential payoffs in combat effectiveness. The introduction of the first tank in WW I demonstrates the potential of the revolutionary approach.

The fiscal and manpower constraints placed on the military when coupled with the fast pace of our modern society make the evolutionary process attractive to many of our developers and planners. However attractive this philosophy may be, its total adoption to the exclusion of the revolutionary may in the long run be a disservice to the Army and the nation. The following examples, while admittedly tongue-in-cheek illustrate this point.

Revolutionary Weapon Introductions Which Have Seriously Impacted on Tactics, Training, and Logistical Support

The Spear as Replacement for the Club

Advantages	*Disadvantages*
Increased range. Increased P_k* given a hit. *P_k = probability of kill	Decreased P_h* Increased training requirements. Increased logistics support: • Iron for spearheads. • Weapon may not be recovered. *P_h = Probability of hit

Comment from Chief of Club-Wielders Guild: "This spear thing will be the end of the true combat soldier. Throughout history it's been shown that the best way to take a man out of the battle is to bash him repeatedly over the head with a good hickory club. I don't know how we'll train these soldiers we're getting today to hit a man-size target at long ranges with that spear thing and the quartermaster-types want us to recover these spears after the battle so we can use 'em again because they cost so much to make."

Bow and Arrow as Replacement for Spear

Advantages		*Disadvantages*
Increased range.	Decreased P_h. Increased training requirements.	Increased logistical support. • Feathers for arrows.
Increased rate of fire.	Requires change in tactics to take advantage of range	• Animal gut for bow strings.
Increased P_k given a hit.	(complex command and control procedures). Decreased fire-on-move capability. Additional basic issue items (quiver, etc.).	• Lowered reliability, availability, and maintainability (RAM) due to system complexity (2-part system bow and arrow vs. spear).

Position of the Imperial Spearchucking Association: Extracted from October-November issue of *SPEAR* Magazine. The introduction of the proposed bow and arrow (B and A) system violates every known concept of modern weapon design. The time-tested design parameters for a man-killing projectile are: length, 3-5 ft; weight, 2-5 lbs; warhead, ½-lb iron or flint. The proposed arrow violates all of these parameters. An examination of the launch mechanism of the two systems (arm vs. bow) reveals other discrepancies. It is doubtful that the complex and lightly constructed (but expensive) bow will ever achieve the thrusting power, availability, and reliability of a well-developed right arm. It is also doubtful if sufficient force structure changes can ever be made to utilize the extreme ranges the

B and A champions are claiming for it. Another disadvantage of the B and A is that it is a single purpose system (long range puncture) where a state-of-the-art spear can be used in this mode and can double as a pike in short range stab-and-jab actions.

On the logistical side of the coin, the B and A introduces incredible complexities. Due to the lower P_h, an increase in each soldier's basic load of projectiles is required (from 1 to at least 10). The system requires the issuance of an additional uniform item, the quiver, to carry the larger number of projectiles. An additional consideration is the relative flimsiness of the arrow system which impacts on both maintenance and supply actions.

This flimsiness when combined with the small size of the projectiles makes it extremely hard to recover for supply accountability purposes, and it is doubtful if the logisticians will ever be able to adapt to a situation which will allow combat troops to expend projectiles in the quantities necessary without the attendant paper work, etc. The low recoverability and high rate of fire dictates an increased stockage of projectiles increasing the total force cost of the B and A system. The low RAM characteristics of the B and A requires an increase in both the numbers and type of repair parts stocked by the unit as shown below:

Parts Stockage Comparison

Spear	*Bow & Arrow*
Shaft, wooden.	Shaft(s) wooden x 10.
Warhead, flint, or iron.	Warhead, flint or iron x 10.
Fiber, binding, shaft to warhead.	Fiber, binding, shaft to warhead.
	Feathers, projectile stabilizing.
	Stave, bow, flexible.
	String bow, cat gut or equivalent.
	Adhesive feather affixing.

Repair Tools Comparison

Knife, general purpose.	Knife, general purpose.
Whetstone, warhead and knife maintenance.	Whetstone, warhead and knife.
Jig, head to shaft alignment, adjustment and attachment.	Jig, head to shaft alignment, adjustment and attachment.
	Knife, feather cutting.
	Jig, feather to shaft alignment, adjustment, and attachment
	Kit repair, for quiver, brown leather.

Additionally, the B and A aggravates personnel problems by instituting a new MOS (99Z fletcher, B&A repairman). In the past, the operator could make field fixes on his spear to enable him to get through the battle; now all repairs must be made by the fletcher with his special tools and training. What assurance does the front line commander have that such support specialists will be available to him in a critical battlefield situation?

The training implications of the fielding of the B and A are not totally known but must be immense since the system requires the adoption of totally new skills which have never been exhibited except by selected laboratory and engineering personnel.

There may be an even greater impact that the B and A may introduce to our society. Today's primary weapon (Spear, *MKIIIA1*) requires that the combat soldier be aggressive, fearless, have great upper body strength to hurl the projectile, and be a fast and agile sprinter to avoid being hit should his first throw miss its victim. These requirements have caused us to select young, strong, aggressive men to defend our nation. The characteristics of the B and A require little physical strength and encourage the operator to adopt a more passive battlefield role. It may be that our female population will provide better potential B and A operators than males.

Replacing the Longbow with the Harquebus (15th Centry Matchlock)

Advantages	*Disadvantages*
Increased range.	Reduced rate of fire.
Increased P_k given a hit.	Increased training.
Increased armor penetration.	Increased log support.
	• Supply.
	• Maintenance.
	Low RAM.
	High Cost.
	Increased weight.

SUBJECT: Treatise Concerning the Introduction of the Harquebus into the Royal Army

FROM: General Sir John Archer, Chief Royal Corps of Bowmen.

THRU: The Directorate Superior, Royal Army.

THRU: The Grand Field Marshall, Royal Army.

TO: Sir James Twitt, 1st War Lord.

Dearest Sir:

It has come to my attention that there is a scheme of most alarming proportions afoot to replace the stalwart longbow with an infernal machine known as the harquebus as the standard arm for the Royal Corps of Bowmen. Before embarking on any such rash and potentially disasterous endeavor, I beseech you to present His Majesty with all of the considerations in this matter, including those both favorable and unfavorable to such an action. As all men learned in the ways of warfare know, the longbow is the decisive element upon any field of battle. Time after time the outcome of battle has been determined by the fact that our doughty Companies of Bowman have been able to fill the skies with their famed "messengers of death," inflicting grevious damage on all opposing them. This advantage is not one to be taken lightly or given away.

First, it is said this firearm will extend the range at which we can fell the enemy. What matters if the enemy dies 100 yards or 100 furlongs from you? He is just as dead in either instance. It is said that if a man is hit by both an arrow and the lead ball spat from the harquebus he is more likely to die from the impact of the ball than that of the arrow. I must say that it is indeed a stalwart foe who may take an arrow wound and continue the advance. If he does so, I say, let him come on and provide a fitting test of mettle for the steel blades of His Highness' Grand Infantry who seem to have had too little to do in our most recent campaigns. Also alleged is that the projectile from this weapon will penetrate the armour of all opposing knights. What is to prevent them from merely procuring a more formidable breast plate? Additionally, it must be remembered that the best way to dispose of opposing knights is to dispatch a squadron of His Highness' Royal Cavalry against them and enjoy the spectacle of that splendid group in action against a worthy foe. It is not secret that many a young man has been so inspired by tales of such clashes that he has immediately entered into His Majesty's service.

It is said that a harquebus can only be employed against the enemy once every minute. By contrast, a good bowman can turn a foe into a veritable pincushion in that passage of time. This new weapon (and its attendant devices) is so heavy that it requires at least two men to carry it into battle and properly aim it. Should we turn every other of our fine bowmen into a pack animal to have this thing in our forces? I think not. However, it may be that these "hand-cannons" are so expensive that we may be able to field only half as many of them for the same cost as twice as many bowmen. These guns and their powder are notoriously unpredictable and prone to failures of the most alarming sort, even to the point of exploding and killing the firer of the weapon. This never happens with the longbow. If one of these devices exhibits some mechanical infirmity can the trusted company fletcher be counted upon to repair it? Of course not. A mysterious tinkerer called a "gunsmith" must be found to restore it. How many gunsmiths are in our kingdom today? Bloody few! And what is to become of the displaced fletchers who have served the king so faithfully; are they to be cast aside?

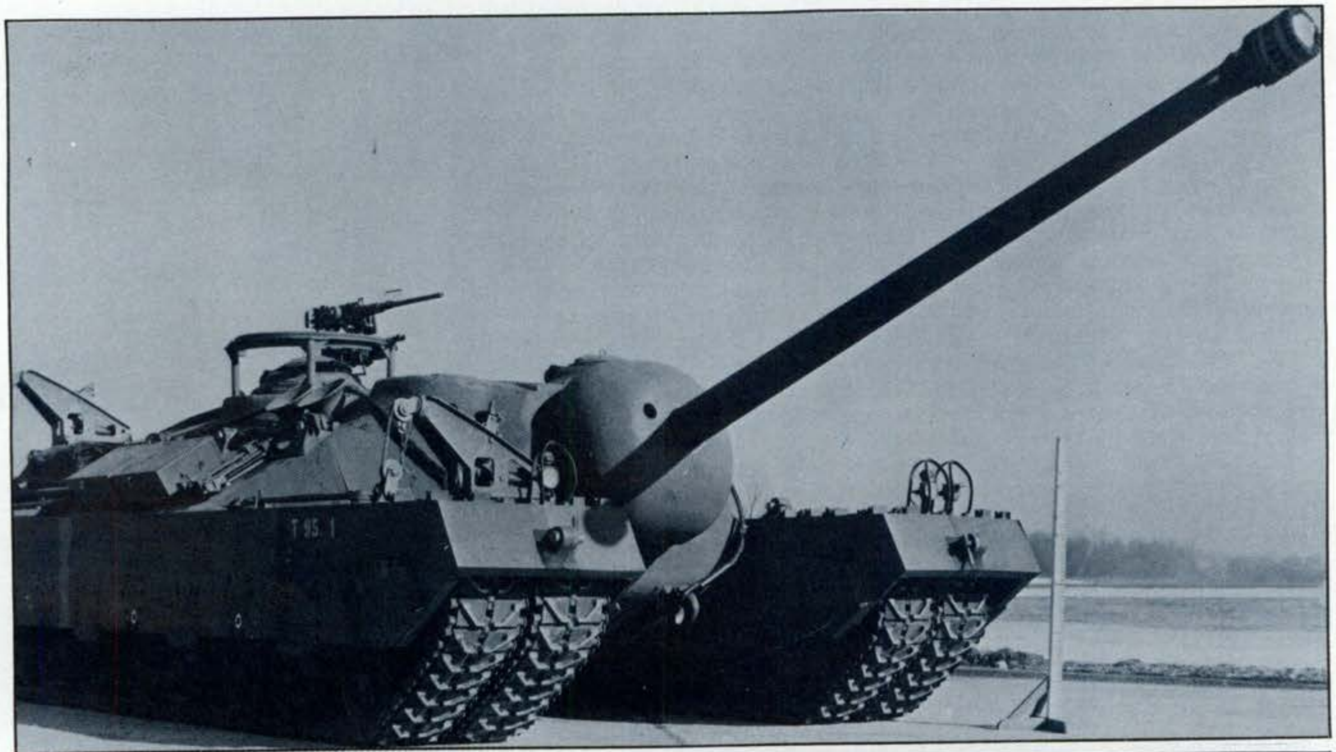
The thought of the complexity and costs of producing and transporting vast amounts of gunpowder is enough to spin one's head. While chemists may produce enough for amusements such as aerial rockets, fire crackers, and other such frivolities, where will we find enough of these magicians to produce tons of the substance? And, once one has a large quantity of the stuff, what does one have? Another potential disaster, that's what! If handled improperly, it may explode and remove a whole country and its occupants to Heaven for eternity. Do we dare trust such a thing to the care of the teamsters in the Corps of Consolidated Provisioners? If they don't destroy it and themselves, they may steal it and sell it since it is so dear and expensive to produce.

In short, sire, I must protest this so-called advancement since it does nothing for our soldiers except burden them with additional things to do, things to carry, and puts them ever more at the mercy of sophisticated mechanics and artificers and even more dependent upon the services of the notoriously unresponsive Corps of Consolidated Provisioners.

Sir John Archer
General

Had the "pure" evolutionary process been followed, might not our hypothetical force still be equipped with the club. Undoubtedly, it would be the world's finest, product-improved, state-of-the-art club, but still a club, and at a relative disadvantage to its modernized contemporaries.

CAPTAIN RODNEY B. MITCHELL was commissioned in armor upon graduation from ROTC at the University of Colorado in 1971. He has attended AOB, OMO, AOAC and ORSA, and has served as platoon leader, executive officer, and company commander in tank battalions in CONUS and USAREUR. He is currently assigned as a project officer in the Directorate of Combat Developments, USAARMS, Fort Knox.



U.S. Army heavy tank development during WWII included those shown here. The 45-ton *M-6* (left) was undergunned and too heavy for its power plant; armor varying from 2-12 inches made the *T-95* (top) so heavy that it needed four tracks, and a 90-mm gun made the *Pershing* (above) a match for the German *Tigers*.

by Captain Michael R. Matheny

Will the XM-1 Revive the Heavy Tank Doctrine?

In the late summer of 1957, a brief message from United States Army Europe to the 899th Tank Battalion directed that unit to prepare to receive *M-103* tanks and add the word "heavy" to its official designation. In order to employ the heavy tanks properly, the companies of the battalion would be separated and deployed across the entire Seventh Army zone.

The TO & E for the 899th Heavy Tank Battalion called for three companies with six platoons of three tanks each. This provided for a company strength of five officer platoon leaders and one NCO platoon leader plus the company commander and executive officer—a total of seven officers and 126 enlisted men. Operationally, the platoons were often used in pairs. The training of the platoons, however, centered around the conceptual employment of heavy tanks. Specifically, "The platoon test was devised to simulate a single platoon attachment to a medium tank company which was generally the concept for these tanks."

The *M-103* tanks were well equipped to support the medium tanks with long range fires. The 120-mm gun of the *M-103* could reach out accurately to 3.6 kilometers. This gun fired separated ammunition (projectile and charge were loaded separately) which required two loaders. In addition to its excellent gun, the 62½-ton *M-103* had, at its thickest point, in excess of 7 inches of armor. The thick armor was believed necessary for whenever the entire company might be used offensively to "effect a breakthrough."

On 1 May 1958, the 899th Tank Battalion (Heavy) was redesignated the 2d Heavy Tank Battalion, 33d Armor. Eleven months after the battalion had received the new tanks, General Order 322, Headquarters USAREUR, dated 22 December 1958, dissolved the battalion headquarters and assigned the companies directly to the units they formerly supported. The last heavy tank battalion in the U.S. Army had bitten the dust.

Although automotive and reliability problems surfaced soon after the *M-103* was fielded, it remained in service with the U.S. Army until 1964 and with the U.S. Marine Corps until 1973. The technical and tactical problems which were assoicated with the deployment of the *M-103* were characteristics of all the U.S. efforts at developing a heavy tank doctrine.

United States heavy tank doctrine, for all practical purposes, began immediately prior to our entry into World War II. It grew out of the need to cope with the German success in deploying superior heavy tank designs. In late October of 1940, the Ordnance Department drew up specifications for a heavy tank. The *M-6* tank, weighing 60 tons and armed with a 75-mm main gun plus a coaxially mounted 37-mm gun, was the eventual result of these specifications. Repeated delays and production priorities prevented the *M-6* from being evaluated at Fort Knox until June of 1943. During the tests, the *M-6* was found to be too heavy, undergunned, and poorly shaped. A few more attempts were made to come up with an adequate heavy tank, which included simply welding more armor on to the *Sherman* tank. This tank, the *M-4A3E2* was quickly dubbed the *"Jumbo"* and produced in only limited quantities. A renewed design effort came only when the evident superiority of the German heavy tanks spurred the U.S. into serious planning.

Heavier tanks and bigger guns were definite trends in tank development during World War II. This was nowhere more apparent than in Germany. Beginning with the *Tiger I* and continuing to the giant *Maus,* the Germans appreciated the need for heavy armor and big guns. The *Tiger I* and *Tiger II* heavy tanks were perhaps the most famous of the German designs. Both tanks were armed with versions of the powerful 88-mm gun, but were operationally limited by their great weight.

Germany maintained 10 heavy tank battalions during WW II which were normally assigned to specifically chosen panzer divisions. Additionally, a heavy tank company was usually included in the tank regiment of the elite units such as SS formations and the Panzer-Grenadier Division of Grossdeutschland.

The heavy armor of these tanks permitted them to be used offensively as the forward elements of the tank wedges used in breakthroughs. It was in this manner that the German heavy tank battalions were used at Kursk during the Russian campaign in an attempt to sledgehammer their way through the Soviet defenses. Later in the war, the long reach of the main guns of the heavy tanks were used with great success in the defense while their armor ensured their survivability.

Eventually, the German fascination with heavy tanks became divorced from operational reality. The *Maus,* of which two prototypes were built, weighed 188 tons and was armed with a 128-mm gun plus a coaxially mounted 75-mm gun. Unbelievably, this was not the last word in heavy tank design. The plans for the *Lowe* or *Tiger Maus* called for a 1,500-ton tank that would be powered by no less than four U-boat engines. Needless to say this design did not get off the drawing board.

Our reaction to the German heavy tank designs was not limited to uparmoring medium tanks. Our own version of the *Tiger* tank was officially designated as the *T-95* Gun Motor Carriage. It was designed in 1945 and by 1946 two prototypes had been built. The *T-95* weighed 94 tons with armor varying from 2 to 12 inches thick. Armed with a 105-mm gun, the *T-95* was so heavy it was supported by four sets of track. Equipped with the same engine as the *Sherman* tank, it was greatly underpowered and could lurch along comfortably only at 8 miles per hour.

A more reasonable approach was adopted with the design and production of the *M-26 Pershing* heavy tank. As a direct result of the inadequacy of the *Sherman* against the German heavies, the *M-26* was rushed to Europe in January of 1945. Armed with a 90-mm gun and weighing 45 tons, the Pershing at last provided U.S. forces with a tank capable of dueling with the *Tigers.*

As in World War II, subsequent heavy tank development was in response to the threat. The *M-103* heavy tank, with which the 899th Heavy Tank Battalion was equipped, was the American version of the British *Conqueror* tank. Both the *M-103* and *Conqueror* were developed as a counter to the Soviet *JS-II Stalin* and *T-10* tanks.

The *JS-III* culminated a long line of Soviet heavy tanks and was certainly a formidable opponent in the postwar world. In 1953, a further development of the *JS-III* resulted in the *T-10* which was armed with a 122-mm main gun and weighed 49 tons. In both cases, the Russian heavy tanks were maintained in separate battalions and regiments to provide an even heavier mailed fist in the breakthrough and to generally support the medium tanks in the defense.

Throughout the history of the heavy tank, it has been specifically equipped to withstand the demands of the breakthrough and provide long-range, direct fire support. All of the heavy tanks have been evaluated in their ability to meet these two requirements. Originally, the heavy tanks supported the infantry, but as their offensive potential and firepower increased, they were used to support the medium tanks in both the offense and defense.

Heavy tank development in the West continued to be plagued by super-heavy, underpowered behemoths that were often not up to these operational requirements. These difficulties were resolved by adhering to the continuing trend toward bigger guns and heavier armor for medium tanks. The term main battle tank (MBT) simply disguises the fact that medium tank design merged with heavy tank doctrine. The *M-26* was, in fact, redesignated as a medium tank in 1946. The *Chieftain,* the current British MBT, weighs only 10 tons less than the *Conqueror* but has the same caliber main gun. The Soviet *T-72* weighs only 7 tons less than the T-10 and has a bigger main gun.

Within the U.S. Army, the medium tank design of the past 3 decades has reflected the trend in bigger guns and heavier armor. The introduction of the *M-60A2* in the seventies, however, represented a brief return of the tradition of American heavy tank doctrine. The *M-60A2* weighs only 7 tons less than the *M-103* and has much in common with the last American tank to equip a battalion officially designated as "heavy."

The *M-60A2* known both affectionately and frustratingly as the *Starship*, was employed operationally like the *M-103*. In some cases, the *Starships* were integrated into mixed battalions consisting of one company of *A2s* and two companies of *A1s*. This was the situation in the 3d Infantry Division, where the *A2* was deployed much in the manner as the *M-103* some 20 years before.

Like the *M-103*, the *A2* was built around its ability to provide long-range fires. Armed with a gun/launcher capable of firing either a *Shilleagh* missile or a conventional 152-mm round, the "A-Deuce" was an attempt to take advantage of the advanced missile technology which blossomed in the early seventies. The sometimes too-complicated blessings of advanced technology, however, resulted in the same reliability problems which have always plagued American heavy tanks. The *A2* then will go the way of all American heavy tanks and disappear from the inventory after only a relatively brief service.

Since the phasing out of the *M-60A2*, the spiritual and technical heirs to the 899th Heavy Tank Battalion may well be the new *XM-1* units. The introduction of the *XM-1* or *Abrams* tank will initially have more in common with our experience in the deployment of heavy tanks than the series of MBTs that preceded it. Both technically and tactically the *Abrams* tank is well within the tradition of our heavy tank doctrine.

The most interesting aspect of the *XM-1* will be its tactical employment. For many years, the *Abrams* will serve side by side with the many versions of the *M-60* series tank. Within a mixed tank fleet, the *XM-1* may well be cast into the role formerly reserved for heavy tanks. The *XM-1* units might become like the elite German heavy tank battalions of World War II.

These units were shuttled across the battlefield to lead other, less heavily armored tanks into the attack. The German heavy tank battalions were also used as the nucleus of defense, utilizing their survivability and long-range fires to supplement other armor.

The increased cross-country mobility of the *XM-1*, however, will provide something the other heavy tanks have always lacked. The *Abrams* is the culmination of the trend which has transformed the medium tank into a heavy tank. We now depend on the technical excellence of our bigger MBTs to bridge the gap between the roles which were formerly assigned to light and medium tanks. With the mechanical fusion of the medium and heavy tank the operational possibilities with the *XM-1* revive some of the earlier theories of *Blitzkrieg*.

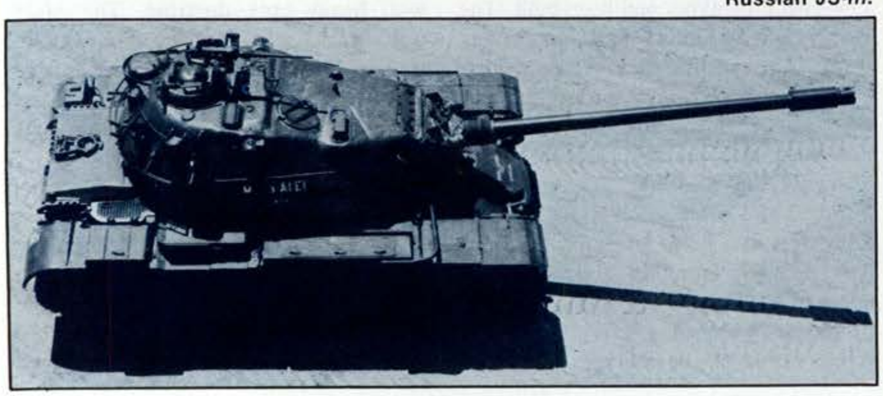
In J. F. C. Fuller's original version of *Blitzkrieg*, as revealed in his famous "Plan 1919," he envisioned a new tank which he called the *Medium D*. This new vehicle was to have a much greater range and mobility than the tanks then available. While the slower tanks slugged it out, crushing the enemy in the conventional manner, the new tank was to capitalize on its mobility and strike deep into the enemy rear. As the *XM-1* represents the optimum mix of mobility and survivability, it could assume the role of the *Medium D* with unprecedented effectiveness. Will the *XM-1* battalions assume a special role on the battlefield?

Until the *XM-1* completely replaces the *M-60* series, the advantages that this vehicle brings to the battlefield will entitle it to special consideration in operational planning. Much of that planning will involve the familiar considerations applied in the past to heavy tank battalions.

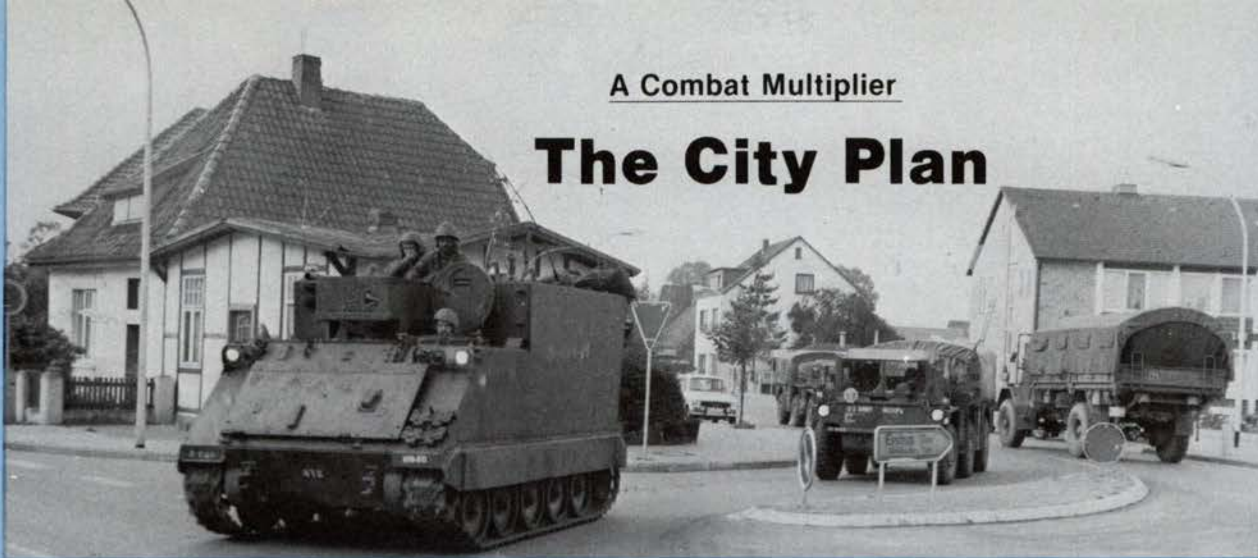
As a combat vehicle, the *XM-1* has the weight, armor protection, and with the addition of the 120-mm main gun, the long-range fires which will far exceed the capabilities of the other tanks with which it will serve. All these characteristics have been traditionally associated with heavy tanks and their special role. The *XM-1* represents the fulfillment of American heavy tank doctrine.

With increased cross-country mobility, the opportunity exists to combine the functions of the "breakthrough tank" and the "pursuit tank," as Fuller might have described it, into the new MBT. If the *XM-1* has overcome the difficulties such as reliability and operational range which have plagued the American experience with heavy tanks in the past, it may be the vehicle to breathe life into the dreams of men like Fuller, Guderian, and Patton.

The *M-103*, which was patterned after the British *Conqueror*, was developed as a counter to the Russian *JS-III*.



CAPTAIN MICHAEL R. MATHENY was commissioned in Armor upon graduation from the University of Dayton in 1972. He has served as a tank platoon leader and executive officer in Company A, 4-69th Armor in Mainz, Germany. He is a graduate of Wright State University with an MA in History. After completing the Armor Officer Advanced Course, CPT Matheny was assigned as the military history instructor at the U.S. Army Armor School. Presently, he commands Company A, 1-64th Armor.



A Combat Multiplier

The City Plan

by Captain Carl E. Daschke

The massive urbanization that has occurred within West Germany since World War II has brought about several significant changes in the terrain's ability to support military operations. As a consequence, traditional avenues of approach into West Germany have begun to lose their significance and military planners have formulated new concepts and tactics for operations in and around urban centers.

One of these emerging concepts envisions the city as more than just a potential obstacle for impeding the progress of the attacking force. Known as a city plan, the concept makes use of the city's materials, equipment, and facilities to stiffen the defense and support the force that is conducting the operations.

Basically, the plan identifies and documents the potential logistical support, maintenance facilities, and governmental agencies that can be integrated into the defense plan.

The first step for the intelligence officer in developing a city plan is to determine which city in the defensive sector can best support the unit's needs.

The size of the urban area is of prime consideration because it provides the planner with an indication of the support capacity of the city and its potential for being targeted by the attacking forces for interdiction. Therefore, if a smaller city or town will meet the needs of the unit, while attracting less attention, it should be selected over a larger city that will certainly invite the attention of the attacker.

Another factor in selecting a city for integration in the defense plan concerns the road net and its effect on both defender and attacker. Irregular patterns of streets and roads restrict the flow of traffic; radial patterns cause some difficulty in movement, while rectangular nets pose few restrictions to mobility. Therefore, urban areas with irregular road nets can become obstacles to the attacker and may even be integrated with impassable terrain as part of the barrier plan, particularly if the city is located well forward. On the other hand, a city with a jumbled network of streets would not likely be selected to support friendly operations due to poor routes into, within, and out of the city.

Selection of an urban area as the subject of a city plan is affected by yet another geographical factor—that of location. A city toward the rear of the sector provides easier access and centralized location, and also insures that the city will be out of the range of most enemy indirect fire. If at all possible, the city selected for planning should not be astride a major mobility corridor that will support a motorized rifle regiment or larger unit to reduce the likelihood that the city will be identified as an objective for the attacking forces. Careful selection of the urban area, in relation to planned or proposed battle areas, will insure that the assets and facilities located in the city can be used to their fullest extent by the defending forces.

The City Plan

Once a city is selected for integration into the defense planning, the following elements are analyzed and evaluated.

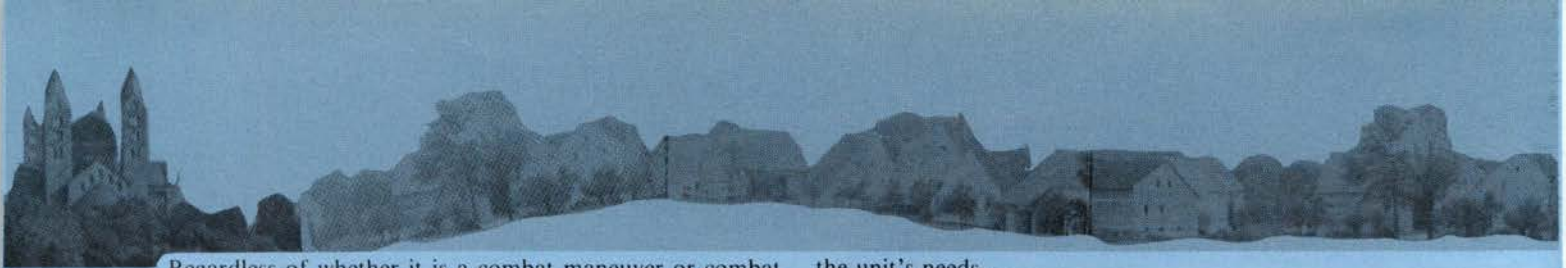
Population Control. During the first few hours of battle, a large segment of the civilian population can be expected to flee to safer areas.[2] Although the official policy of the German government is for the population to stay in place, a massive migration can be expected. This exodus will undoubtedly clog most major routes leading from the endangered area and will hamper the movement of our forces into and laterally across the defensive sector. In addition to keeping the routes into sector open by establishing numerous traffic control posts for military traffic, the control of the general population also will be an important task. The more undesirable elements and opportunists, not to mention saboteurs, can be expected to take advantage of the situation to create disorder and dissension among the population.[3]

Local police agencies can assist the commander in controlling the routes into sector and dealing with the civilian population. The headquarters of these organizations, as well as the key personnel, will be included in the unit's city plan.

City Government and Services. The major offices of the city or higher government located within the city are identified and listed, as are the personnel who occupy key government positions. Also, the services such as the fire department and public utilities will be identified for possible use by the defending commander even though they may have little initial military value. They will serve, however, as a stabilizing factor for the general population.

Political Orientation. West Germany has several political organizations and although the majority of them support the democratic government, there are some parties which would be suspect in the event of hostilities with the Warsaw Pact.[4] By determining the prevailing political inclination of the general population and those individuals who occupy key positions, the commander will have a better idea of the general attitude of the population toward his forces.

Logistical Support. The establishment and maintenance of an adequate logistical base will be vitally important to the defending unit's survival. Problems encountered when establishing the logistical base originate from two major deficiencies common to all combat maneuver units, *time* and *transportation.*



Regardless of whether it is a combat maneuver or combat support unit, the problem of insufficient time to lead equipment remains constant. We have required some of our forces to load at least part of their basic combat loads of ammunition, but little has been done to decrease the time necessary to load equipment such as tools and associated maintenance equipment.

The second major deficiency, *transportation,* results from the unit's inability to transport materials and equipment with organic transportation. For example, that part of the unit's basic load of ammunition not loaded aboard combat vehicles will have to be moved on the battalion's organic cargo trucks.

A similar situation exists with respect to the unit's fuel hauling and storage capability. Our defensive plans are based upon the assumption that, given sufficient reaction time, our units can move smoothly into their respective defensive positions and the various logistical plans can be put into operation. Under the countersurprise scenario, warning time and the resultant insufficient reaction time will not allow our various grandiose plans to be put into action. Consequently, combat units will be forced, at least initially, to depend upon their organic fuel distribution assets.

Let's examine an average armor battalion's fuel hauling and refueling capability versus its real world requirements. The battalion, with its 54 tanks, can operate for approximately 12 hours or cruise 340 miles. During this operation, each tank will use about 375 gallons of diesel or about 20,250 gallons for the battalion. This figure does not include the battalion's wheeled vehicles, generators, or other tracked vehicles.[5] Current modified tables of organization and equipment authorize each battalion four *GOER* fuel trucks.

Another, and possibly even more critical, consideration is that the fuel which is made available to the battalion will be drawn and transported from the division trains area. It is recognized that prime targets for interdiction, under Soviet doctrine, are the logistical areas which support the defending units.[6] The loss or non-availability of fuel through combat loss and administrative losses, such as accidents and contamination, will pose a very real problem for the defending commander.

By pre-identifying the various sources of fuel and transportation found within the urban area, the planner can assist in avoiding an extremely serious situation. The logistical portion of the city plan will identify, at a glance, the location of gas stations, fuel storage facilities, and wholesale outlets. In addition to the fuel, vehicles capable of transporting fuel should be identified including milk, water, and other trucks capable of carrying liquids.

In addition to fuel and energy sources, maintenance facilities should be identified for possible use. Auto and truck repair shops are not important for their repair parts capability, but rather for the equipment which is normally found in the shops. It is far easier to replace a tank's power pack using the hoists and associated equipment found in a maintenance facility, than to perform the same operation in a more awkward environment. Although the Host Nation Support Agreement[7] provides for certain civilian services and equipment to be made available to U.S. forces, there is no guarantee that the agreement will provide sufficient services and equipment to satisfy the unit's needs.

The active defense, which the U.S. relies upon to defeat an attacking Warsaw Pact force, requires extensive preparations of the battlefield by the defending force. This preparation includes constructing defensive positions, clearing fields of fire, constructing barriers, and executing prechambers. All of these preparations require extensive engineer efforts. Unfortunately, the direct support engineer company will have its hands filled with executing obstacles and erecting complicated barriers. Therefore, the responsibility for the erection of unit positions and defenses will rest on the individual unit. It is easy to recognize the important support potential offered by the urban area. Almost every city or town has at least one construction company, which can supply the defending commander with bulldozers, bucket loaders, and chain saws to be used in the preparation of his sector.

Cities are also an important source of raw materials, including concrete, bricks, blocks, and timber, which can be used in the construction of unit defensive positions and obstacles.

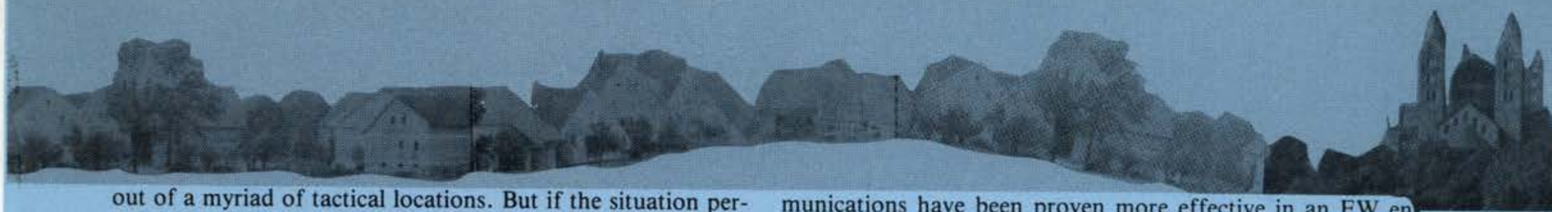
Transportation. The transportation support offered by any fair-sized city or town will prove to be invaluable to the defending commander. Transportation, for the purposes of the city plan, is categorized as road, rail, and aviation. In instances where the city is located along a navigable waterway or canal, water movement will also be included.

Roads. The evaluation of the road net is far more extensive than just identifying which roads are capable of carrying high-tonnage traffic, although tonnage is an important consideration. The identification of routes to and from the various support facilities must be considered and documented. Routes selected should be void of construction which may impede traffic. If at all possible, routes entering and leaving the city should not contain areas which are easily interdicted, such as bridges and tunnels.

The road evaluation is expanded to include the location of companies having trucks available to alleviate the shortage of cargo trucks within the defending unit. In addition to vehicles, trucking companies may also have well-constructed storage facilities which can be used to safely store materials and equipment.

Railways. Rail facilities are less important to the planner, primarily because we don't have the expertise to utilize a rail system. There are, however, several uses for local rail facilities. There is usually a great deal of heavy equipment associated with a rail yard, ranging from fork lifts and hauling equipment to steel rails and ties which can be used in the construction of positions and obstacles. Also, storage facilities are often collocated with the train station and could be used by the defending units.

Aviation. The aviation support offered by the urban area initially will be the most important consideration. Air requirements go far beyond the airports, which are generally located in only the larger cities, to those facilities capable of supporting our tactical aviation assets. Most towns and cities have small airfields, usually the small grass strip variety, servicing single engine aircraft and gliders. These airfields are important for several reasons. Tactical aviation plays an ever-increasing role in our defense plans. Rotary wing aircraft can be staged



out of a myriad of tactical locations. But if the situation permits and an airstrip is available, why not use at least a part of its facilites. Most airfields have at least limited maintenance services, and these facilities can be pressed into service to assist in maintaining a higher aircraft availability rate.

Airfields can also be used to support unit resupply operations by providing an acceptable place to land heavier transport aircraft, and as a landing area for low-altitude equipment extraction operations.

Communications. The inability to communicate, within sector, must be addressed by the defending commander. Considering the difficulty of communicating via FM radio during peacetime, one can imagine the problem which will be encountered on the modern battlefield. To allude to the Soviet potential for electronic warfare (EW) as being ominous would be an understatement. Time and again we have been told the EW threat will render radio communications extremely difficult with our present family of radios.[8] Therefore, it is important to identify and locate those communications facilities which can be pressed into service to augment our communications within the defensive sector. At an absolute minimum, plans will be made to maintain one or more reliable communications networks between the brigade and its maneuver battalions.

Communications modes which may exist within the civilian community include voice, telegraph, teleprinter, and mass media.

Voice communications systems associated with the urban area can be further defined as wire and radio. Wire communications will generally be limited to the existing telephone system. The Bundespost (West Germany's telephone system) operates a reliable, extensive telephone network. In the city plan, Bundespost telephones will be identified by phone number and location, for continued operation during hostilities when normal services are discontinued. As a minimum, those telephones located in facilities planned for occupation will be identified for operation.

In addition, consideration should be given to establishing telephone communication between company, battalion, and brigade command posts. Telephone communications will prove to be invaluable because they are easily maintained and are virtually invulnerable to EW efforts.

Radio systems which may be located within the city include high frequency (HF), very high frequency (VHF), and ultra high frequency (UHF) systems. Generally, high frequency radios are associated with police, fire and paramilitary organizations. The primary consideration when planning for the use of civilian HF systems is that of compatability with our tactical radios. UHF and VHF radios can be found at the airfield serving the urban area. These radios are compatible with our aviation radios and can be used to augment our aviation related communications.

Telegraph systems found within the urban area will have only marginal immediate tactical value because of the current practice of de-emphasizing telegraphic communications within the U.S. Army. This practice does not, however, rule out the later use of telegraphy to communicate with allied forces operating on or near the unit's flanks. Telegraphic communications have been proven more effective in an EW environment than FM/AM voice radios.

Teleprinter facilities, better known in the army as RATT, may be located in the city. Teleprinter equipment, although not secure, could be adapted to augment or replace our RATT capabilities. Facilities which may contain teleprinters are rail stations, government offices, paramilitary organizations, and Bundespost facilities.

Mass media system newspapers and radio and television stations can be used to disseminate instructions and information to the civilian population. The first few days of the battle will undoubtedly be very chaotic for the civilian community. By providing firm instructions and information to the public we can dispel rumors and calm the population.

Miscellaneous Information. The miscellaneous section contains general information that is required by the unit, or a list of facilities and services that are peculiar to a particular urban area.

Examples of information which the planner may wish to include in the miscellaneous section are:

Industries which have the potential of augmenting the logistical needs of the unit. Pharmaceuticals, heavy equipment manufacturing, and machine shops are examples of supporting industries.

Obstacles found in and around the city which will assist the commander in establishing defenses within the city would be identified by type and location.

Medical facilities which serve the local community and have the capability of extending their services to our forces will be identified in the plan. Existing medical facilities must be carefully evaluated prior to use to ensure that they are large enough to provide service to the defending forces without severely degrading medical service for the civilian population.

Conclusion

If we are to emerge the victor from a conflict where the attacker enjoys supremacy in virtually every tactical area, exhaustive prior preparation and planning must be conducted by the defending unit. The only true combat multiplier which tactical intelligence can provide the commander is an extensive understanding of the defensive sector's terrain and how it can support the defending forces. Every piece of defendable terrain, including urban areas, must be utilized to its fullest potential and the city plan can assist the commander in maximum utilization of all available assets.

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[1]Defence Intelligence Agency, *The Soviet Rifle Battalion* (Washington, D.C. 1978) pp. 103-104.

[2]General Sir John Hackett, *The Third World War, August 1985.* (New York, 1979), pp. 253-259.

[3]"Special airborne units of the Warsaw Pact have the general missions of reconnaissance and sabotage... It has been confirmed that special airborne units of the East German, Polish, and Czechoslovak armies conduct training exercises wearing the uniforms of the West German, British and American Armies." Friedrich Wiemer and William J. Lewis, *The Warsaw Pact Armies* (Vienna, Austria, 1977), p. 79.

[4]Office of the Chief of Military History, Special Studies, Civil Affairs: *Soldiers Become Governors* (Washington, D.C., 1964), pp. 73-78.

[5]By including the remaining equipment authorized by TO&E, the fuel required by the battalion would easily be half again the 20,250 gallons required by the tanks.

[6]Hqs, Department of the Army, FM 30-198, *Opposing Forces, Europe* (Washington, D C., 1977), pp. 14-32, 14-35.

[7]Host Nation Support allows the HQ forces to pre-identify the local assets which will be needed during periods of hostilities.

[8]Military Operations of the Soviet Army, pp. 246-247.

Flyswatter

by Gordon J. Douglas, Jr.

The NATO nations rely on their high military technology to provide for the common defense, substituting sophistication for numbers. This reliance on technology is especially true of the U.S. While "quantity" in men and equipment is replaced with "quality," the end result is often highly complex and expensive systems of dubious reliability, high cost (to procure and maintain), limited interoperability (with existing systems and forces), and long development times.

For example, for short-range defense against aircraft, especially attack helicopters, ground forces must rely on complex gun and missile systems (in the absence of air defense fighters and/or air supremacy). Individual unit defense depends on light, shoulder-fired, guided missiles of the *Redeye* type and machinegun/automatic cannon fire. The cost of the *Redeye* ($15,000 when last procured in 1972) discourages widespread distribution to all arms on the scale of the *M-72* LAW (for antitank defense). Antiaircraft machinegun fire requires the expenditure of large quantities of ammunition, but has little chance of hitting and destroying an aircraft. The automatic cannons used in antiaircraft fire, such as the 20-mm *Vulcan*, are more effective and less available in terms of the large numbers required to equip enough units.

What is needed is an unsophisticated, shoulder-fired, antiaircraft weapon that is simple to build and to use. It would correspond to the antitank *Panzerfaust*-like weapons currently in use. The system proposed, the *Flyswatter* (A device used to get rid of annoying flying creatures.), is an adaption of a World War II concept.

In late World War II, it was difficult for the German ground forces to counter Allied ground attack aviation. Movement of men, material, and essential supplies in daylight was too costly to achieve. The *Luftwaffe* was nearly beaten, reduced to the essential defense of Homeland factories or expended in "Fire Brigade" operations on the Eastern Front. Light antiaircraft artillery units with the ground forces were simply unable to defend adequately against the aircraft threat. As a consequence, tactical movements and the logistical support effort took place in darkness or bad weather, reducing the effectiveness of the remaining German forces.

The *Luftfaust* (or *Fliegerfaust*) was developed as a partial answer to this problem, but the war ended before it could be issued for field service, though large numbers had been built. Designed for simple, quick, and inexpensive manufacture, the *Luftfaust* was a type of shoulder-fired salvo rocket launcher. Looking somewhat like a fat *Bazooka,* the launcher consisted of nine drawn steel smoothbore tubes, with eight tubes spaced equally around a central tube. The tubes were held together by four stamped steel plates of identical pattern. Each plate had an integral sleeve to grip the tubes rigidly. The front and rear plates were welded in place. The center two plates stayed in place by a combination of friction and the firing assembly (figure 1).

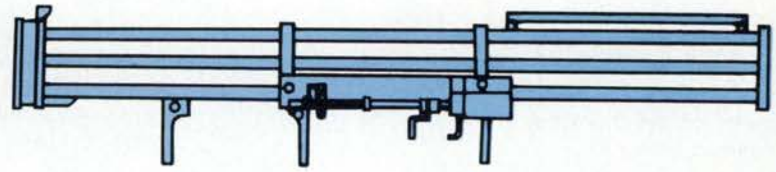


Figure 1. *Luftfaust* launcher

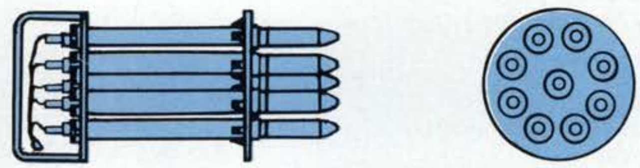


Figure 2. Rocket clip for *Lufttaust*

Ammunition consisted of a preloaded clip holding nine 20-mm rockets. The clip was made up of two stamped steel plates similar to the launch tube plates, but of lighter gage metal. The front plate was secured to the rockets by spring clips, allowing it to slide along the rocket bodies when the clip was loaded into the launcher (figure 2). The rear plate held the base of each rocket and supported the igniters and wiring harness. A bail handle was provided for the loader. To load, the clip was picked up by the bail handle and inserted into the rear of the launcher. When it was seated in the launcher, the clip was rotated slightly to lock it in place. The wire harness was then plugged into the socket provided.

The nine rockets were fired in two groups, one of four and the second of five (after a delay of .2 of a second). This was done to avoid mutual interference. This firing sequence was achieved by inserting a delay pallet in the appropriate igniters during assembly. Rate of fire data has not survived, but would probably have been comparable to 6 rounds per minute of the *M-20* 3.5-inch rocket launcher (*Bazooka*), or a total of 54 20-mm rockets per minute.

Firing the *Luftfaust* was very simple, much like the 2.35-inch *Bazooka* of World War II. The launcher was held on the right shoulder and aimed by the sights mounted along the left hand side of the tubes. Once loaded, the magneto was cocked by setting a spring-loaded rod. To fire, the trigger (located in front of the rear hand grip) was pulled, releasing the magneto rod and transmitting an electrical current to the igniters of the rockets and firing their motors. To prevent inadvertent launching of the rockets and firing their motors. To pretwisted out of line with the magneto rod, preventing any electrical impulse from reaching the igniters.

The individual round was made up of a standard HE cannon projectile (self-destroying fuze) used by the 20-mm *MG-151/20* aircraft cannon attached to a rocket motor. The motor was a simple diglycol stick in a steel tube, the tube being crimped onto the base annular groove of the projectile. The base of the motor tube held a plate with four venturi equally spaced around the rim and set at a 45 degree angle to impart a spin to the rocket in flight. A central venturi provided access for the igniter flame. The primer for igntition was clamped onto the motor base.

The basic *Luftfaust* was issued in a wooden crate containing a single launcher and eight rocket clips (each in a fiber container). Apart from unpacking the crate, no other preparations were needed to fire the launcher.

Production began in early 1945 in small workshops by unskilled labor. Even though few were issued and none were recorded as being encountered by Allied aircrews, the production of the *Luftfaust* had reached 10,000 units by the end of the war. Table 1 gives technical details of the *Luftfaust* and compares it with the *MG-151/20,* whose projectiles it used. Table 2 gives technical details of the next lightest antiaircraft weapon available to the *Wehrmacht.*

The *Luftfaust* was simple, easily built, and used existing ammunition that was surplus to Luftwaffe needs. Thirty-millimeter cannon had been replacing the existing 20-mm *MG-151/20,* releasing large numbers of the later guns for ground use. The 200- to 500-meter effective range of the *Luftfaust* was very good for a light, shoulder-fired weapon. Even if few ground attack aircraft had been shot down, the widespread use of the *Luftfaust* could have caused Allied aircrews to attack their targets from a higher altitude, reducing the effectiveness of aircraft weapons.

The foregoing is interesting from a historical view, but of what use would a weapon such as the *Luftfaust* be for the modern U.S. Army?

A modern variant of the *Luftfaust,* the *Flyswatter,* would be of simple construction and would use 20-mm projectiles made available from stocks held for now-obsolescent aircraft and ground cannon in the U.S. inventory. If the ammunition is still ballistically sound, its use in a lightweight antiaircraft weapon would avoid some of the waste inherent in having stockpiles of ammunition useful only for unused weapons.

If sufficient quantities of current production ammunition are available, a modern 20-mm projectile could be used. Construction of the rocket and the

Table 1. *Luftfaust* characteristics

Launcher	
Total weight	14.5 lb (6.58 kg)
Length (oa)	51.5 in (20.28 cm)
Diameter (of launcher tube)	.875 in (22.23 mm)
Diameter at breech	5.375 in (13.65 cm)
Ammunition	
Clip weight	5.5 lb (2.49 kg)
Weight of one round	8.8 oz (250 gm)
Weight of shell (MG 151/20)	3.88 oz (110 gm)
Weight of diglycol propellant	1.44 oz (40.7 gm)
Length of round (less igniter)	9 in (22.86 cm)
Performance	
Muzzle velocity	918.4-1016.8 fps (280-310 mps)
Projectile spin (40 m from muzzle)	26,000 rpm
Effective range	230-550 yds (210.37-503.05 m)
Maximum range	2,200 yds (2012.2 m)
Average dispersion	10%
Fuze	contact type with self destruct feature
Estimated cyclic rate of fire	6 clips (54 rounds) per minute
MG-151/20 Data	
Weight	93.5 lb (42.4 kg)
Muzzle velocity (HE)	2,656 fps (809.76 mps)
Rate of fire	780 rdpm (using 50 rd belts joined together)
"Typical" syncrhonized range (effective range)	1,093.33 yds (1,000 m)-Air-to-air firing for Fw190A-6

Table 2. 20-mm Flak 38 single barrel light antiaircraft weapon

Caliber	20-mm
Total weight	1,013 lb (459.41 kg)
Weight in action	896 lb (406.35 kg)
Cyclic rate of fire	180-220 rdpm
Muzzle velocity (HE)	2,950 fps (899.39 mps)
Maximum horizontal range	5,230 yds (4,783.54 m)
Effective ceiling	3,500 ft (1,067.07 m)

launcher would be as described for the *Luftfaust,* modified as necessary for current American production techniques. A radiation hazard shield around the rockets will be necessary to avoid accidental ignition due to the effect of stray radio or radar beams in today's electronics warfare environment. A better sight and more modern propellants could well increase the effective range of the *Flyswatter* to nearly 1,000 m against attack helicopters at little increase in cost or complexity over that of the WWII *Luftfaust.*

In use, the *Flyswatter* would supplement the limited numbers of *Redeye* and *Stinger* missiles available for close-in air defense. Organic air defense fire would be greatly increased in effectiveness by adding these simple "bare eyes" weapons to all units. Other uses include attack against light armored vehicles (possibly even being able to knock the tread off an MBT) or "door-busting" in a street fighting scenario.

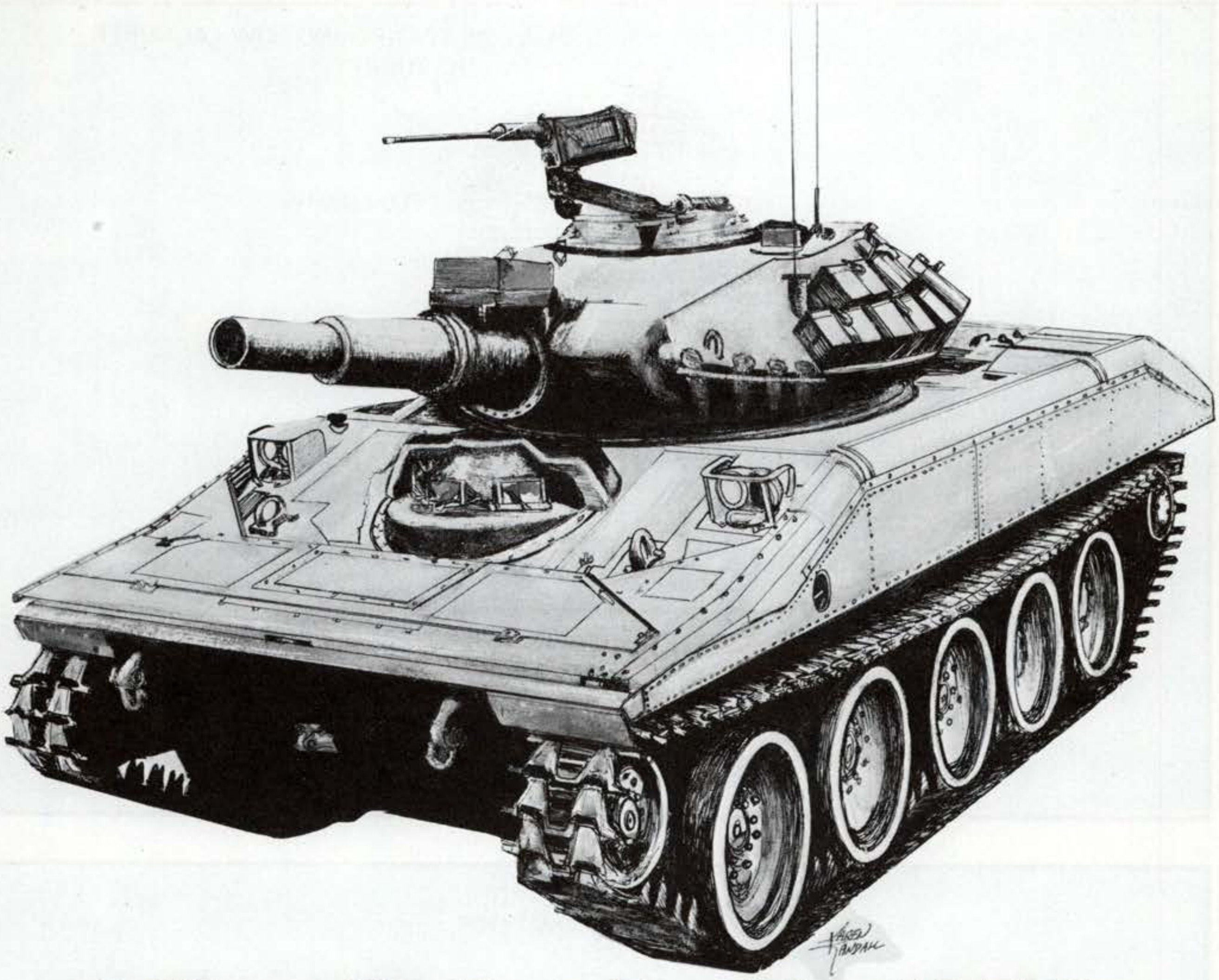
Unlike most current weapons systems, the *Flyswatter* could be built and tested in prototype form for very little investment of time, labor, and materials. Being only a little more complex than the *Sten* machinegun of 1945 (building cost $9.00 in 1945, $38.00 in 1980 equivalent), a production version of the *Flyswatter* should cost no more than $100.00 in quantity. Training for service use would be as simple as teaching a man to shoot skeet with a shotgun. Constructed mostly of low grade steel, the *Flyswatter* makes little demand on strategic materials or costly production facilities.

In summary, the possibility exists for a simple light antiaircraft weapon that is as unsophisticated in concept as the *Panzerfaust* was in its day. The *Flyswatter* could be produced for only a small expenditure of funds and labor, requiring few (if any) strategic materials other than some copper for the magneto and the materials in the sight group. Production could be accomplished by light industry not presently engaged in defense work or by Army ordnance depots. Training is very simple, and can be accomplished during the basic training period of each soldier. Tactical distribution would be much the same as for the 66-mm *M-72* LAW. True, an idea that may have been good in 1945 may not prove to be useful in 1980—but it won't cost years and megabucks to find out. If the *Flyswatter* does prove to be useful, it can be built and issued in a matter of months, providing a cheap way of increasing the organic air defense capabilities of many units in the U.S. Army.

Recognition Quiz Answers

1. **Czech OT-64** (14.5-mm main gun; 7.62-mm coax). Used by Czech and Polish Armies instead of the *BTR-60* to carry motorized rifle troops. Each motorized rifle division has two regiments of *OH-64.*
2. **Korean Fiat 6614 CM** (12.7-mm *M-2* machinegun). Used by South Korean Army as a wheeled APC. Assembled in Korea from parts made in Italy and Korea. Also used by Libya and Somolia.
3. **Soviet BTR-50 PU** (No armament. Has several antennas). Most Warsaw Pact countries use this command and control vehicle to establish battalion or regimental CPs.
4. **W. German Marder** (20-mm main gun, 7.62-mm coax, remote-controlled 7.62-mm gun at rear of turret). *Marder* is used by most West German infantry squads. Some have a *Milan* missile on the turret.
5. **French AMX-10P** (20-mm main gun; 7.62-mm coax) used by French infantry squads in armored units. Also used by Greece, Saudia Arabia, and the Sudan.
6. **Belgian/Netherlands Armored Infantry Fighting Vehicle** (AIFV). (25-mm gun; 7.62 coax.) Used by Belgian, Netherlands, and Philippine Armies. The AIFV is built in the U.S. and can be fitted with a TOW launcher or other armament. The AIFV originally was a prototype for the *M-2* IFV.

(This recognition quiz was prepared by Captain Gerald A. Halbert, Assistant Threat Manager, Directorate of Combat Developments, USAARMC.)



A New Option For The M-551

by Captain Robert A. Snedden

Given that the present TOW vehicles (M-113A1 (TOW)) and improved TOW vehicle (ITV) are not satisfactory platforms for the TOW, is there an alternative that is readily available? The retirement of the *M-551 Sheridan* from the active inventory presents very real alternatives that would be both readily available and comparatively cheap. The *M-551* has a distinct possibility in 2 forms—a modification of the existing vehicle and a hybrid using the M-551 chassis and a different turret.

The problems with the *M-551* that contributed to its retirement seem to be centered in the present 152-mm gun/launcher turret. A complex electronic turret system coupled with a gun known for its massive recoil resulted in poor readiness, and its inability to survive Soviet-type artillery fires are its major failings. The chassis is, on the other hand, reliable automotively with good maneuverability, cross-country mobility, and speed. This suggests two possible alternatives.

The first modification (figure 1) leaves the present *M-551* chassis unchanged, and keeps the same basic turret structure. The 152-mm gun/*Shillelagh* is replaced with a medium-caliber, high-velocity gun (MCHVG). Several candidates have been developed for the HIMAG testing and could be readily procured.

This would give the vehicle a good, reliable gun with both KE and chemical capability with recoil compatible with the vehicle's light weight, and allow an increased basic ammunition load. The *Shillelagh* would be replaced externally-mounted or built-in TOW missiles. A slightly modified version of the present TOW sight would be coupled to the main gun. The turret is already rated in slew, elevation, and depression rates for missile tracking.

The turret may be elongated to accomodate storing more TOW missiles and additional main gun rounds.

This modification retains many of the advantages of the pre-

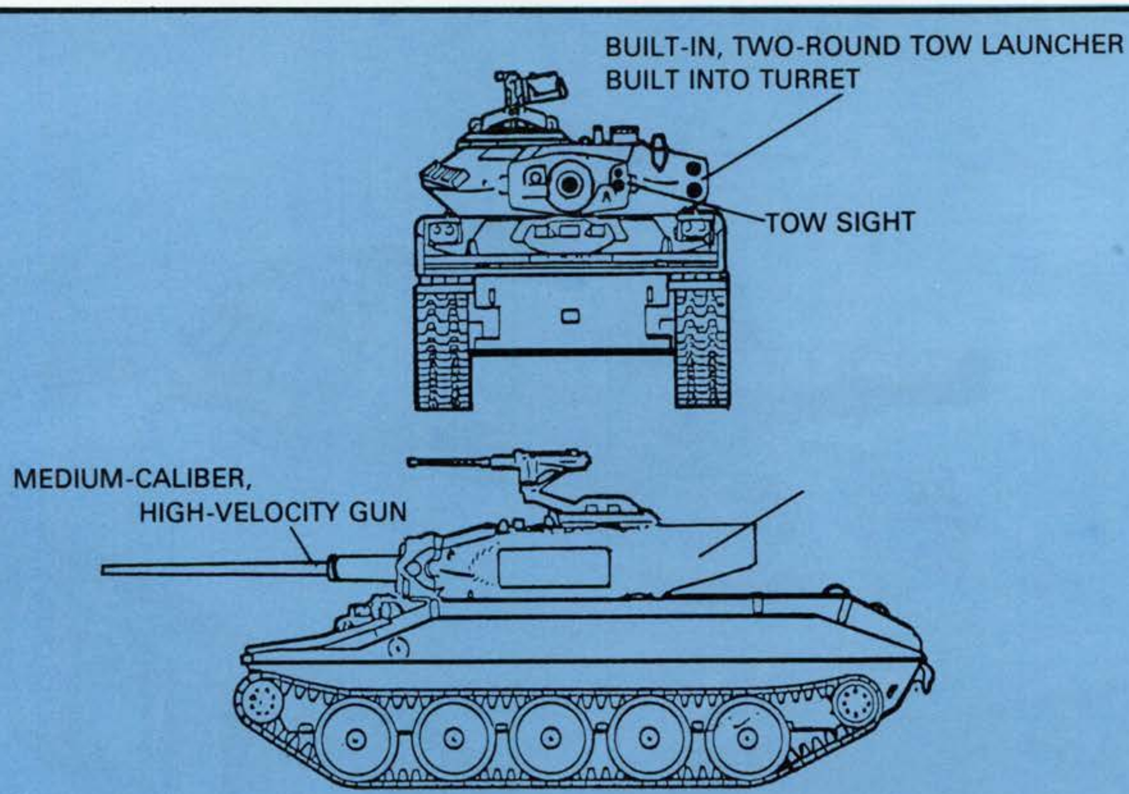


Figure 1. Modified M-551 light tank with TOW launcher inside the turret.

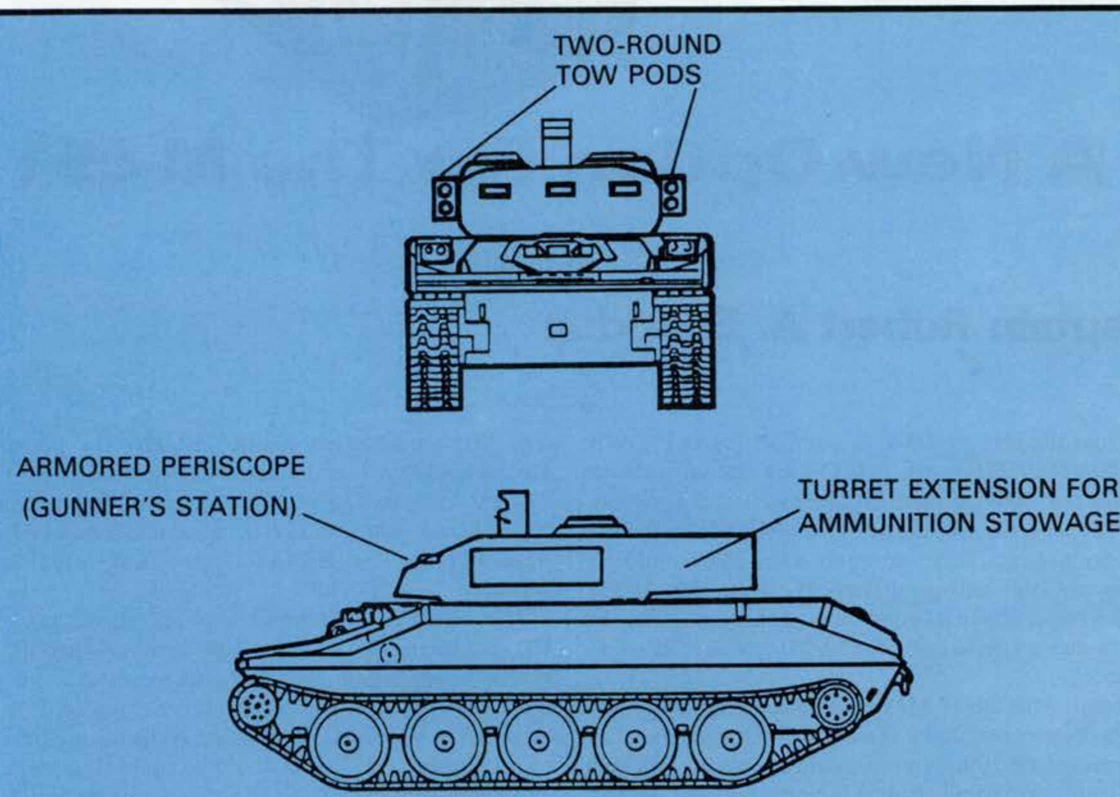


Figure 2. M-551 light tank hybridized as a dedicated TOW vehicle.

sent *M-551,* while eliminating the disadvantages of the complex 152-mm gun/launcher and its related maintenance and recoil. It allows an increase in the basic load, giving the vehicle a capability for sustained combat. It also lends itself to improvements such as an auto-loading gun, allowing a 3-man crew, and bolt-on armor plating, to reduce vulnerability to artillery.

This version of the *Sheridan* could be used as a light tank for the airborne forces, and possibly for rapid deployment-type forces. It could also serve as a dedicated antitank vehicle in infantry battalions, giving the infantry both long-range missile capability, and the shorter-range, rapid-fire gun capability. This could be very important if armor protection trends continue to reduce the HEAT round's effectiveness.

The second modification is intended to be a dedicatd TOW vehicle to replace the present ITV. The *M-551* chassis is retained for its speed, mobility, and maneuverability, while the turret is replaced with a boxlike turret approximately the same height, but wider and longer than the present turret (figure 2). This turret has no main gun, but rather, pods are fitted to each side of the turret containing two TOWs each. Each pod can be reloaded from the inside. Backblast is vented outside of the turret and each pod will elevate and depress relative to the turret.

The optics and tracking instruments will be contained in an armored periscope that can rotate independently of the turret. The turret will need to be aligned with the periscope only during the launch. The turret would be constructed of steel thick enough to shield crew and contents from artillery fragments, and be big enough to provide stowage for at least 12-16 rounds of additional ammunition.

This hybrid vehicle would offer a number of advantages over the present dedicated TOW vehicle:

- The gunner is completely enclosed in a cocoon of steel, reducing his vulnerability to small arms and artillery suppression.
- The reloading function is completely enclosed. In addition, 4 rounds are available before reloading is required.
- Maintenance sould be simpler than that of the ITV.
- There are fewer moving parts with easier access to those that do, and the optics link is *much* simpler. Three men can observe/search—the gunner from the sight, the squad leader and the loader from their hatches.
- Carries larger basic load. A basic load of 20+ rounds is envisioned as compared to 12 for the ITV. Thus it is more capable of sustained combat.

It is recognized that neither of these vehicles is the perfect vehicle for the job—nor even the best, but are simply doing the best with what we have or can hope to get in the next 10 years. The best candidates would surely be derivatives of the *M-2/3* (or even *XM-1* chassis), but the crying need for a modern fighting vehicle by the infantry and cavalry will not allow it in the near future. These two vehicles, then, could fill one major design criteria; with proper procurement methods, these vehicles could be fielded rapidly and probably at a signficantly lower cost than a new design.

Product Improved T-72?

A photograph of an unidentified Soviet tank was recently published in the Soviet magazine *Tekhnika I Vooruzheniye* (Issue No. 9/80). The tank is similar to the Soviet T-72 except for the addition of side skirts, an unidentified short tubular object on the right top of the turret, and the removal of the blister for the right fire-control optic.

AWOL Prevention

by Captain Mark P. Hertling

Recently, an article appeared in *All Volunteer, The Recruiter's Magazine* which had as its premise that the reenlistment process of good soldiers begins the day the new private enters the orderly room. If this new soldier sees good leadership, feels he is being taken care of, and can actually practice the soldiering skills for which he enlisted, he will be "sold" on the Army, and when the time comes, reenlist. Selling the Army to this soldier is a continuous 3- or 4-year process that is based on good leadership and training. The AWOL prevention program adopted by my unit carries this same goal of leadership and soldiering with one additional aspect—that of luck—and it allowed Company A, 3-77th Armor to remain AWOL-free for 3 years.

This unit developed an extensive orientation program, and the orientation SOP is a definite factor in keeping the soldier on his job. Army statistics state that the majority of AWOL soldiers leave their unit within the first few months; therefore, this period of welcome and initiation to soldiering is critical. The nervousness of any young soldier upon reporting to his first unit can be compared only to that of an airborne volunteer making his first jump. Both know they are ready to go; but when the door opens, there is the likelihood of hesitation.

The first sergeant and platoon sergeant lay the groundwork. On a daily basis, each platoon is aware of who will get the next new man. Upon the company's notification by the Personnel Administration Center (PAC) that there is a soldier waiting at battalion headquarters who has just been assigned, the platoon eligible to receive the replacement is notified by the first sergeant. This platoon then sends a sponsor to the PAC to meet the replacement. This sponsor is a good PFC or SP4 who will stay with the new soldier for the next few days or until the man is completely oriented to the unit. The long walk from the battalion headquarters to the company orderly room is the perfect time for the sponsor to give the new man some unofficial information about people and the unit which will ease his first-day jitters. It is important that this unofficial information coincides with the chain of command's "party line" because information passed by a SP4 is sometimes more readily acceptable than that passed by the first sergeant or company commander.

The first sergeant makes it a point to see each new soldier immediately. The orientation that is given is one that combines the intricacies of relaying pertinent information (the brigade commander's policy on driving while intoxicated (DWI), vehicle and weapon registration on post, etc.) with making this new soldier sense the feeling that he is in an elite and proud unit. The first sergeant's in-briefing consists of all of the vital information this new arrival needs, including a strip map of facilities such as the post theatre, chapel, laundry facilities, and the like. The continuous thread that binds this initial orientation is the emphasis on the new soldier's use of the chain of command.

Immediately after the first sergeant's orientation, the new man is prepared to see the unit commander. This part of the welcome is conducted in a very informal atmosphere, and the primary topics discussed are standards that the soldier is expected to meet, the commander's open-door policy, and again, the chain of command. The soldier is told that the standards which have been set for him are very high. Conduct, dress, and military bearing are addressed, but primarily the new man is told that his soldiering skills will continually be tested.

After his orientation, the new man realizes that he is faced with constant training opportunities—"hip pocket" classes from his NCOs during maintenance periods in the motor pool; three or four predetermined skill qualification test (SQT) tasks that are at the bottom of the training schedule which he finds the first sergeant or commander testing him on every Friday; and more formal training at least once a week, in addition to the usual tactical or tank gunnery training that is found in the average armor company.

These opportunities not only make a well-trained unit, but they also successfully confront two causes for AWOL—boredom and job dissatisfaction. Stress on training must be intense! Discussion of the chain of command and the open door policy is interwoven during the commander's briefing. Although many units consider the open door as a time for unsolved grievances to be aired, the emphasis the discussion is placed instead on the opportunity for the soldier to suggest areas that need to be improved. This approach leads the soldier to believe that he is an active, contributing member of the unit. Surprisingly, this concept has led to many sodliers' making valuable contributions to the unit during off-duty time.

In regards to problem solving, the soldier is again reminded that his chain of command is closest to him and, therefore, can in most cases, solve his everyday problems. He is reminded to approach the commander or first sergeant only about those problems that he feels have been overlooked by his chain of command.

The final portion of the company commanders' briefing is a vital element in the AWOL-prevention program. The new soldier is asked for an address to which he would like a letter sent that will inform the recipient of his assignment to the unit. A copy of the form letter that is used is read to the soldier, and he realizes that it contains information relevant to his job assignment, the company's history and pride, and facilities available to him. The final note in this letters tells the recipient that the company commander would welcome any correspondence concerning questions about the unit or Army or inquiries concerning the soldier's welfare or development.

This letter accomplishes a myriad of AWOL-prevention tasks. Initially, it shows the soldier that the unit is proud to have him as part of the team. In addition, the first letter from his parents, wife, etc. which states they have received word of his assignment and his fine job performance from the company commander is a tremendous morale boost. This letter is the key in opening lines for future communication on trouble areas at home which may be the cause for the soldier's going AWOL. A case in point: a "geographic bachelor" had not informed his chain of command that his family was being evicted from their home in North Carolina. The wife wrote the commander informing him of the circumstances, and the soldier was led to the Army Emergency Relief Center (AER) which quickly solved the problem.

Requesting an address and phone number of those close to the new soldier also gives an indication of where the soldier would go if he was reported AWOL. Often a soldier who gives his girlfriend's name during the in-briefing clues the chain of command that he would not necessarily go to his "home of record" if he were to leave his duty station. Additionally, a phone call to an AWOL's girlfriend explaining the seriousness of the offense usually leads to the location of the soldier. In any case, the unit now has on hand a current address and phone number of each man in the company. This saves the trouble of looking through the personal historical forms when information of this nature is need immediately.

The final phase of orientation comes from the platoon leader and platoon sergeant. The major contributor to the no-AWOL record is passed along at this briefing, and that is the unit "HELP" card. Every phone number the soldier would call when in trouble, including the charge of quarters, battalion staff officer, and the home phone number of his complete chain of command is on this 2- x 3-inch card. Although these cards were originally initiated to curb DWI offenses, they have been handy to many soldiers who were in trouble while on a leave or pass. After the phone numbers are placed on the cards, acetate is applied and these cards are frequently inspected during barracks and personnel checks.

The wives of the unit also play an important role in AWOL prevention. An action was initiated which has proven popular with the soldier and to him is positive proof that he is cared for in a personal way. It was the feeling that the soldier in the barracks felt loneliest on his birthday. A list of soldiers who lived in the barracks and their birthdays were made, and on the appropriate day a home-baked cake or cupcakes would appear with a note addressing the soldier on his special day. High morale is obviously a detriment to the AWOL problem, and this small act contributed greatly to the morale of the unit.

This tidbit was passed to other commanders who initiated the program, and it proved highly successful in all the units. Many times the soldiers commented that they felt a lot like a big family—they felt they were cared about by many more people than just their chain of command. This not only contributed to the no-AWOL record, but it developed teamwork and pride in what they were doing on a day-to-day basis.

A primary motivation which keeps soliders on the job is a unique training program. The routine missions of an armored unit can be supplemented by training which included rapelling, slide for life, escape and evasion missions, and realistic riot-control actions. Recently, a few favors were cashed in and the unit performed an airmobile operation courtesy of the division's air cavalry troop. A training program which consists of periods like these contributes to the soldier's feelings that he is participating in a constant adventure, and this allows him to look forward to each new day. Soldiers want to be trained, and the unit NCOs can respond to this need with innovative and vigorous programs, classes, and training periods.

A hearty and demanding PT program is also an important morale builder. During runs, the NCOIC usually designates four or five privates at various times throughout the 3-mile course to give the "Jody" calls. Once again, this soldier involvement contributes to the enlisted man's feeling that he is a vital part of the unit, and that his contributions are recognized by his being singled out to lead his comrades. During the exercise phase of the morning PT, privates and PFCs are normally scheduled a week in advance to give the conditioning drills. This develops soldier skills and leadership abilities as well as contributing to unit pride. These drills also force the NCO to take extra time the night before with the private who is scheduled to give the drills. The harassment this NCO receives from his peers is unbearable should "his" private not have his act together during PT.

Too often in our mechanized and fast-moving Army, the only time a soldier is talked to is when he is getting reprimanded. Alpha Company has, as part of its training calendar, a 4-hour block every month where a formal counselling session for every soldier in every platoon is the order of the day. Each platoon sergeant talks to the serviceman, using the format of the preprinted Enlisted Evaluation Report (EER) and any other area which he feels should be discussed. This is done concurrently with a clothing and equipment inspections or during barracks maintenance so all the soldiers are in the same vicinity and are not wasting time waiting for their names to be called. Even if the report is a bad one, the soldier knows that someone is concerned about his duty performance. This counselling session is usually scheduled on payday to avoid disrupting training as well as facilitate "payday activities."

Although there are other areas which could be extensively discussed in this article—unit functions and parties, NCO professionalism classes, publicity of awards such as a day off for going X number of days without an AWOL—these areas must be addressed by each unit, and its commander's, personality. All of these areas are vitally important to limiting AWOLs and are incorporated to some degree in any successful prevention program.

Three more factors that contributed to Alpha Company's success that cannot be overlooked and that are self-explanatory are the strength of the NCO corps within the unit; an outstanding group of strong dedicated soldiers; and a whole lot of luck. Without these three factors the unit could not have had 3 AWOL-free years: the longest record in FORSCOM.

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Future Close Combat Vehicles

by Clifford D. Bradley

The first new U.S. main battle tank (MBT), the *XM-1,* in development since July 1, 1973, rolled off the production line at Lima, Ohio on February 28, 1980. Although the vehicle competitive validation phase started July 1, 1973,with the award of advanced development contracts to Chrysler and General Motors, the ill-fated forerunners of the *XM-1*—the *XM-803* and *MBT-70*—actually date back to 1963. Many of their components found their way into the *XM-1.* Many of the key members of the staff of the *XM-1* program started the earlier *XM-803/MBT-70* program in 1963. Thus, the U.S. Army has been nearly 18 years bringing a new tank into production.

The Infantry Fighting Vehicle (IFV) *M-2* and the Cavalry Fighting Vehicle (CFV) *M-3* will start to roll off the production line at San Jose, California in May 1981. The IFV, successor to the well-known and widely deployed *M-113,* has actually been under development since 1974, when FMC was awarded a development contract after a competitive concept phase with two other contractors. However, the government in-house laboratories, with some contractor assistance, had been conducting concept design and test-bed analysis of a new infantry personnel carrier since 1963 under such program names as Infantry Combat Vehicle (ICV), Armored Infantry Fighting Vehicle (AIFV), Mechanized Infantry Combat Vehicle-65 (MICV-65) and MICV.

The CFV *M-3* was merged with the IFV *M-2* using a common chassis and weapon station in 1976. This occurred after the Armored Reconnaissance Scout Vehicle (ARSV) program was cancelled in 1975, 3 years after a contract award for in-house laboratories had been conducting design analysis and test-rig efforts on a reconnaissance/scout vehicle to replace the *M-114* since the early 1960s.

The Army, for one reason and another, has consumed the better part of 2 decades bringing vehicle systems to production that will be the major maneuver elements of the U.S. Army through the remainder of the 20th century.

It is noted with some concern that during the 1960s and 1970s when the new close-combat vehicles were being developed, the Army faced an expanding Soviet force that was growing in both quantity and quality at an ominous rate. During this period, at least three new Soviet tanks entered their armed forces (the *T-62, T-64,* and *T-72*) and possibly a fourth one, the *T-80,* which is expected in the early 1980s. Additionally, the *BMP* was fielded and modernized several times during this period.

Contrast this with the U.S. maneuver element systems fielded during the 1960s and 1970s, which have consisted of the *M-60* series, the *M-113* and the *M-114,* and later the *M-551.* In effect, the U.S. Army has been forced to be ready to fight, employing operational concepts and using essentially fixed materiel assets, to counter an enemy force that consisted of nearly four generations of technical upgrading, in addition to the Soviet quantitative advantage in numbers deployed. Emerging also during the late 1960s and 1970s was the increasing Soviet awareness of the potential tactical value of attack helicopters and the introduction of this weapon into their armored forces in substantial quantities.

Planning for the Next Generation

This year, the Army's continued advanced system investigation has progressed to a structured planning program for a new generation of combat vehicles which are potential follow-ons to the *XM-1,* the *M-2,* and the *M-3.* The program includes coordinated activity at several levels. In-house concept design and analysis studies have been in progress since October 1979. These system concepts have included technology exchanges with the various research and development (R&D) commands and centers that will provide componentry and sub-systems to future vehicles. These exchanges continue and are built around the Armored Combat Vehicle Science and Technology Program. Under this U.S. Army Materiel Development and Readiness Command (DARCOM)-wide program, representatives from involved agencies participate as action teams (firepower, mobility, sensing, survivability, communications, and support) that evaluate technology opportunities and requirements.

The most important coordination involved in the concept studies, however, has been between developer and user. The coordination extends from the basic research level through the evaluation of complete systems configurations.

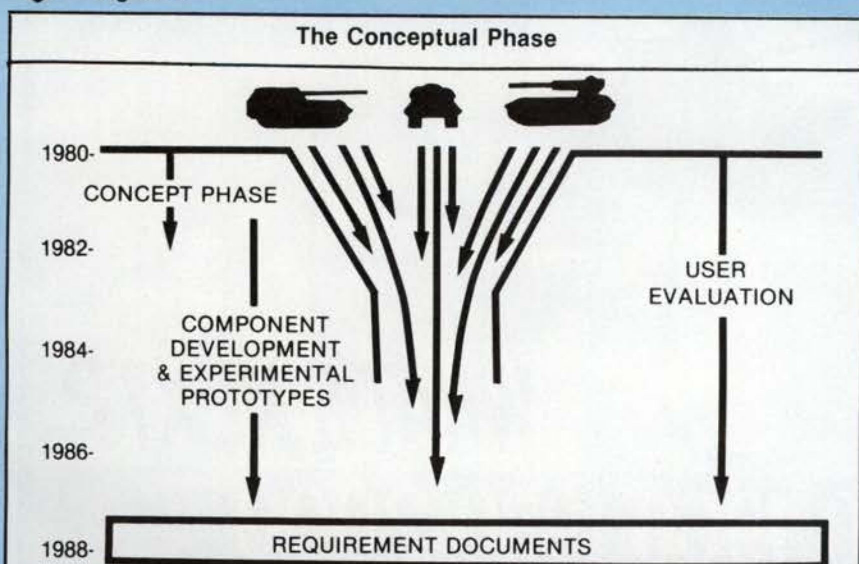
Some rather detailed preliminary discussions have been held between the Tank/Automotive Research and Development Command (TARADCOM) Concepts Laboratory and representatives from the U.S. Army Armor Center (USAARMC) to discuss the major technical and operational factors that will play key roles in shaping future close-combat vehicles. Some early discussions have also taken place with representatives from the U.S. Army Infantry Center (USAIC). Continuing dialogue between the Training and Doctrine Command (TRADOC) and DARCOM communities will take place throughout the conceptual phase of the program, which will literally take nearly all of the 1980 decade to determine the requirements for a future close-combat system or systems.

On May 21, 1980, the Concepts Laboratory of TARADCOM hosted a presolicitation conference to discuss future close combat vehicles with some 220 representatives from industry and government. The stated objective of the conference was to bring together the best "brains" of industry for the specific purpose of asking them to take a look at the challenge of what follows the *XM-1*, the *M-2*, and the *M-3*. Industry was given briefings on systems background and design considerations, future threats, operational concepts, and future technology. The industry representatives were invited to take a copy of the Request for Proposal (RFP) for future close-combat vehicles, and if interested, to submit proposals to TARADCOM by July 9, 1980.

It should be emphasized again that the task requested of industry is not to product-improve the *XM-1*, the *M-2*, and the *M-3*—that will be handled separately. This program is intended to exploit the most advanced projected technologies to achieve a level of combat performance significantly higher than that projected by the *XM-1*, the *M-2*, and the *M-3*. It is also to justify the development of a new family of close-combat vehicles.

The industry representatives at the conference were invited to address a most monumental challenge, and the program they will help initiate could very well set the stage for the future close-combat system, sub-systems, and component development for the remainder of this century. The winning bidders will be given classified briefings prepared by TRADOC on future threats, future survivability technology, and projected close-combat vehicle operational concepts for the mid-1990s. In developing a conceptual system, industry teams must successfully address the "Threat" as briefed by intelligence sources, the operational concepts provided by TRADOC, and projections of future technologies, and through a comprehensive and logical understanding of the basic problems facing current close-combat vehicles, develop projected system capabilities that will be needed to support the operational concepts.

Figure 1



Once system capabilities are developed, they must—through innovative and imaginative thinking, coupled with a broad knowledge of total system design and integration—develop plausible conceptual options incorporating the system capabilities that satisfy the requirements of the operational concept.

Now, for the last and possibly most important part of the study, the industry teams must, through a series of evaluative trade-offs, select the best concept from the stable of plausible options to fill the role for the follow-on *XM-1*, *M-2*, and *M-3*. The choice may be one for one replacement of the current vehicles, or a single vehicle that will accomplish all three roles or some other combination of vehicles.

Seven proposals were received by the date requested, and at the time of this writing are being evaluated. It is expected that contracts will be awarded to at least three and perhaps as many as five successful bidders in early 1981, pending receipt of final, updated operational concepts for the mid-1990s.

The over-all "game plan" for accomplishing the conceptual phase of the follow-on *XM-1*, *M-2*, and *M-3* is shown in figure 1. In the upper part of the chart, the conceptual options that will be generated in-house now and through 1981 in the Concepts Laboratory are shown entering the "funnel" or "hopper." The concepts that will be developed by industry are shown entering the hopper in approximately February 1982. During the first half of 1982, a comprehensive analysis of all the concepts will be conducted. If it appears to be productive, perhaps even a reworking of some of the conceptual options may be in order, to enhance the quality or explore variants of promising ideas.

Thus, from the bottom of the funnel in the late 1982 time frame, we hope to select perhaps as many as four to six concepts for test-bed fabrication. The concepts selected and the test beds that follow will have three major objectives. First, they will serve to focus future component developments that are derived from a system need.

Secondly, the test beds will serve as technology demonstrators to validate the suitability and feasibility of the components in a realistic dynamic environment. Thirdly, some of the test beds may serve as exploratory and configuration-type test beds in which the functional, operational, and tactical employment are such a radical departure from the current system that a complete user evaluation is required in a real world field environment. Some test beds may involve three of the above considerations. It should also be noted the test beds may even be recycled in the 1985-1988 time frame to yield additional test data and information pertinent to future close-combat vehicle requirements and system capabilities.

The concepts of the follow-on *XM-1*, *M-2*, and *M-3* that will be evolved from operational concepts, future technologies and future threats will set the stage for future close-combat vehicle development for the 1980s and lay the groundwork for close-combat vehicles through this century.

The Challenge

It can be readily perceived by all who have followed the evolution of close-combat vehicles since World War II and even before, that the task facing those changed with defining and developing the *XM-1*, *M-2*, and *M-3* follow-on vehicles is indeed an awesome and challenging endeavor. The penalty for failure or for providing less than the best solutions may place the U.S. Army in such a position of qualitative inferiority that it cannot perform its mission.

A short discussion of each of the follow-on systems will serve to illustrate the dimensions of the challenge. Since the tank is considered to be the centerpiece of land combat forces and the focal point around which land combat tactics and doctrine are structured in all armies, let's start with the tank.

The tank as a close-combat system has existed for just over 60 years. It was conceived and introduced in the latter part of World War I. The tracks and armor provided relative immunity to barbed wire, trenches, and automatic machinegun fire, all deadly deterrents to infantry movement. Thus, the tank restored mobility to the battlefield.

Since tanks were first introduced on the battlefield, a major distinguishing capability has been immunity to all or at least a major portion of enemy threats expected to be encountered. Historically, it has been this commitment to armor, coupled with balanced firepower and mobility, that has distinguished the tank from other tracked vehicles on the battlefield.

The contribution that a given level of armor protection makes to the overall tank survivability is a transient one, since the battlefield threat to tanks is a changing factor and is related to weapon and firepower technology. Thus, the evolution of tank designs over the years has reflected the contest between the offensive capability of firepower and the defensive capability of armor for various time frames. A new and improved technological development on the part of one always stimulates a response by

Figure 2

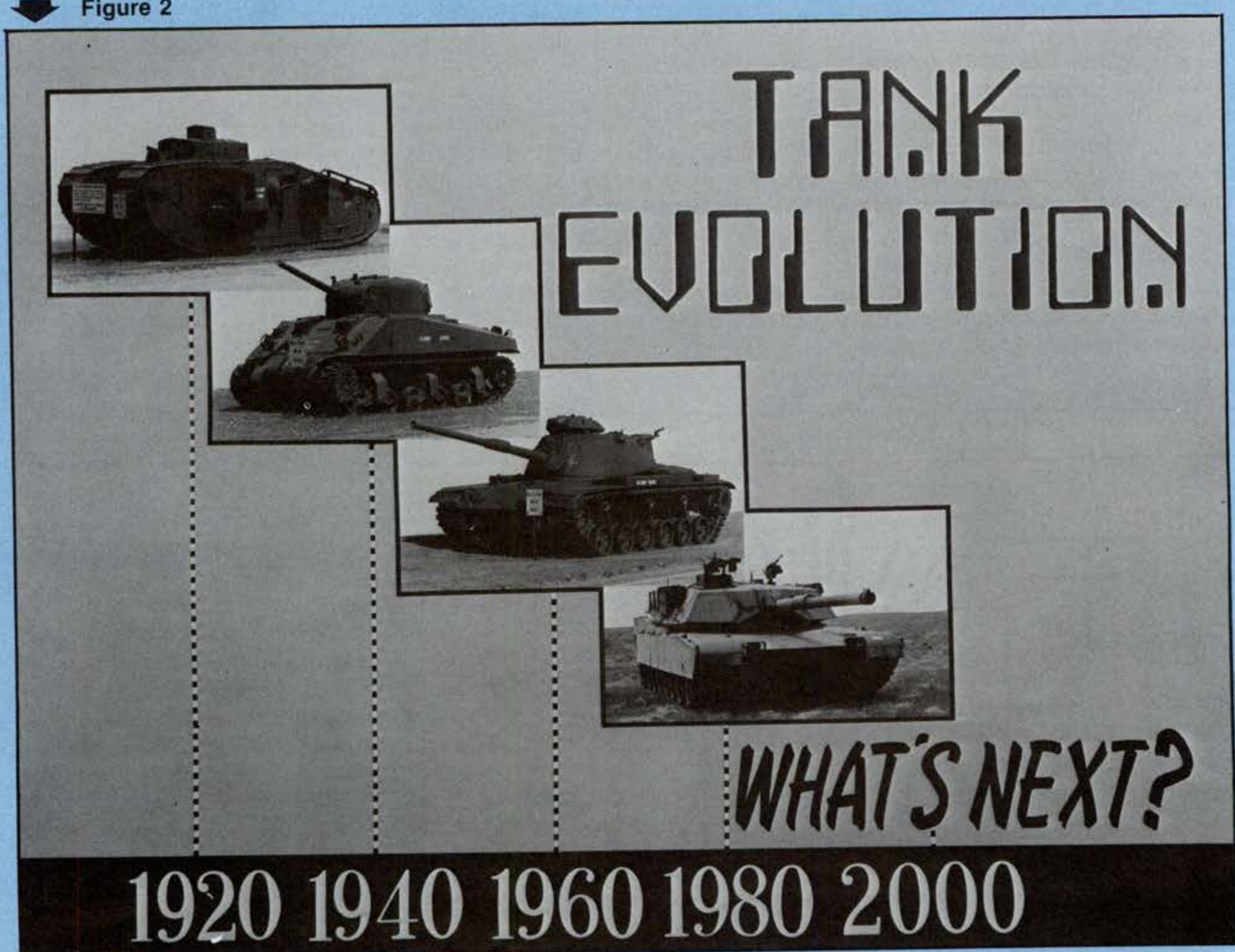


Figure 3

the opposing technology to match or surpass the other. This contest, over the years, has lead to a successive introduction of heavier and more costly vehicles by all countries worldwide. This fact is certainly well illustrated in figure 2 which shows the chronological evolution of U.S. tanks at 20-year intervals since World War I.

The modern day turreted tank used worldwide is generally conceded to have evolved from the *T-34* tank introduced by the Soviets in 1939. It was closely followed with similar configurations by the Germans, French, and British, and finally the U.S. with the *M-4 Sherman*. The turreted configuration has been accepted by most countries (Sweden was an exception but has now joined the others) to be the optimum instrument for mobile protected firepower in the land warfare role of aggressive assault.

During the past 15 or 20 years, the threat to the tank, evolving from a broad set of related technologies, has been progressing at a faster rate than the technologies related to tank armor and defensive capabilities. This was brought home to the U.S. Army analysts and tacticians by the mind-boggling losses in the first 3 weeks of the 1973 Middle East War. Another important aspect of this technological imbalance is the relative ease of updating the offensive capabilities of a tank system by the integration of new and improved fire control and more effective cannons and projectiles. Contrast this with the difficulty of significantly altering the armor envelope once the basic design has been initiated. For example, the armor selected for the *XM-1* in the mid-1970s and the armor on the first tank produced in February 1980 may well remain the basic armor for the vehicle through the end of this century. Meanwhile, the offensive threat will go through several generations of improvements.

The technological imbalance mentioned above, coupled with the equally important difficulties in integrating the competing technologies to upgrade a fielded system, does little to guarantee the survival of current tanks on future battlefields. Many knowledgeable people are asking: Can the tank survive and be tactically viable and cost effective on future battlefields? The answer is that some form of mobile protected firepower is absolutely essential to offensive land warfare. The challenge to tank designers is to determine the "optimum configuration offensively that can still survive."

One possible alternative is to have the diminshed contribution that armor makes to survivability as a function of time restored by non-armor augmenting devices that act to defeat the threat by other means. Thus, while some level of armor would remain as the cornerstone of protection, the tank with other means of survivability could, in the future, remain the "bully" of the battlefield and the centerpiece of land combat forces. That is the job facing the future system developers. It is their task to fill in the blank space in the lower right corner of figure 2.

Now, let us take a brief look at the future IFV. The evolution of the modern day system culminating in the production of the *M-2* IFV in 1981 is shown chronologically in 20-year intervals in figure 3. Over the years and especially in the last decade, the infantry carrier has had a much greater tactical and doctrinal change than has the tank and this is certainly reflected in the *M-2*. The tank has had essentially the same battlefield role of mobile protected firepower over the years and the changes, at least since 1940, have come about by the continuing technologically-driven one-upmanship between firepower and protection.

Infantry vehicles, on the other hand, up to the current *M-2* IFV, have been largely intended as transporters of infantry, with fighting in the dismounted role as the main and vital task of the infantry soldier. Thus, the evolution of the infantry carrier up to the present IFV reflected the technological gains made in vehicle mobility and an increasing level of protection for the "battle taxis."

While fighting dismounted is still a vital and dominant role of infantry, the *M-2* IFV reflects a new doctrine and is truly a fighting vehicle capable of mounted action in supporting the *XM-1* as a vital member of the combined arms team. A question then arises as to whether the mounted role will become more dominant, will the survivability level tend to match more nearly the tank either through armor or armor augmenting devices, or will the firepower be further upgraded? Once again, filling the lower right square in figure 3 is the task of future system developers answering the question, "What follows the *M-2* IFV?"

Now for the *M-3* CFV. Figure 4 shows that the CFV and reconnaissance vehicles evolved in a manner similar to the tank and IFV. In the case of the CFV for all armies worldwide, the role or mission has not been a major determinant in shaping the configuration, characteristics, or size of the vehicle, as it has been in cases of the tank and the IFV.

In fact, there has never been a general consensus or agreement along military theorists and tacticians regarding the

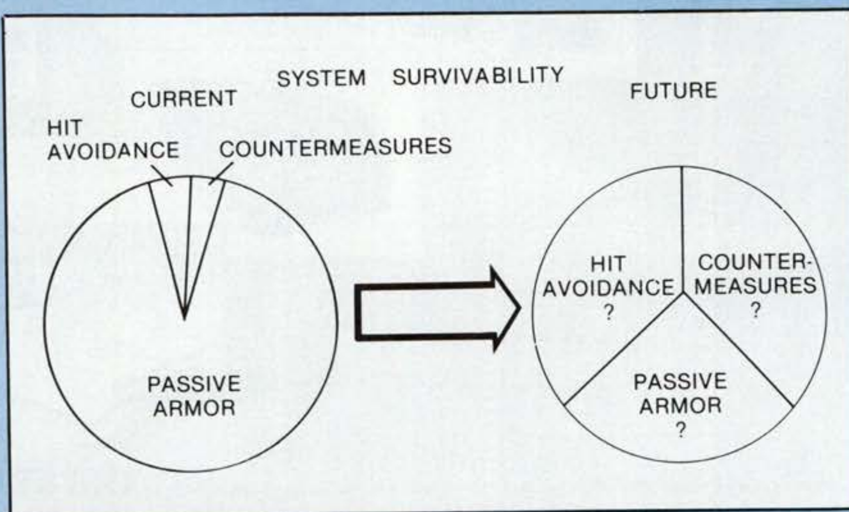


Figure 4

Figure 5

level of firepower, protection, and mobility and the priority accorded each in the trade off process for the cavalry or scouting reconnaissance role. This was very much in evidence during the development of the ARSV program in the late 1960s and early 1970s. It was also a major factor in the compromise choice of merging the requirements with the IFV for economic reasons, both from an acquisition and logistical standpoint. Again, the task facing the developers is to take a look at the pacing factors and determine what comes after the *M-3*.

In Summary

It is becoming increasingly evident that the awesome lethality of the future battlefield, coupled with the quantitative superiority of enemy forces, is making the design and development of U.S. land forces a most monumental challenge. The basic issue will be system survivability, and in turn, force survivability. The latter question, while a derivative of the first, may eventually be most impacted by the tacticians and those who set system priorities. The former will continue to be a challenge to the technologists and developers.

If innovative technology and imaginative new concepts are going to play a major role in system survivability, a means of quantifying the contribution of new technology to the survival process must be developed. This challenge is best demonstrated in figure 5. On the left is shown the current importance of armor in the survivability of a tank such as the *M-60* or the *XM-1* with hit avoidance and countermeasures playing a minor role. The rapidly escalating capability of battlefield threats is diminishing the capability of armor to provide adequate protection for the close-combat mission; thus creating a pressing need for other means of protection such as hit avoidance and countermeasures. The proper blend of these survivability means must be understood, quantified, and integrated.

The first step has been taken in launching the Future Close-Combat Vehicle Program. There is much work ahead and now is the time to get started. The 1980s will be an exciting decade for those involved.

CLIFFORD D. BRADLEY is currently serving as Chief of the Exploratory Development Division, Tank-Automotive Research and Development Command, Warren, Michigan. Mr. Bradley joined the Tank-Automotive Command in June 1951 after receiving his B.S. Degree in Mechanical Engineering from Wayne State University. Prior to entering college, he was in the U.S. Army from July 1940 to September 1945 and served in the 7th Cavalry Brigade and the 1st and 4th Armored Division. Following completion of a 15-month engineering training period at the Tank-Automotive Command, Mr. Bradley has been associated with advanced military vehicle concepts for his entire career and has participated to some degree in all major vehicular development progams initiated at TACOM.

New Combat Vehicles Are A Long, Long Time In The Making

For those interested in statistical detail, the following information may be interesting:

•During the 18 years or so that it took to bring the *XM-1, M-2* and *M-3* to production, at least nine generations of users, reflecting World War II, Korea, and Vietnam experience provided guidance on requirements and operational concepts.

•At least an equal number of generations of DARCOM and DA action officers provided the fiscal manipulations with program funding during the 18-year development time.

•Engineers from the *XM-1* and Fighting Vehicle Systems Program Manager's office who joined the programs as GS-12s and GS-13s recently retired as GS-14s and GS-15s. They had spent 60 percent of their careers on one or the other of these programs.

•During the 6 or 7 years preceding award of the MICV contract to FMC, the Advanced Concept Group at TARADCOM (TACOM) generated approximately 145 vehicle concepts with supporting analytical work and an equal number of mini-layouts of subsystems and technical integration. They also directed the fabrication of at least 8 wooden mock-ups in order to satisfy and respond to changing requirements as to what was needed and to resolve what was essentially the best technical approach for various conceptual options.

Although offered in retrospect and not intended as criticism, it is very doubtful if the user, developer, and tactical doctrine people who played a part in the development process over the 18-year period gave full consideration to the combined arms team interrelationship of the three members of the team that will make up the maneuver elements of the U.S. Army through the 1980s and 1990s. In fact, it is likely that the importance of modern day combined arms team operational concepts was first brought home to the U.S. Army by the real life experience observed in the 1967 and 1973 Middle East wars. The lessons learned there have undoubtedly become the basis for future Army training at all levels. Thus, we could well have some concern about the new materiel about to be fielded and the operational concepts required to meet the changing threat of the future.

Cliff Bradley

The mysterious curved kanjar is an essential part of the traditional dress of Omani men and it is a prominent heraldic feature of the nation's flag.

Oman

Critical to the Western Worlds Oil Supply

by Lieutenant Colonel Thomas M. Johnson

This article would not normally appear in ARMOR. The situation in the Middle East and interest in the Rapid Deployment Force, however, makes it important to our readers. Parts of the first page reprinted by permission from Men at Arms. Ed.

Until recently, the Sultanate of Oman was virtually unknown to the rest of the world. However, recent political and military considerations have thrust this small, Middle Eastern country into the international limelight. It only takes a glance at a map of the Middle East to see why Oman is of such strategic importance to the Western World.

Located on the southeastern corner of the Arabian Peninsula, Oman shares with Iran the guardianship of a narrow stretch of water, the Strait of Hormuz, through which passes approximately one-half of the Western World's oil supply. With the fall of the Shah in Iran, Oman's role in keeping the Strait of Hormuz open has become critical.

Oman is approximately the size of Kansas and is ruled by an absolute monarch, Sultan Qaboos bin Said bin Taimur, who overthrew his father in a 1970 palace revolution. With the new Sultan, came a dash into the 20th century with modernization and a decline in tribalism, making Oman a fascinating country of stark contrasts between mud-brick villages straight out of the Middle Ages and modern hotels, schools, and social service projects.

Oman is bordered on the north by the United Arab Emirates and the Gulf of Oman, on the west by Saudi Arabia, on the southwest by the Peoples Democratic Republic of Yemen, or South Yemen, and on the southeast by the Arabian Sea (see accompanying map). More than 70 percent of the population is engaged in fishing and subsistence farming, with the latter being extremely difficult in a climate that is one of the hottest in the world. Temperature extremes of up to 120° F are common during the "summer" months. Although Oman's oil production is modest compared to some other countries and sheikdoms on the oil-rich Arabian Peninusla, oil currently accounts for some 70 percent of the national income, compared to agriculture's 2 percent.

Oman is a land of geographical contrasts and varied terrain ranging from the treacherous, rocky mountain peaks of the Ras Musandam Peninsula in the extreme north to the shifting sand dunes of the Rub-al-Khali (Empty Quarter) in the south. In between are the Jebel Dhofar (mountain range) which turns green after the Indian Ocean monsoon ends; flat gravel plains slashed by deep, meandering wadis; miles of white beaches along hundreds of miles of coastline, and a multitude of fjords and inlets from the sea. The country is mostly arid with interior water sources few and far between.

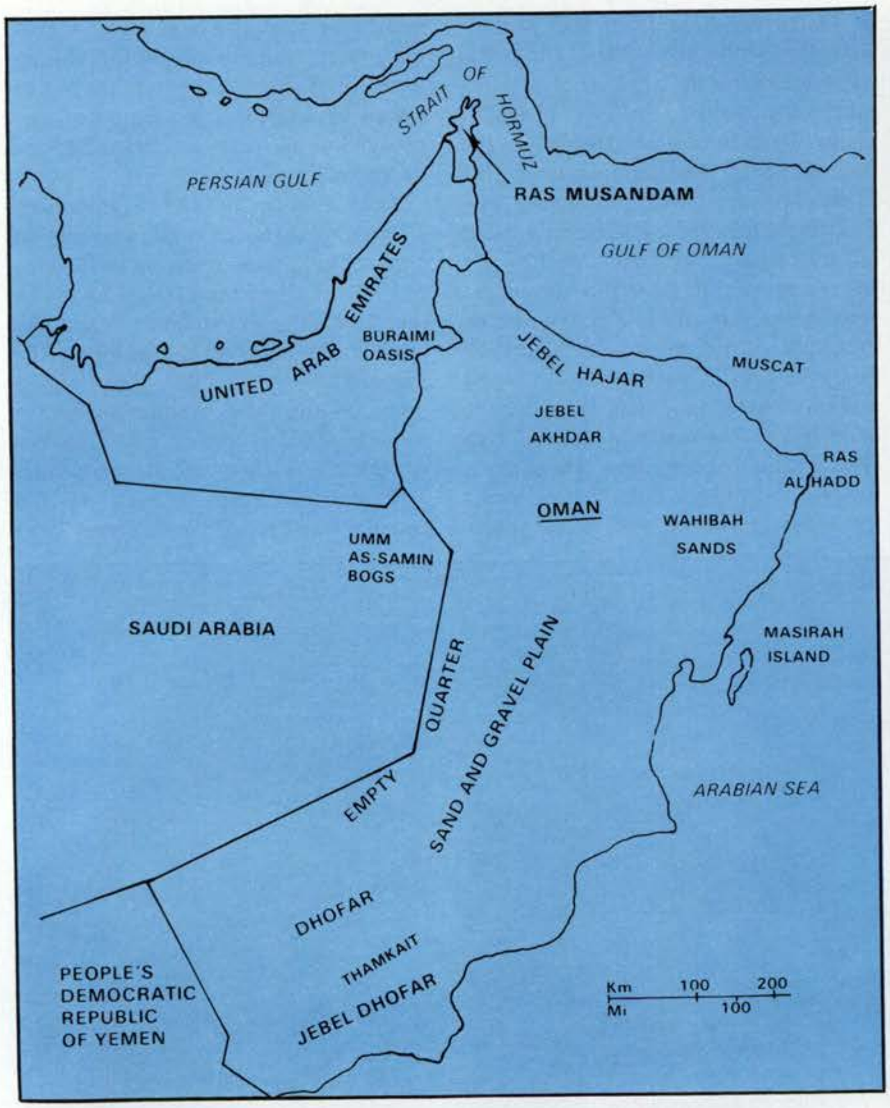
Oman's overall terrain is characterized as stark and extreme and six distinct topographic regions can be readily identified:

Jebel Hajar. This 400-mile long range of jagged mountains parellels the Gulf of Oman coastline from Ras Musandam, the northernmost tip of the country overlooking the vital Strait of Hormuz, almost to the Ras-al-Hadd, Oman's easternmost protrusion into the Arabian Sea. The mountains of the Musandam are sheer and barren and drop straight to the sea, forming isolated fjords where inbred families of fishermen live. In fact, the Musandam resembles a subtropical Norway with its multitude of fjords and inlets. Picturesque villages located in barren wadis and on unlikely mountain cliffs dot the countryside. The major town of Khasab is a sizeable fishing village girded by a heavy stand of date palm groves and is located on the northern tip of the peninsula at the head of a huge wadi. At present, there are no roads on the Musandam, which is separated from the rest of Oman by United Arabs Emirates' territory, and all travel is restricted to sea or air.

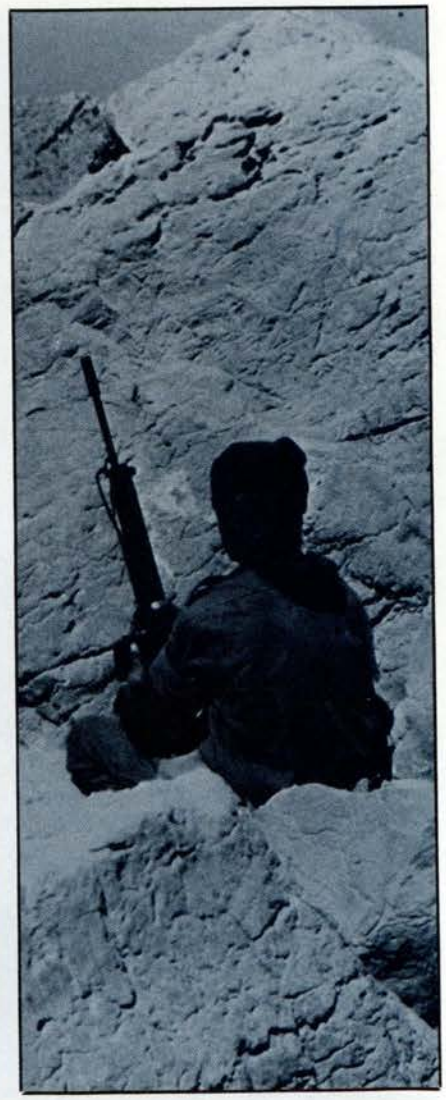
Jebel Akhdar or Green Mountain. The Arabs liken this mountain range to a man's backbone, referring to the area to the east along the Gulf of Oman as the "Batina" or "stomach," and the area to the west of the range as the "Dhahira" or "back." The highest point on the Jebel Akhdar towers to some 10,000 feet and its wild grandeur typifies the scenery of the highlands. The narrow Batina Coast is the country's principal agricultural and

A British noncomissioned officer and an Omani infantry officer pose for a picture after a helicopter flight into the mountainous area of Dhofar. For many years, Oman relied upon expatriate military advisers, but is now modernizing its armed forces and operates its own officer education system.

Landing a helicopter atop the mountains of the Musandam is a challenge.



Tankers carrying approximately one-half of the Western World's oil supply must pass through the narrow Strait of Hormuz that is guarded by Oman and Iran.



A lone sentry mans an outpost atop a craggy peak on the Musandam Peninsula.

date-growing area and is watered by wells drawing on subterranean runoff from the mountains.

The Gravel Plain. This region south of Jebel Akhdar encompasses hundreds of miles of flat, open vistas that are randomly and repeatedly cut by deep wadis running north to south. From the air, the area resembles shattered, dry earth devoid of vegetation except for scattered acacia bushes and hardy perennial desert plants.

The Dunes Area. Empty and relatively sterile sand dunes extend along the Oman-Saudia Arabia border from the Wahibah Sands in the east, westward to the Rub-al-Khali (Empty Quarter). Nomadic tribes roaming this area with their camels and goats in search of water are oblivious of national and international boundaries. Another feature of the Empty Quarter and the endless sand sea of Arabia are dunes that rise to the astonishing height of 600 feet.

Jebel Dhofar. The southernmost extreme of Oman rises into the wild, extensive mountain area of Dhofar called Najd where the finest frankincense originates. Unlike the other mountain ranges, this region catches the Kharif or Indian Ocean southwest monsoon and during the summer the seaward slopes are cloud-shrouded and cloaked in elephant grass and other vegetation. Except for the palace grounds and a few select, manicured traffic circles in Muscat, the Jebel Dhofar is the only green area in Oman's stark countryside.

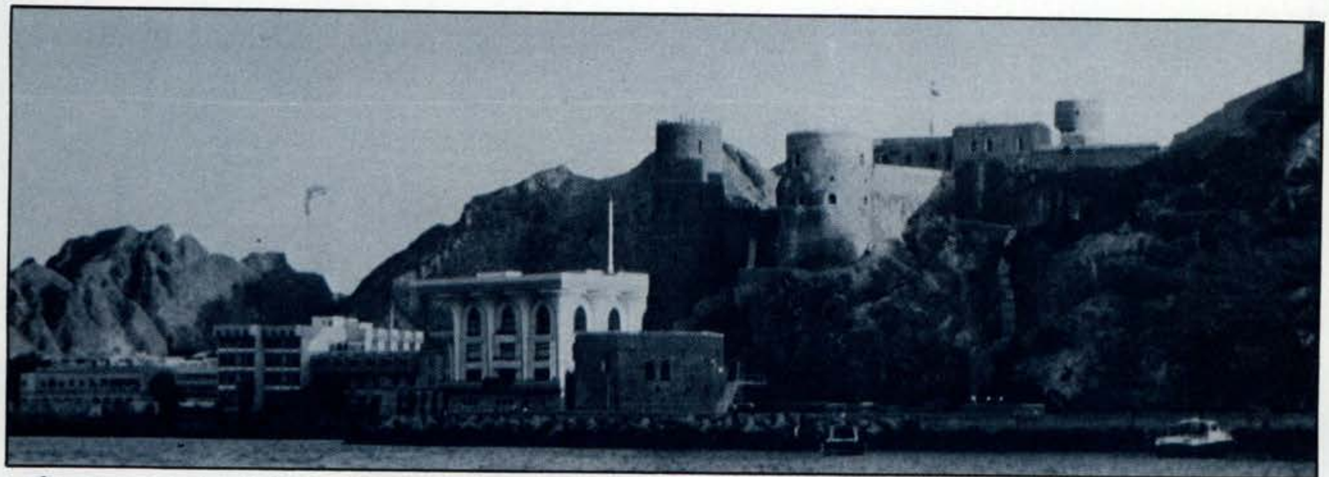
Umm as-Samim. This trackless bog and quicksand area along the Oman-Saudi Arabia border is so extensive that the desert Arabs say that it is a 2-day march in any direction from its center. Only a few Duru tribesmen know the safe routes across it.

Masirah Island is another area of Oman that has not, until recently, been considered strategically important to military planners. Masirah is an inhospitable, barren, desert-like island lying just off the Oman coast in the Arabian sea at the foot of the Wahibah Sands region. The island is 36 miles long and varies in width from 2 to 9 miles.

The terrain of the island is much like that of the mainland, consisting of mountains, plains, and coast, some of which is covered by scrub vegetation and date palms. The island's 4,000 population of Bedu tribesmen is engaged primarily in fishing.

Oman, like many other developing countries of the world, is moving forward with a modernization of its relatively small military establishment.

His majesty, The Sultan, is Com-



The ancient walled city of Muscat overlooks the Sultan's palace on the Gulf of Oman.

mander in Chief of the Armed Forces and Minister of Defense, but until 1 April 1977, Command of the Armed Forces was delegated to the Commander, Sultan's Armed Forces (a British Major General). On that date, the command structure was changed to a single service system with a commander appointed for each service. The three service commanders report directly to the Deputy Defense Minister through whom defense policy is formulated.

The real change in an organized Omani military force began with the 1965-1975 campaign to put down the rebellion in the Dhofar areas in the south. The Omani land forces underwent an enormous expansion, increasing in size four-fold.

Oman presently has a true multinational military. Four separate languages are spoken within the military. Estimates of the population of Oman run from 750,000 to one million (no official census has ever been conducted in Oman). Because of this limited population base, there is a limit as to how much military expansion the country can absorb.

There is no conscription in Oman and, at present, there are no plans to incorporate a draft. The country has a true volunteer force with the term of service being 5 years.

Education remains a massive problem for both the military and the populace as a whole. Prior to Sultan Qaboos bin Said's successful *coup d'etat* in 1970, there were only three schools within the entire country. Thus, there are many Omanis who still cannot read or write. The number of Omani public schools has now burgeoned to 365.

At present, most Omani officers are commissioned directly from the ranks, but this situation will change soon when more students are graduated from the officer education system that has now been in operation for 9 years.

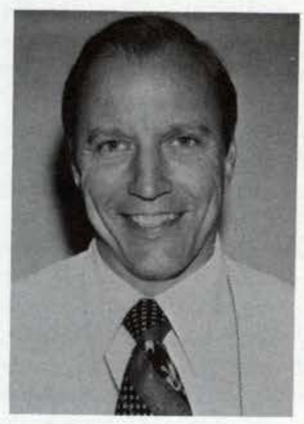
For many years, the Sultans of Oman have called upon expatriate advice, most recently, principally from the United Kingdom. In the military, the expatriate officers and NCOs fall into two categories—those personnel on secondment (loan service) from their homeland military services and those personnel under contract (direct hire) to the Sultan. There are presently several foreign nationalities represented among these expatriate military personnel, i.e., British, Pakistani, Indian, and Jordanian.

Since 1975, the military has been actively engaged in pursuing a transition from a capable British-led and advised counterguerilla force to a modern conventional armed force. A key to this transition is a long-term program known as "Omanization"—a gradual replacement of liberally distributed expatriate officers and NCOs with qualified Omanis. The issue of Omanization revolves principally around the British presence due to their large number, occupation of positions at the highest levels of command (the commanding officers of all three services are presently British), and the obvious fact that they are "foreign" (Non-Arab).

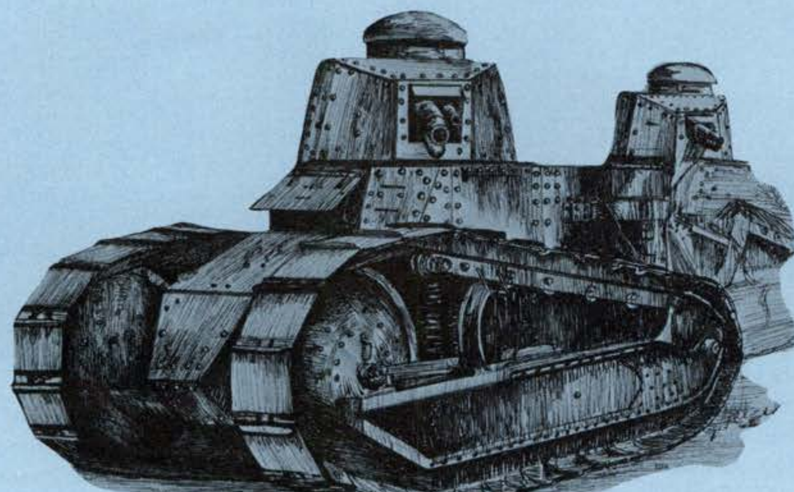
In the civilian sector, a huge inflow of foreigners has occurred because there have not been enough trained Omanis to fill the myriad of positions opened up by the rapidly expanding economy. There has not been sufficient time to train enough native technocrats, and a combination of the conservatism of the old Oman and the attraction of much higher salaries elsewhere on the Gulf means that Oman cannot find enough of its own qualified workers. As a result, only about 30 percent of the employees in the private sector of the economy and about 65 percent of those in the public sector are Omanis.

Although the 10-year rebellion in Dhofar caused as much as one-half of Oman's national budget to be allocated to defense, it failed to inhibit the monumental development which is rapidly bringing Oman into the modern world.

Now, Oman's strategic position, as one of the keepers of the Strait of Hormuz and with its Musandam finger on the Western world's oil lifeline, makes it impossible for "unknown" Oman to remain unknown any longer!



LIEUTENANT COLONEL THOMAS M. JOHNSON returned recently from a 3-week trip to the Sultanate of Oman as a member of a U.S. Defense Survey Team. LTC Johnson is a frequent contributor to *ARMOR* and other military periodicals. He is presently assigned to the Contingency Planning Group (CPG) of the Office of the Joint Chiefs of Staff.



Light

by Second Lieutenant Edward G. Miller

> The light tanks sped toward the Germans. The Germans . . . could not track the light tanks [and] began to flee and were cut down by the tank-mounted machine guns . . . the light tanks overran the enemy artillery, antitank guns and entrenched infantry. [Later they] overran an artillery battery, destroyed the guns and killed the crews. . . [They ran circles around the enemy] and caused so much confusion that the enemy fled. The light tanks had pried open the Siegfried Line. . . .

Nearly 6 decades after the introduction of the tank onto the battlefield, we remain confronted by the question of the need for a light tank. This article will outline the past roles of the light tank in the Army and then draw upon the past in an effort to assess the need for a light tank today.

Experience in WW I proved that the light tanks used (such as Renault *FT*) could perform an effective close support role with the infantry. Despite mechanical unreliability, lack of proper communications with foot troops and the development of early tactics in a static environment, proponents of the tank stressed its value when used in mass attacks. Unfortunately, some believed that there was little value in the continued development of the tank because they felt that these problems could not be overcome.[2]

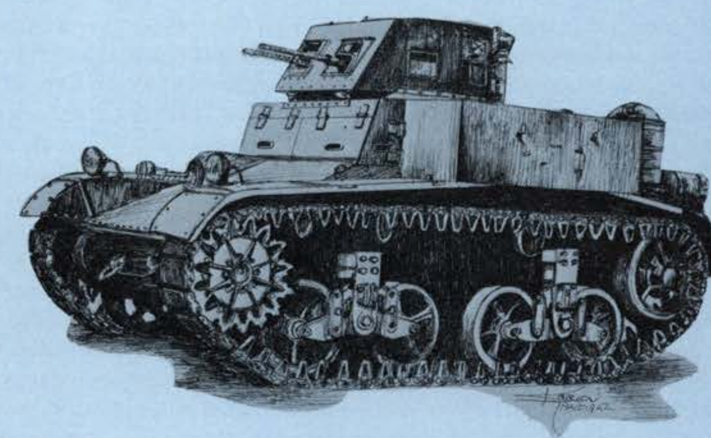
As a result of the following debate which lasted nearly 2 decades, U.S. light tanks reflected tactical development in response to infantry requirements and technical development in an environment of severe financial limitations on research and development funding.[3] Thus, the desire for a tank to meet the tactical requirements of the infantry and the search for the most inexpensive way to meet those requirements were the major original contributing factors to the development of light tanks in the Army.

Rapid demobilization of the Army after WW I, the passage of the National Defense Act of 1920 which led to the end of the Tank Corps as a separate branch, and the fears of conservative elements in the Infantry and Cavalry about a new competing branch, led to tank doctrine which reflected the desire of the Infantry to have an armored vehicle to accompany ground troops.[4] No long-term tank development policies were established by the War Department, and therefore, the Ordnance Department was unable to obtain the information needed with which to develop new tank designs.[5] The only concrete guideline under which Ordnance could work was the requirement that light tanks weigh 5 tons or less so as to meet bridging limitations, and the only substantive official statement gave endorsement to the accompanying role: [the role of the tank was to] ". . . facilitate the uninterrupted advance of the rifleman in the attack."[6] It would be 1922 before a developmental policy would be established by the Army.[7]

Initially, it was desired that a medium tank and a light tank be developed simultaneously. However, many former members of the WW I Tank Corps remained in favor of the development of a medium tank which could offer sufficient armor protection and also meet the tactical requirements of both light and medium tanks, but limited funds and the lack of a satisfactory design prevented further development of medium tank designs. Funds were limited to only what was necessary to maintain existing numbers, most of which were light tanks.[8] It apparently seemed to some that a light tank could be developed which would fulfill the role of either a light or a medium tank simply because light tanks were cheaper to procure. In effect, a cheap medium tank was desired, but it could not be produced under the political and financial conditions of the day.[9]

In 1922, the Chief of Infantry endorsed a tank which would possess ". . . speed, a large cruising radius and an adequate supply of ammunition . . . ."[10] Although the Army possessed no tank which would meet these requirements, interest nevertheless grew in the light tank because of the reasons noted above and, as we shall see later, because of influence by British theorists.

Tank development was also impeded because many cavalry-



Tanks

men feared that the tank would replace the horse. Even then, Major George S. Patton, Jr. would write that, although tanks were of use to the Cavalry they could never replace the horse because of mechanical limitations inherent in mechanized units: "All branches are vitally concerned with the problems that . . . ground fighting machines are thrusting upon them . . . ." He had once written that tanks could assist cavalry in the execution of short turning movements and in rearguard operations.[11]

Fortunately, some officers were not inhibited by the conservatism of the day. Major Levin Campbell, later a Chief of Ordnance, wrote during this period that the mechanical capabilities of the tank would allow them to be separated from the infantry: "Such performance . . . [makes] it obligatory to separate the tanks from the infantry in their . . . operations." He noted that light tanks were valuable because of their high speed reconaissance capabilities. He also recommended the development of a 75-mm self-propelled gun to be used in a direct supporting artillery role with light tank forces.[12] At that time, the *T-1,* which showed ". . . a miserable lack of inspiration" in design was under testing. However, such technical development and production was limited to only about two experimental vehicles produced per year through the early 1930's.[13]

Even though technical development stagnated during this period, progressive tactical thought flourished. American ideas were greatly influenced by the British. J.F.C. Fuller and B.H. Lidell Hart, among others, advocated mass assaults using light tanks. Fuller's early theories stressed the penetration of the enemy front and the use of fast (light) tanks to exploit attacks in the enemy's rear. Lidell Hart proposed that a mixed force of light and medium tanks deliver the "decisive blow" to the enemy. This "expanding torrent" of light tanks was to be used to draw the enemy from the "indirect approach" of the main force. In 1932, he would note that the light tank should always advance under fire, "sweep" concentrations of antitank weapons and seal off the battlefield from enemy counterattacks.[14]

By 1930, some perceptive cavalrymen began to realize that the development of tanks would have a great impact upon their branch because fast light tanks were well suited to the basic mission of the Cavalry. Writing in the July 1930 issue of *The Cavalry Journal,* Patton noted that armor should join the battle from defilade positions, facilitate the advance of the main body and be used in "counterreconnaissance," "offensive counterreconnaissance," and "defensive counterreconnaissance" roles (large patrols used to "guard the secrets not the security" of the main force.)[15]

Also during this period, the Infantry began to refine its own concepts of the employment of light tanks. The official role of tanks was divided into roles of *chars d'accompagnment* and *chars de manoeuvre ensemble.* These French ideas were based on the accompaniment concept which was a holdover from the tactics of WW I. The roles assigned to tanks were accompaniment of infantry, penetration of the enemy front, and as a reserve which could be used to exploit breakthroughs of the enemy front. Light tanks were assigned the accompaniment role.[16]

Despite relatively modern tactical thought, War Department guidelines still remained few. New designs were proposed but financial conservatism prevented their development. For example, the Experimental Mechanized Force (1928) was to have been equipped with 72 light and 16 medium tanks. However, no satisfactory designs for the tanks existed because existing designs were suited only to fulfill the requirements of the National Defense Act.[17]

Another reason for limited funds during the period 1919-1934 was the ongoing controversy between John Walter Christie and the War Department. Christie's imaginative designs were unable to meet Ordnance Department specifications and requirements for mechanical reliability. Funds which might have been better spent on the development of a reliable, standard tank were often diverted to the negotiations with Christie.[18]

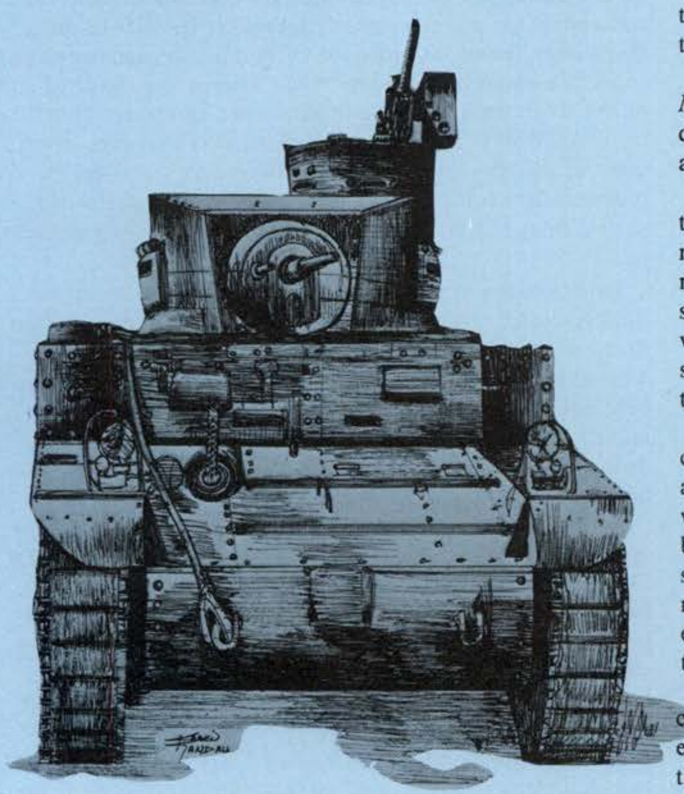
After his appointment as Chief of Staff in 1931, General Douglas MacArthur ordered mechanization throughout the

Army. He directed the Infantry and Cavalry to develop their own designs separately. Due to limited funds, MacArthur felt that it was better to develop a few pilot vehicles of different designs per year so that future production might be hastened if the need arose for large numbers of tanks.[19]

Through an effective lobbying effort, by the mid-1930's the Cavalry began to take the initiative in tank development from the Infantry. Light tank development would now reflect Cavalry desires for fast, mobile light tanks. This fact, coupled with more appropriations from the Roosevelt administration, placed emphasis on refining the existing *T-2* design, which offered the Cavalry a light tank developed with its own needs in mind. The cavalry vehicle had to be called "combat cars" because the National Defense Act prevented the Cavalry from possessing tanks. The differences between tanks and combat cars were for the most part differences in name only.

By the late 1930's, the views of men such as Chaffee and Van Voorhis began to dominate. Light tank battalions were formed and infantry divisions lost their light tank companies. Also during this period, role distinctions between Infantry and Cavalry tanks began to disappear. (The term "combat car" would be dropped with the formation of the Armored Force in 1940). The new series of light tanks developed in this environment was the *T-5—T-5E2,* a development from the *T-2* series. The *T-5E2* was redesignated the Combat Car *M-1* in 1937 and the Army at last had a light tank with which it could practice tactics developed in the 1920's and early 1930's. According to Chaffee:

> If fast tanks can operate in an [aggressive striking] manner, we will greatly aid in restoring mobility to warfare: in keeping with the doctrine of operating on the flanks and rear and through the gaps, and in forcing the enemy to make detachments to guard his lines of communication . . . and bases, we would so considerably weaken his main forces in battle that a quicker decision will be reached.[20]



In maueuvers held in August and September 1939 near Plattsburg, NY, the 7th Cavalry Brigade (Mechanized) reinforced lines by operating as a mobile reserve. Using its combat cars, it engaged in typical cavalry missions. The 13th Cavalry Regiment (Mechanized) made a river crossing to secure a bridgehead. The new doctrine demonstrated what had been stressed for years: the mass employment of light tanks.[21]

Light tanks developed to 1940 carried .50 cal. and .30 cal. machineguns in traversing turrets. They also carried a number of machineguns in the hull which were holdovers from the days of infantry accompaniment. The next major development was a turning point in light tank design. The *M-2* series resulted in the *M-2A4* which was developed during 1940. The *M-2A4* carried a 37-mm main gun with the usual number of .30 cal. machineguns. This tank might be described as the first light tank as such used by the Army.[22]

The *M-3 Stuart,* which was developed from the *M-2A4,* was the first U.S. light tank to see combat in WW II when a number were used by the British in North Africa. Unfortunately, it was used as a main battle tank (MBT) and its speed and superior mobility, which made it best suited for reconnaissance missions, were negated.[23]

The *M-5* series, derived from the *M-3,* was the principal light tank used by the Army in the European Theater of Operations. Although it was obsolete when it was introduced, the *M-5* was often used as a scouting and reconaissance tank.[24] *FM 17-100,* 15 January 1944, officially spelled out the role of the light tank in the latter part of WW II:

> [The light tank is] a fast mobile element that may be used to exploit the success of medium tanks; to probe for weak points in the enemy position; to execute battle reconnaissance; to act as a covering force; to draw the enemy into prepared traps, and to act as advance, flank, or rear guards.[25]

When operating with cavalry squadrons or combined arms task forces, light tanks were often used in scouting actions or to secure towns and assist infantry in clearing out towns.[26]

The last light tank developed by the U.S. in WW II, the *M-24 Chaffee,* entered service in Europe too late to see a great deal of combat action, but it was used for flank protection and as mobile artillery during the Korean conflict.

Development of light tanks to the present has centered on the *M-41 Walker Bulldog* and the *M-551* Armored Reconnaissance/Airborne Assault Vehicle. Development commenced on the *M-41* shortly after the end of WW II and it was standardized for production in September 1950.[26] For reasons which will not be discussed here, the *M-551* did not prove as successful as intended. However, interest in air transportable/airborne combat vehicles will probably continue.

Is there a use for a light tank or light armored combat vehicle in the future? Despite emphasis on MBTs there may yet be a role for light tanks. The light tank of the 1920's and 1930's was unable to accomplish what it was designed for partly because interest in light tanks stemmed from the desire for a single inexpensive tank to accomplish what the more costly medium tank was best suited for: to close with and destroy the enemy. In the end, the Army had tanks which could not effectively accomplish either the mission of light or medium tanks.

When employed as an MBT, the light tank could seldom accomplish its mission. The major past obstacle to the effective employment of the light tank thus stems from the maxim that the effective use of any weapon entails a *knowledge of its uses* as opposed to its *actual* use. Just because a light tank looked

like a medium tank it should not have followed that it need be employed like a medium tank when there were sufficient numbers of medium tanks available.

After emphasis was placed on the development of medium tanks, new designs were developed which fulfilled many of the original roles of light tanks. After production of medium tanks was underway, light tanks and armored cars were employed in various scouting and reconnaissance roles; roles best suited for the employment of lighter weight tanks. However, changing tactical requirements and better developed medium tanks replaced lighter tanks in many of their former roles.

What then is the role postulated? The ideal light tank would, of course, possess speed, dependability, and the best possible combination of firepower and protection. In addition, it should possess a high degree of strategic mobility and deployability. It matters little if the vehicle is called a light tank or a light armored vehicle as long as it is correctly used. The exact form of the vehicle also matters little; that is, if, for example a successful air-cushion vehicle were to be developed, it might serve the same purpose as the present day tank as we know it. Such a vehicle might serve an important role as part of a "rapid deployment force" or it may serve more conventional uses as part of a covering force or a delaying unit, especially if such vehicles are mass-produced. Above all, they must be reliable and easy to service. They can be combined with infantry units equipped with ATGMs to form integrated rapidly deployable covering forces. If such vehicles were produced, there is no reason to believe that having two principal armored fighting vehicles might not be worth the cost—as long as these vehicles are employed in the role for which they are designed.

Mobility is an asset which cannot be lost in any future conflict, despite the numbers of antitank weapons expected to flood the battlefield. The death of the tank should not be impending if for no other reason than the fact that mobility must be preserved whatever type vehicle is introduced into a conflict. The lessons of the use of the light tank in the Army should not be lost to us today because one can see the importance of employment of any combat vehicle (or any weapon) in the role for which it was designed. This fact prevented effective past employment of light weight tanks by the U.S., but if we learn from these past experiences, the lesson need not be lost again.

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[22] Ellis and Chamberlain, *British and American Tanks,* 83-88; "Light Tanks," n.p.
[23]Jarrett, G.B., ed., *West of Alamein,* Northridge, CA, 1971, 136-139, 148.
[24]Ellis and Chamberlain, *British and American Tanks,* 93-96.
[25]War Department, FM 17-100 *The Armored Division,* 15 January 1944, 23.
[26]Cocke, Maj. James W. "Light Tanks in Pursuit," *Cavalry Journal,* 54, September/October 1945, 18-26.
[27]Icks, Col., Ret., Robert J., "Light Tanks M-22 'Locust' and M-24 'Chaffee,' *AFV Weapons Profile #46,* Windsor, Eng., June 1972, 104. Icks, "*M-103* Heavy Tank & *M-41* Light Tank (Walker Bulldog)," *AFV Weapons Profile #41,* Windsor, Eng., March 1972, 199, 207.

SECOND LIEUTENANT EDWARD G. MILLER was commissioned in May 1979 through the ROTC program at Western Kentucky University. Following his commissioning, he completed his master's degree at Western Kentucky during which time he served as tank platoon leader and transportation section commander with the 2/123 Armor, KYARNG. He has also completed an NBC warfare course taught through the 5030th USAR School. He is currently attending the AOBC after which he will remain on active duty and be assigned to the 194th Armor Brigade at Ft. Knox, KY.

An Aid to Better Combined Arms Operations

Universal Standing Operating Procedures

by Captain George L. Humphries

Situation: It is D + 4. You are Commander, Team C, 2-12th Armor, assigned to Task Force 2-79th Mech. Your team presently consists of 1st Platoon, Company A, 2-80th Mech; 3d Platoon, Company B, 2-79th Mech; and your "own" 2d Platoon. You have just been notified to move immediately to the vicinity of Task Force 2-6 Armor, to which you will be attached. You establish communication with their CP, and are informed that upon closing into their area, you will lose one mech platoon and gain one tank platoon. You think, "Well, at least we will be tank-heavy again. And because it is an Armor organization, they will have a feel for the ammunition and POL requirements of my tanks. Perhaps I can get an expert to fix my gun computer and some repair parts for C22's coax. They probably won't have any spare SOPs, so our reports and supply requests won't be straight for 24 hours. The fact that my M-88 is still with 2-79 certainly won't brighten their day. . . ."

If your unit has ever cross-attached with mechanized infantry, the scenario above is likely to be painfully familiar. We do not live and work in combined arms teams. When we must do so, a great deal of planning and coordination must be accomplished before we can be jointly employed with even minimum effectiveness. Current Threat analysis suggests that Ivan intends to reduce our time available for this process to zero.

The Israeli Army does not face this problem, according to statements of several of its senior officers. An Israeli mech company and engineer squad can fall in with a tank battalion and immediately conduct a long series of movements to contact, breaching of minefields, and hasty attacks—*at night!* Why? The Israeli high command long ago recognized the requirement for units at all echelons to be able to act in concert in the heat of battle, without prior liaison. Standing Operating Procedures (SOPs) are prepared at the highest levels—and are uniform throughout the army. For example, every Israeli tank has main gun ammunition stowed exactly the same. If one loader is wounded, another can take his place and automatically respond to fire commands with the right round. If a new loader paused in a short range engagement, the tank and entire crew could be destroyed. The Israeli SOPs allow a smooth and efficient systems interface at all levels, from individual crew member to maneuver brigade.

By contrast, our battalion SOPs barely provide an efficient systems interface in a "pure" battalion, much less a combined arms team or task force. In most cases, they are prepared in garrison to meet the requirements of annual general inspections, rather than the exigencies of intense combat. Company SOPs do not advance our capabilities much, either. Management by crisis rarely allows a company commander the opportunity to compose his thoughts of detailed operational procedures in writing.

Israeli-type standardized SOPs offer obvious advantages. However, several obstacles stand in the way. The first is our individualism. Units have traditionally been responsible for originating SOPs, and these documents frequently reflect the personality of the commander. In the days of pistol charges and bayonet attacks, when a leader could control his command in battle with the sound of his voice, this was acceptable. But on the fluid modern battlefield, where the commander will be required to operate routinely with total strangers and *do it right the first time* or pay the ultimate penalty, this luxury of self-expression must be eliminated. We can certainly afford to eliminate the incredible duplication of effort in identical organizations inherent in current procedure, especially when these expenditures of time and effort degrade our combined arms capabilities.

The second obstacle to standardized SOPs is deciding at which level they will be prepared. Will company teams and battalion task forces find themselves fighting as part of other brigades in their divisions? As part of other divisions in their corps? As part of divisions in other corps? The answer to all of these questions is, "Quite possible." If this is true, then it follows that unit SOPs should eventually be standardized throughout a Theater Army. This, however, opens a Pandora's box of other problems.

At least with current procedures, SOPs are written at unit level, providing a certain responsiveness to unit problems. If the SOP is found to be invalid in certain subject areas, the unit can quickly modify or eliminate those sections.

If the responsibility passes to higher echelons, however, those commanders will each wish to add their own preemptive inputs. The result may be that SOPs are henceforth prepared by staffs in Heidelburg, TRADOC, or the Pentagon who haven't seen a tracked vehicle in 15 years. Once these documents are distributed back down the chain, they will be locked in more solidly than even the Maginot Line.

The pitfall is that given unrealistic procedures, a unit will ignore them, invalidating the document before it is issued, In November 1975, a brigade of the 2d Infantry Division promulgated an SOP which dictated winter field gear to be carried in the rucksack. The rucksack weighed over 100 pounds. The SOP was followed by one of three light infantry battalions for only one field problem in the steep, rugged Korean terrain. But 6 months later, the offending section of the SOP had still not been rescinded. The point is, an *effective* feedback loop is essential, or the system is doomed to failure from the outset.

A Field SOP is a distillation of concepts, theories, and principles into standardized practical techniques and procedures. Its function is to shorten the time necessary to prepare and disseminate plans, to allow leaders to analyze problems more thoroughly, and to allow disparate units to operate effectively and readily together in crisis. A system of standardized SOPs will properly integrate combat, combat support, and combat service support elements, providing an apparent improvement in combat readiness above present capabilities. This is not a program which can or should be instituted overnight. It will require more thought and analysis than has ever gone into unit SOPs.

The starting point is the tank-infantry team. The tank-infantry team's tasks of destroying the enemy with direct fire weapons and seizing and holding terrain are the most difficult and critical tasks on the battlefield. All other combat systems support the successful accomplishment of these tasks. The procedures of all other elements must therefore be driven by the tactical requirements of the tank-infantry team.

To provide a responsive, realistic, and useable document, tank-infantry team SOPs must not be written by brigade or division staffs. Divisions should provide definitive guidance as to the subjects to be treated. The SOPs themselves should be written by tank and mechanized infantry unit commanders. Each battalion should be required to prepare one team SOP, using a conference of line company commanders. A program of suspenses should be spread out over several months for individual annexes, with each annex signed by the company commanders indicating approval. Dissenting opinions would be forwarded as an attachment. Annexes would include combat organization and control, supply and service, NBC, fire support, intelligence and counterintelligence, mines and demolitions, air defense, tactical operations, reports, and communications. The communications annex should be especially detailed, outlining techniques and procedures that will allow surivival and continued communications in an environment of intensive electronic warfare. As annexes are forwarded, conferences will be necessary to rationalize techniques between armor and infantry elements and with supporting arms and services and to achieve a consensus. The result will be an interim, pocket-sized, tank-infantry team SOP which will also provide a point of departure for SOPs of parent echelons and supporting arms and services.

As previously outlined, however, an effective feedback loop is essential to the system. As units train to the SOP, flaws will be illuminated that require corrective action. A quick response mechanism must be created and supported by division commanders to take such matters under discussion, with a turnaround time of not more than 14 days.

A system of standardized SOPs within the division should be the immediate goal of this program. It would be necessary for the SOPs to solidify within the division before a similar rationalization process could begin at higher levels, in order to insure that all support requirements and methods are realistic. When finally standardized by the highest desired echelons, these SOPs should be adopted by all Active and Reserve Component units.

It must be recognized that this program could take a great deal of time to complete. But considering the tremendous increase in combat effectiveness it could provide, we cannot afford to delay its implementation.

Concepts and strategies guide wars, but only disciplined techniques and procedures win combat engagements. We can ill afford to fight the first battle while our team and task force commanders are struggling to make the combined arms team a reality. NATO Interoperability will remain a moot point until we learn to operate effectively with ourselves.

CAPTAIN GEORGE L. HUMPHRIES was commissioned in Infantry from the University of California, Santa Barbara, in 1971. A graduate of Airborne School, the Mortar Platoon Leader Course, the Infantry Officer Advanced Course, and the Foreign Area Officer Course, he has served as a platoon leader in Europe, commanded a rifle company in Korea, and he was the Engineer Coordinator, U.S. Army Readiness Region VIII. Currently, he is the S-3, 1-30th Bn (Mech), 3d Inf Div.

Combat Services Support For Division 86

by Captains Bill Bledsoe and John R. Drebus

The heavy combat power of Division 86 is contained in its tank and mechanized infantry battalions. These maneuver units are designed as pure battalions with the recognition that they will usually be cross-attached to form combined arms task forces. This fact, coupled with the complexity and logistical demands of new equipment, required that compatible support organizations be developed. A "common base" of similar skeletal structure was established by the U.S. Army Armor and Infantry Centers (USAARMC and USAIC). (See November-December 1980 *ARMOR* for an overview of the Division 86 Study.)

Organizations

The common base is evident when comparing the tank and mechanized infantry battalions (figures 1 and 2). The TOW missile company in the mechanized battalion is the only unique organization not shared by the tank battalion. The maneuver platoons consist of four combat vehicles, the companies have three platoons, and each battalion has four maneuver companies. This provides a symmetry which enhances combat tailoring and allows the battalion the flexibility to attack on two axes or defend against two avenues of approach.

The combat support company (CSC) has been eliminated; ground surveillance radars have been placed in the artillery's target acquisition battery; armored vehicle launched bridges are now in the engineer battalion; and the *Stinger* (formerly *Redeye*) air defense section is located in the air defense artillery bat-

talion. This centralization of combat support assets was determined to be advantageous for accomplishing the increasingly technical training and maintenance associated with the equipment of these elements. The assets are tactically employed when and where most needed. Only the scout and mortar platoons remain from the old CSC. These were absorbed into the headquarters company.

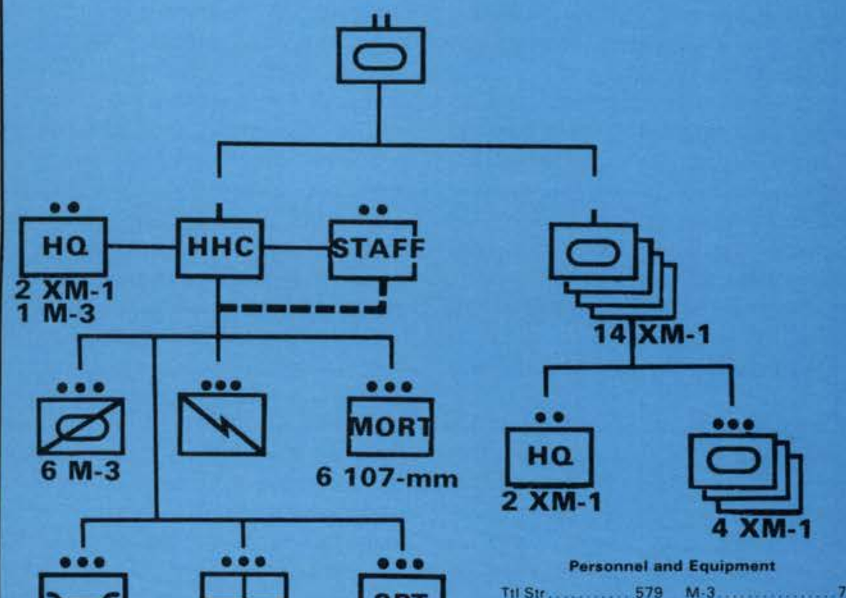
The total size of the headquarters and headquarters company (HHC) is rather large. For this reason, the commanding officer is a major with a captain for an executive officer. As shown in figures 1 and 2, virtually all elements of the HHC are under the operational control of the various battalion staff officers, and thus, the size of the company does not pose a span of control problem.

The HHC of both the mechanized and tank battalions contain identical scout and mortar platoons. The scout platoon, derived from the Cavalry Scout *Ad Hoc* Committee and Battalion Scout Studies conducted at the USAARMC, contains six *M-3* cavalry fighting vehicles, each with a five-man scout crew. The battalion mortar platoon has been increased to six 107-mm (or 81-mm improved) mortar tubes with the capability of splitting the fire direction center into two sections. (Company mortars have been eliminated from the mechanized infantry units.)

The remaining elements of the tank and mechanized HHCs are qualitatively and organizationally similar with quantitative differences. These differences are based upon variations in the weapons systems and the number of personnel supported.

The maintenance platoon represents a departure from the current organization. Increased tactical demands on company commanders, peacetime maintenance requirements, increasingly complex weapons systems, and limited resources resulted in the development of a centralized maintenance concept.

The USAARMC initally proposed the formation of a maintenance company



Personnel and Equipment

Ttl Str	579	M-3	7
XM-1	58	107-mm	6

Figure 1. 4-3-4 tank battalion.

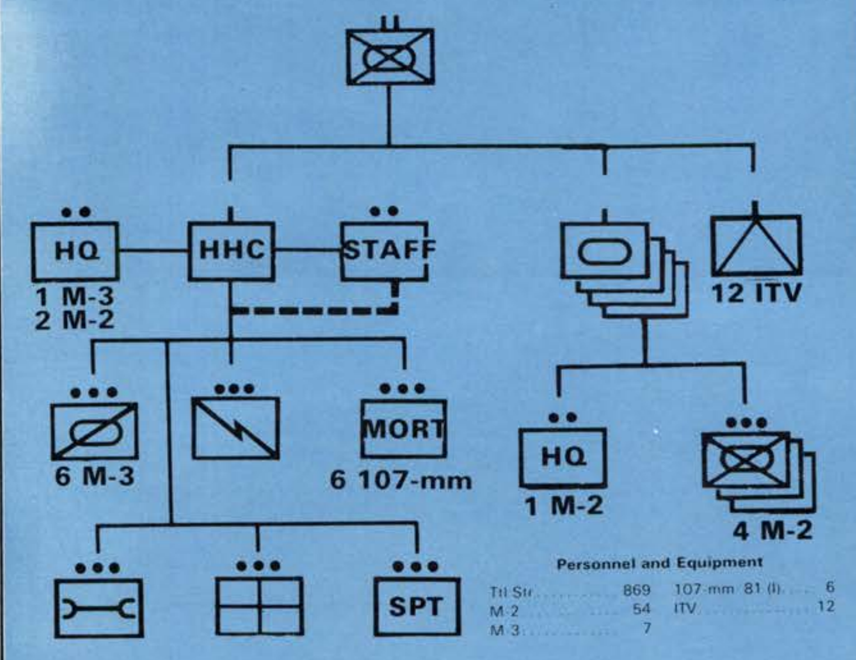


Figure 2. Mechanized infantry battalion.

which included a limited direct-support (DS) capability. This concept was abandoned due to the cost in company headquarters overhead and the uncertainties associated with developing a totally new company for the maneuver battalions. The centralized maintenance platoon that was adapted (figure 3) is under the control of the battalion motor officer with technical supervision and assistance from the automotive maintenance technician.

Each maneuver company receives maintenance support from a forward support team which provides automotive, turret, communications-electronics maintenance, and vehicle recovery. The mechanics are system-specific (tank or infantry fighting vehicle). The team is carried in an *M-113* armored personnel carrier, a 2½-ton truck w/trailer, and one *M-88A1* recovery vehicle.

The inspection/quality control section is responsible for before- and after-operations inspections during garrison operations and performs diagnosis and battle damage assessment with the appropriate maintenance teams in the forward area during tactical operations.

Repair parts and maintenance records are centralized within the maintenance/administration section. Unit integrity of repair parts and records are maintained as required for cross-attachment.

The recovery support section provides maintenance support to the rear elements of the battalion, power generation equipment maintenance, and backup support to the forward maintenance teams.

The battalion support platoon has been considerably increased. While the mess section remains essentially the same, the transportation section (tank battalion) will have ten 10-ton ammunition trucks and eleven 2,500-gallon fuel trucks. (The mechanized battalion has retained a 10-ton and 5-ton mix to accomodate TOW missile cubic bulk requirements.) These heavy, expanded-mobility, tactical trucks (HEMTT) will possess greater cargo capacity than the current *GOER* vehicles and will provide a better combination of highway and cross-country mobility. The considerable increase in organic transportation is based upon carefully calculated company consumption and expenditure factors predicted for the 1986 European combat scenarios. The armored combat logistical support vehicles (ACLSV) were not included in the Division 86 organizations (see "Unchained Mobility," *ARMOR* July-August 1979) because the program was not considered to be far enough along in the research and development process to be included in the Division 86 Study.

The medical platoon's combat capabilities have been enhanced by increasing armored evacuation vehicles from four to six and providing two *M-557* aid station tracked vehicles to provide a split or leap-frog capability. An emergency physician has joined the physician's assistant to expand trauma treatment capability.

Communications throughout the battalion use the SINGARS-series radios, with key staff sections possessing tactical facsimile equipment. The communications platoon has two motorcycle couriers and sufficient radios for a "jump tactical operations center" capability.

As mentioned previously, the requirement to cross-attach companies will be routine. In addition, company battle positions may not provide easy lateral access. In order to decrease logistical contortions, the battalions have been structured to insure that each company can be provided an equitable slice of support. In the tank battalion this is comprised of:

- Maintenance forward support team, including a recovery vehicle, prescribed load list (PLL), a PLL clerk, and a communications-electronics mechanic.
- Mess team.
- Medical evacuation team.
- Two 10-ton ammunition trucks.
- Two 2,500 gallon POL trucks.

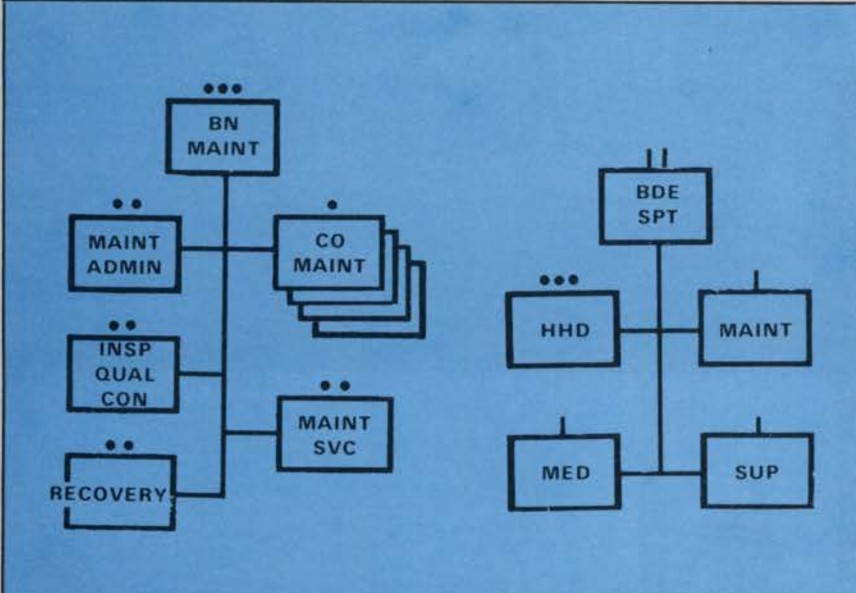


Figure -3 Figure -4

Operational Concept

The maneuver companies have been relieved of the burden of managing and maintaining the support mission. This allows combat company commanders to cope better with an intense threat and to fight more effectively their complex weapon systems. The company executive officer (XO) must be ready to assume tactical control of the company, and therefore, he will be positioned forward in a combat vehicle (a tank in the tank company). This places him in a position where he can observe logistics requirements and call for the appropriate support when required.

The company first sergeant, while still functioning as the company's senior enlisted leader, will respond to calls from the XO and will obtain the required support from the battalion combat trains. The supply sergeant has been retained in the company to assist with this task. Those support assets which have armored protection (maintenance, recovery, medical) will be able to position themselves forward with the companies. This concept anticipates support needs and increases responsiveness.

The battalion staff will function the same as in the current staff with the exception of the expanded role of the battalion motor officer. As the controller of all battalion maintenance assets, he will have the ability to weight the forward maintenance and recovery effort as directed by the battalion commander. Company maintenance teams will, however, habitually support and associate with the same maneuver company. Command responsibility for support and impetus will be from the rear forward.

The maneuver battalions receive their logistical support from the support battalion (figure 4) located in the brigade support area. This support battalion is a formalization of the current *ad hoc* forward area support team (FAST). Under the command of the division support command commander, there will be a support battalion in direct support of each ground maneuver brigade. These battalions provide the services currently provided by the FAST (DS maintenance, medical, supply, and transportation), but with increased command and control and greater responsiveness. An ammunition transfer point (ATP) also will be established in each brigade area to supply high bulk, high expenditure munitions. Each ATP has the capability to move 500 short tons per day. This will provide some relief to the maneuver battalions that obtain the bulk of their ammunition from the corps ammunition supply point (ASP) well to the rear; however, much of the ATP's munitions will resupply field artillery units.

Conclusion

The combat service support of the Division 86 tank and mechanized infantry battalions has been enhanced, when compared to our current H-series organization. The common base between the battalions aids cross attachment. Consolidation of maintenance at battalion level recognizes the sophistication of the *Abrams* tank and infantry fighting vehicles. The combat company commander concentrates on fighting his weapon systems. Support has been designed so each line company can be provided an equitable slice of resupply, maintenance, and medical assets. On balance, these improvements will increase combat and training readiness.

CAPTAIN BILL BLEDSOE graduated from New York State University at Albany. He served in Vietnam with a combat aviation unit and commanded a tank company in Europe. He currently is assigned to the Directorate of Combat Developments at the U.S. Army Armor Center.

CPT JOHN R. DREBUS was commissioned in Armor after graduation from Indiana University in 1973. He has served as a tank platoon leader, support platoon leader, and battalion S-1 while assigned to the 1st Battalion, 68th Armor. A graduate of the Armor Officer Advanced Course, CPT Drebus served with Studies Div, DCD, USAARMC, and now commands Hq. and Svc. Co., 1st Tng Bde, Fort Knox.

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 30)

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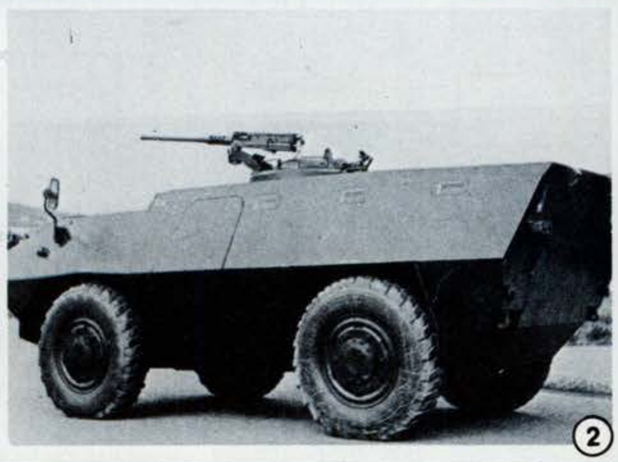

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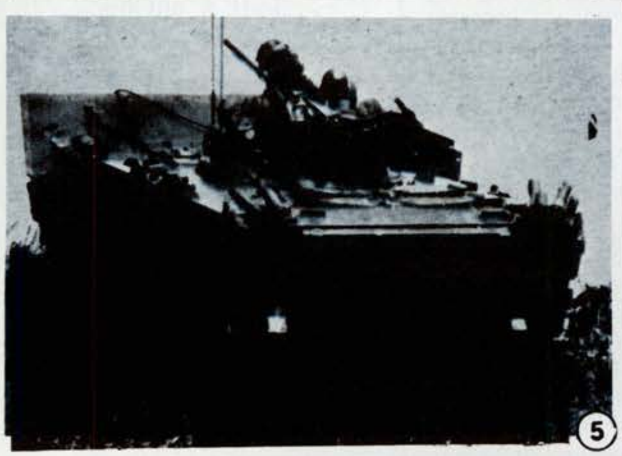

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PROFESSIONAL THOUGHTS

Peer Instruction

One dark, rainy, and muddy evening during the Battle of the Bulge, in the St. Vith area, a tank battalion commander requested that I visit his unit and welcome 175 replacements that he had just received. They were assembled in the blackout when I arrived.

After a few words of welcome, I asked one of them when he had left Fort Knox. His reply was: "We have never been to Fort Knox." I asked another how he learned to be a tanker. He said: "We have never seen a tank." I asked where they had received their basic training. They said, "Camp Croft," which I recognized as being an Infantry Replacement Training Center.

I pointed out that they would be in battle at daylight the next morning with a tough enemy, as loaders, gunners, and perhaps drivers, and they had better listen closely to the tank commander and the other members of the tank crew because the next morning we played for keeps. *They were motivated to learn.* The tanks fought well the next day and those ex-infantrymen played their part in the tank teams satisfactorily or better.

This simple story, which was more or less repeated many times in our Army in World War II and later, and will undoubtedly be repeated again in case of war, should cause our peacetime trainers to think of the problems of rapid mobilization and the prompt replacement of casaulties on the battlefield.

We have, for years, recognized "on-the-job" training as being a big part in preparing officers and men to become competent members of Army combat, combat support, and combat service support "teams." This process is usually essential even when replacements arrive with their basic training completed. *Peer Instruction* is a more rapid process usually.

After 11 months of battle in World War II, as Division Commander, I directed a study of our officer casualties and how they were replaced and trained during our combat period. I found that we had replaced our combat company commanders about once a month and our combat platoon leaders more often. We did not make a survey of the turnover of the squad leaders or tank commanders, but these were also very often required.

Where did these leaders come from? They were moved up from below. Some moved up more than once during the war. They had not been to an NCO Academy or to an Officers' Basic or Advanced Course. They had not had specialist courses in their MOSs. But they learned fast and maintained the momentum and excellence of their units and the division. Their *motivation* was no problem and their associates felt a very personal interest in qualifying them for their new positions. This is what I refer to as *Peer Instruction.*

Lieutenant Colonel Creighton Abrams, a recent Chief of Staff, was one of my tank battalion commanders. He filled vacancies in his tank platoon leaders many times in 11 months of battle. Whenever he could find time in the evening, he assembled his platoon leaders for what he called their "Basic Course," which he taught himself.

I am sure it followed no formal curriculum and the course varied from week to week, but he produced outstanding leaders for his tank platoons from the NCOs he brought up from the ranks.

The transition from our peacetime educational system for personnel (officer and enlisted) will be very drastic once we commit our troops to combat. Our officers must be oriented to expect this and how to handle the problems effectively and promptly. *Peer Instruction* is a big part of the solution.

The effectiveness of this training depends greatly upon the ability and dedication of the noncommissioned officers and junior officers.

BRUCE C. CLARKE
General (Retired), USA

Electronic Warfare: Fact or Fantasy?

Electronic Warfare (EW) seems to mean different things to different folks. That's understandable, because most of us define things based on our own point of view and experiences. But we do need to get on with the business at hand—and that's 20th Century battle. Therefore, I'll not redefine EW in this article, but rather, I'll attempt to remind you of the importance of EW in combat.

Most of us are familiar with the phrase, "Train as you will fight." Now that's an admirable goal, but hard to do because of the many restrictions and resource shortages we face on a daily basis. And, initiative or not, it's physically impossible to "do more with less," unless you've been grossly inefficient in the past. *But,* each commander—and that includes everyone that's commanding somebody—should remember that we will probably "fight like we've trained," at least initially.

When you think of going into battle *today,* with what you've got, in the way you've trained with it, it brings it all real close to home—it's not a game or positioning for officer efficiency reports anymore. Will you survive? Or, more importantly, will your men survive and accomplish the mission?

How much do you know about EW? How much EW training has your unit executed recently? Now I know what goes on, and into, training schedules; that's not the question. Does your unit, other than one or two guys, even understand what EW is?

Soldiers operate the bulk of the Communications-Electronics equipment (CE) in your outfit. True, you and I use it, but, they are the operators. Can they recognize jamming or imitative and manipulative communication deception, and do they know what to do about it?

"What goes up must come down" is a familiar admonishment. Now, I realize that space flight has tarnished the image of this trusty axiom, but I would like to offer an analogy. My saying goes something like this: "What's emitted or transmitted is available for intercept, analysis, or direction finding."

The point I'm trying to make is simple. Every transmission your outfit makes—in garrison or in the bush, is available for intercept. The interceptor is not doing his job for fun and games, he wants to establish a viable Electronic Order of Battle (EOB) which includes your unit. This information and intelligence will assist him in imitating you and your subordinates, in manipulating your unit's actions, in deceiving you, and in targeting you.

If you do not demand that your unit train in a realistic EW environment, then should your outfit go to war, your command is going to be an electronic beacon to the enemy. The enemy will know who you are, where you are, how you operate, what you're doing; and, he'll probably have already decided whether to kill you, use EW against you, or ignore you once the battle starts.

During training, have you ever ordered "STOP JAMMING," or allowed the jammers to operate only between 0100-0300? If you have, your rationale was: jamming disrupts training. The next time you come to a similar decision point, please remember that "STOP JAMMING" and time restraints are not a part of Soviet EW doctrine.

The counter to my last comment usually is: "But you just don't understand! We've got to learn the basics before we go to the more complex."—and so forth. Well, I think I do understand, and offer only one simple rebuttal. When do we move from the simple to the more complex? Remember—you'll fight as you've trained!

The successful execution of mid-intensity battle demands the application of all resources available to the commander. EW is a primary resource. Now, I know that we in the combat arms like to kill enemy systems in combat. We like to see that bright orange flash, smell the powder, and hear the boom. That's neat, and I love the sound of a DIVARTY TOT or a tank task force cranking up early in the morning as much as anybody. But, have you counted noses lately?

In my opinion, we're good—but so is he, and he's got more stuff. Therefore, we must use EW resources and techniques to improve, in our favor, the force ratios a unit must deal with at a given point in time. We have this capability, if we'll just use it.

It's true that EW does not normally kill enemy systems directly. But, in a practical sense, it can contribute to their destruction by disrupting, confusing, or delaying enemy actions. This buys us time which in turn allows our weapons to engage enemy formations in a manner that provides us an advantage—the initiative.

Seldom can EW be effectively employed at the tactical level by itself. The application of EW must be planned for, and executed in coordination with and in support of firepower. This is accomplished during the normal commander and staff planning sequence. The key is that we don't forget EW, and we don't add a few words on it as an afterthought. The boss must consider the use of EW resources just as he does other weapons.

- What are the critical firepower targets to be attacked; and in what order.
- What are the critical EW targets to be attacked; and in what order.
- What critical targets are to be attacked by both firepower and EW; and in what order.

EW is a weapon system and each unit in the Army has some capability to execute a part of EW. To train realistically with EW does not require any exotic equipment or personnel—only an understanding of the need is required. The other guys understand the importance of EW; do you?

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Major, USA
Air Force Electronic Warfare Center
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Positional Warfare?

Captain Wayne Hall's article on "The Active Defense" *(ARMOR,* May-June 80) presented a number of interesting ideas. Most of them deserve considerable thought and examination prior to adoption as standard American responses to certain situations. However, Captain Hall has also made several points that deserve special mention, but likewise deserve greatly expanded clarification as well.

Captain Hall has titled his work "The Active Defense," yet he seems to be an advocate of positional warfare; that is suggested by the statement "Units will have to stay behind and inflict maximum casualties on the Soviets." By no stretch of the imagination can it be assumed that such a defense is mobile; it is, by nature, restricted to a certain area, totally surrounded by the enemy.

Captain Hall mentions the static defenses employed by the Soviets in the defense of Stalingrad; what he fails to mention is that these defense areas were totally overwhelmed, their men killed or captured. In point of fact, the only thing that saved the defenders of Stalingrad was the eventual massive operations that isolated the German Sixth Army.

Captain Hall makes much of the German units which in World War II managed to become surrounded, then fought their way to a juncture with friendly troops who were driving a corridor into the pocket. He fails to mention the numerous other German units that were cut off and either failed to escape the Soviets or were so damaged by that escape as to be almost useless.

Captain Hall suggests that cutoff units attempt exfiltration after having somehow managed to inflict major casualties on the enemy. No consideration was apparently given to the casualties who would either have to be taken along in the breakout, or abandoned to the enemy—an enemy whose treatment of the wounded in even the best of times could best be described as barbaric—nor the amounts of material that would have to be abandoned simply because it couldn't be gotten out in time. The manual *Evasion and Escape* (FM 21-77 and FM 21-77A) details the dangers of such an action.

No consideration was apparently made of the psychological implications of being cut off by the enemy. Again to cite FM 21-77, we find that about 75 percent of the men who became POWs were isolated, that 70 percent of the units had enough ammunition available to conduct effective operations, and that in 90 percent of the cases, food was not a constraining factor. Can we therefore expect modern troops, exposed to the same conventional dangers, and the probability of biological and chemical weapons on the battlefield, and, looming over all operations, the spectre of nuclear weapons, to do significantly better in an isolated position? As much as we may dislike the loss of friendly territory, we may be forced into a position where we must trade time and space for survival as a viable combat entity.

The positional defense resembles that imposed on the German Army during World War II, the infamous ". . . where a German soldier has once set foot. . ." syndrome. In such a case, as Captain Hall perceives the future battles, we may be forced to hold each inch of friendly territory. Such a defense is wasteful in almost all terms anyone can think of.

Both Captain Hall and John Milsom suggest that special units are to be trained for the ("Stay Behind Armored Units," *ARMOR*, May-June 80) "stay behind role."

Deliberate stay behind units may, if captured, be treated as spies, potential or actual, and dealt with in a summary manner. The Soviet treatment of guerrillas in the past has not, by any standards, been lenient.

Captain Hall makes the suggestion that each division use some of its assets to form these stay behind units. This practice would be counterproductive for a number of reasons. First, the removal of combat manpower from the division's assets to stay behind and hopefully cause enough damage that their eventual capture or destruction would be worthwhile would, if the number of men is to be significant, seriously degrade the ability of the parent unit to conduct an optimal defense.

Secondly, the troops selected for such a mission would, of necessity, be volunteers; they would undoubtedly be highly motivated and highly trained personnel; therefore, these troops, if divided among the remainder of the division, at appropriate levels of command, could contribute more to the division's operations than they could contribute by blowing up a few trucks and shooting a cook or two.

Thirdly, the use of these troops would blur the line between dedicated Special Forces units who are deliberately committed, after extensive training, in the same role as suggested by both Captain Hall and Mr. Milsom.

Captain Hall suggests that we spend time and resources in training rear area specialists as combat troops. Unfortunately, to be effective, they would need a considerably lengthened training cycle to meet their assigned role, as well as their rear area security role.

A very good case can be made for the fact that the use of rear area specialists, frittered away in defense operations, made the German Army considerably less effective than it could have been. Considering the complexity of modern equipment and the lengthening training cycles, could we afford to spend trained manpower in roles for which they are not properly suited. The better solution may well be to organize rear area security units from men who would otherwise be unsuited to the stress of frontline combat. At such a point, these units would only have to stop or slow an enemy force long enough to allow the fully-trained, top quality troops to eliminate the enemy.

Captain Hall also makes the suggestion that local civilians be used to assist in the defense. This suggestion makes no apparent concessions to the legality of such operations, where the role of civilian and soldier becomes blurred to the point that distinguishing between noncombatant and combatant becomes impossible. Any action which can be construed as actively assisting in the defense would remove whatever "protection" the civilians would have under law; at this point, they may be legally shot out of hand if captured.

Captain Hall states that "We assume away our opponent's intelligence. . ."; but then he proceeds to expose a number of potential Soviet weaknesses that can be exploited. Each of these "weaknesses" can be perceived as being a product of assuming away our opponents; intelligence. We often neglect to mention that, despite the alleged inflexibility of Soviet forces, lack of initiative, and poor low-level leadership, a much less well-educated, less technologically advanced, and more numerically equivalent Soviet Army decisively defeated the German Army, whose technological, tactical, and operational superiorities were much, much greater than the current situation *vis-a-vis* the Soviets.

The Soviet Armed Forces suffered heavy casualties during the advances of World War II, but once more a good case can be made that these casualties were suffered in the pursuit of geopolitical aims, rather than purely military goals. Thus, after the capture of the Rumanian oilfields, there was little real reason to continue the offensive into the Balkans, except the poltiical goal of insuring the presence of Soviet troops on Rumanian, Bulgarian, and Yugoslavian territory to prevent anticommunist movements from arising.

There was no need to capture Austria later on, except to prevent an Allied occupation of the country. Equally, there was scant need to campaign across Finnish territory to take a relatively minor and static front out of the war, except the geopolitical goal of securing large portions of Finnish territory that would better protect the Soviet Union. Finally, there was no reason to start the "Race to Berlin," except the fantastic political goal of capturing the capital of the major enemy, while Allied units would have to be content with the virtually bloodless occupation of Rome.

It is my firm belief that much of this so-called "failure" of the Soviet Armed Forces has been exaggerated into a virtual cult by many historians. Hence, we should look further before we become victims of our own prejudices and dogma.

Despite its nearly 35-year-old facts, the *Handbook on USSR Military Forces* presents a much more balanced picture of the Soviets in action than does the later writings of its principal author, General Reinhard Gehlen. It is time that we conduct a review of the available literature in a more critical fashion, and do so before it is too late.

ROBERT C. SMITH
Pennsauken, NJ

news notes

Attack Helicopter Company Activated

Company C, 1-6th Cavalry (Attack Helicopter) was activated at Fort Rucker, AL, 1 December 1980. The activation of Company C marks the first time for an attack aviation unit to be stationed permanently at the U.S. Army Aviation Center. The unit's combat mission is to locate, disrupt, and destroy enemy forces, particularly armor and mechanized units, by applying aerial combat power in coordination with other members of the combined arms team. The company also has a mission to support training activities of the Aviation Center when required.

Army 86 Studies

The U.S. Army Armor Center has published a series of three pamphlets dealing with operational and organizational concepts of the Army 86 Studies. The pamphlets cover the "Division and Corps 86 Cavalry," "Air Cavalry Attack Brigade," and "Division 86 Tank Battalion." The booklets can be obtained by writing to

Director
Directorate of Combat Developments
ATTN: ATZK-CDSD
Fort Knox, KY 40121

The Department of the Army is currently developing the transition plan for the implementation of the Army 86 Studies.

New Tank Towbar

The Tank-Automotive Research and Development Command (TARADCOM) has developed a new lightweight towbar for towing disabled tanks.

Made of a combination of steel and a durable composite graphite and epoxy material, the new device weighs only 125 pounds, making it 225 pounds lighter than the bar now in use.

The graphite-epoxy tubular towbar met all combat-vehicle towbar strength specifications during tension, compression, and crush tests conducted by TARADCOM. Field tests are scheduled early this year.

Man-Portable Antiarmor Weapon

An Infantry Man-Portable Antiarmor Weapon System (IMAAWS) that uses one of the first applications of millimeter wave technology is under development. The millimeter wave target sensing capability of the round will allow infantrymen to fire the weapon and take cover, thereby limiting their exposure to fire.

The two-man portable, "fire and forget" IMAAWS consists of two subsystems. The launcher is a breech-fired recoilless rifle with a fire control subsystem mounted permanently on the tube. The round is a simple, low cost projectile that employs improvements in armor-piercing warheads.

Millimeter Wave Radar Guidance System

A radar guidance system that uses the millimeter wave region of the electromagnetic spectrum has been used successfully to guide missiles to heavily-obscured targets.

In three successful launches, the target was obscured by heavy smoke and aerosols, and, in one firing, the missile was guided to the target even though the smoke-shrouded visibility was further reduced by light rain.

Millimeter wave radar operates between the lower frequency conventional microwave radar and the higher infrared. This type of radar is superior to conventional radar in angular resolution and better than infrared in penetrating adverse weather and other battlefield obscurants.

Studies are underway to determine what further experiments are required to expand millimeter wave technology, including target acquisition, missile capture, and operation against electronic countermeasures and through rain and fog.

Improved Decontaminating Apparatus

An improved version of the Army's current power-driven decontaminating apparatus is in the final stages of engineering design at the U.S. Army Armament R & D Command's Chemical Systems Laboratory. It offers an improved capability for decontamination of equipment on the nuclear and chemically contaminated battlefield.

The new version provides an improved decontamination capability and increased system mobility.

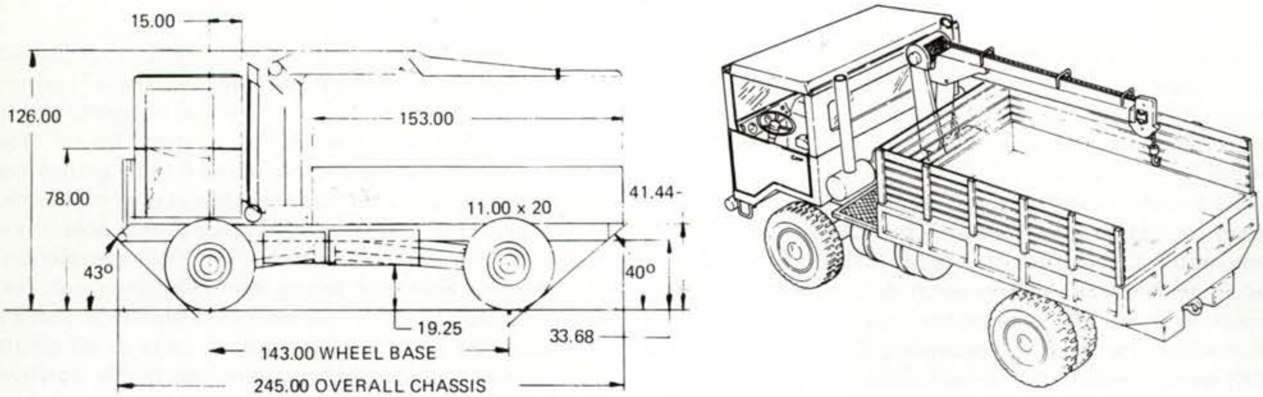
The unit is permanently mounted on a 5-ton cargo truck. Features include a steam and high pressure water cleaning capability with an onboard generator, an increase in output from 50 to 100 gallons per minute, and an easily-erected wash/rinse rack for quick rinsing of vehicles.

Vehicles can be driven through to rinse off the decontaminant, much like in a car wash.

The equipment will also be capable of limited terrain decontamination.

Four hand-held hoses with nozzles and brushes are also provided for decontaminating of difficult-to-remove substances on vehicles. A troop shower frame allows for showering of up to 25 personnel at a time at a decontamination station.

Installation of the newly designed apparatus onto cargo trucks is scheduled to begin this year.



3-TON, 4 x 4, CARGO TRUCK

5-TON, 6 x 6, CARGO TRUCK

New Tactical Trucks

Two new tactical trucks have been developed by the White Motor Corporation. One is a 3-ton, 4 x 4, the other a modification of the 5-ton trucks now used by the U.S. Armed Forces.

The 4 x 4 truck retains the cargo body of the Army's *M-35A2* vehicle. Vehicle length has been reduced by 2 feet and on-board material handling equipment has been incorporated in the design. The vehicle is equipped with standard Army 5-ton truck wheels and tires, blackout drive lights, instrument cluster, tow hooks, pintle hook, bumperettes, and accessories. Curb weight of the 4 x 4 truck is 3,000 pounds less than the standard 2½-ton Army truck. The vehicle's lighter weight, combined with commercially-available chassis components, reduces fuel consumption by 25 percent.

The White 5-ton truck is designed to modernize the Army's tactical fleet through conversion of existing *M-39* and *M-809* series trucks.

During 5,000 miles of shakedown tests, an early version of the design demonstrated fuel consumption ranging from 6.04 mpg at 60 mph to 7.46 mpg at 50 mph, fully loaded. This represents an improvement in fuel economy of 25 percent, which is attributable to a reduction of 2,000 pounds in curb weight, elimination of the transfer case, and introduction of a commercial power package and drive-train components.

LIQUID COOLED GARMENT CONCEPT DEMONSTRATED

Tests recently conducted at Yuma Proving Ground, AZ, utilizing unique individual cooling systems have shown clear promise of means to overcome heat stress on combat vehicle crews wearing chemical protective clothing.

The liquid-cooled garment concept, which has been under investigation by both the U.S. Army Natick Research & Development Laboratories, Natick, MA, and the Tank Automotive Research & Development Command, Warren, MI, became the subject of considerable interest as the need for providing Chemical Biological (CB) overgarments to combat vehicle crews increased.

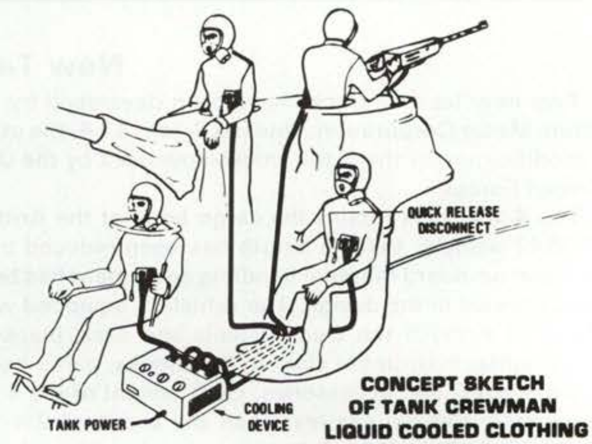
Utilizing an advanced combat vehicle, crews comprised of Marine Corps volunteers assumed crew stations wearing standard CB overgarments and the associated respirator, handwear and footwear. With ambient temperatures in the 100° range, and with skin and rectal temperatures monitored by Office of the Surgeon General personnel, the heat stress problem surfaced rapidly, and as a result the test was terminated in two hours.

Natick personnel then provided crew members with individual liquid-cooled garments (LCG). Worn under the standard CB ensembles, these LCG units provided torso cooling by conductive means. These garments consist of a thin vest containing small channels through which a cooled water-alcohol mixture flows. Being close to the body, the coolant liquid rapidly carries away body heat. Under approximately the same conditions as in the previous test, the Natick team was able to keep the crewmembers comfortable until the completion of the planned test four hours later. The skin and rectal temperatures of the crew members clearly showed the effectiveness of the new cooling units in eliminating heat stress. Crew reactions were also highly positive in favor of the cooling units.

The LCG units used in the test consisted of vests covering the torso area. If additional cooling is required, head units consisting of thin "skull caps" with the same cooling channels could be used. Although the head comprises a relatively small portion of the total body area, it is rich in blood flow and, therefore, is one of the most efficient areas for removing heat from the body.

Researchers at Natick Laboratories also point out that conductive cooling concepts have another real advantage in hot weather operations: They should reduce makeup water requirements. In desert operations where the body is cooling itself largely by evaporation, an individual may require 15 liters of water a day to preclude dehydration. By contrast, conductive cooling should reduce the loss of body fluids and therefore, significantly reduce the logistic problem of water resupply.

In years past, physiologists and other researchers have performed a number of experiments utilizing various techniques of circulating air inside clothing to achieve microclimate cooling of the clothing system. The control of the clothing microclimate allows crewmen to be maintained in thermal balance regardless of the environmental extremes outside of the clothing ensemble. As a result of the tests, crewmen will be able to extend their mission time indefinitely under high temperature and humidity conditions. This will greatly improve the effectiveness of the weapons system, which would otherwise incur limits on mission time due to incapacitation of crewmen by heat stress.



CONCEPT SKETCH OF TANK CREWMAN LIQUID COOLED CLOTHING WITH VENTILATED FACEPIECE

OPMS-EPMS

Restructuring of Armor Officer Training

In September 1980, General Edward C. Meyers, Chief of Staff of the Army (CSA), made the following decisions concerning the future of the officer education system:

• The present Officer Basic Course/Officer Advanced Course progression will remain as is. Course lengths will not change significantly

• A system of promotion qualification entitled "Military Qualification Standards (MQS)" will be established

• Officers will enter the Combined Arms and Services Staff School (CAS^3), located at Fort Leavenworth, between their seventh and ninth years of service

In order to better understand these changes, a brief explanation of their intended purposes and structures is provided. The accompanying chart displays years of active service versus the proposed officer courses and the levels of Military Qualification Standards.

MQS Operation. Each MQS consists of an MQS booklet, which contains all the tasks necessary to develop the skills required of that MQS, and an MQS Qualification Card for recording the successful validation or accomplishment of each task.

MQS 1. When the officer candidate is certified as having fulfilled the requirements of MQS 1, he will have acquired those common military skills and knowledges he will need throughout a career in the U.S. Army. MQS 1 requires completion of a baccalaureate level education (exceptions are OCS and direct commission officer candidates) and completion of the two components common to the MQS system: *Military Skills and Knowledges and Professional Military Education.* All officer candidates will receive instruction in drill and ceremonies, counseling, basic leadership, land navigation, basic communication procedures, UCMJ, and military correspondence. Upon arrival at Fort Knox, each newly commissioned Armor officer will be administered a diagnostic examination in order to become "MQS 1 Qualified." Officers who do poorly on the test will be required to participate in remedial instruction and attend a later basic course. MQS 1 Certification will initiate the officer's entry into the Armor education system.

MQS 2 will broaden the skills learned in the Officer Basic Course by orienting on platoon leader and executive officer job requirements and continue the officer's professional growth. MQS 2 will provide a "road map" for lieutenants to follow to speciality qualification before being considered for promotion to captain. Within his first 3 years of commissioned service, the lieutenant will be required to validate a listing of required Armor/Cavalry skills which are leadership and event oriented (gunnery, ARTEP, etc). In other words, a large number of the needed skills can be acquired as a part of the officer's normal duties. The individual's commander will be responsible for supervising the validation process. The validation process will not be rigidly structured, allowing the commander some latitude in conducting the validation to accommodate the wide variety of Armor lieutenant assignments. An MQS 2 Qualification Card will be forwarded to MILPERCEN, indicating the officer's qualification for promotion to captain.

Military Skills and Knowledges of MQS 2 will include military engineering, unit NBC defense procedures, material readiness, administration of UCMJ, tank gunnery management, communication skills, employment of supporting fires, and operations in special areas (urban, tropic, arctic, etc.).

Professional Military Education standards of MQS 2 will include a Directed Reading Program, monitored by the commander, which will require the officer to read and discuss eight literary works on tactics, leadership, and history that are pertinent to his speciality.

MQS 3 will qualify the officer in his speciality at the intermediate (captain) level to expand on previous professional development. MQS 3 will combine command and staff skills. It will build on MQS 2 with the intended goal of producing an officer with sufficient background to attend the CAS^3 at Fort Leavenworth, KS. MQS 3 requirements must also be validated by the officer and certified by his commander or supervisor. Successful completion of MQS 3 will be a prerequisite for promotion to major.

Military Skills and Knowledges that will be addressed in MQS 3 include leadership and management, operational planning and task organization, logistical planning, combat engineer employment, task force communications and electronic warfare, training management, and intelligence and security operations.

Professional Military Education of MQS 3 will expand the Directed Reading Program, and the officer will be required to read and discuss 16 additional books chosen from Army-wide and speciality lists.

CAS^3 will train all Active Army and Reserve Component officers for duty as primary staff officers at the battalion and brigade levels. Upon promotion to captain, the officer will apply for participation in the 120-credit-hour Non-Resident Instruction (NRI) CAS^3 course. The NRI phase of CAS^3 will provide for common understanding of basic organizations and doctrine. Successful completion of CAS^3 (NRI) will be required to become "MQS 3 Qualified," and for attendance at the Resident Instruction CAS^3 course. Between the seventh and ninth years of active service, officers who have completed a proctored examination of NRI-CAS^3 subjects, will attend the 9-week resident phase at Fort

Leavenworth. The student officer will participate in group learning seminars, map exercises, computer-assisted wargames, logistical and interoperability exercises, and written and oral communications. The CAS^3 graduate will return to his unit, and subsequent assignments will be based on Army requirements according to grade and speciality. Upon completion of MQS 3, the officer will have met the requirements for promotion to major.

The Command and General Staff College (C&GSC) course will continue in its present configuration and length. It will address command and staff skills at brigade and higher echelons. C&GSC attendance will be limited to 40 percent of a year group, and occur between the 9th and 14th years of active service. Those officers selected must be CAS^3 graduates, be chosen by a formal DA selection board, and have attained the rank of major or captain (P).

The greatest impact of the CSA's decision is that future promotion will be based on qualification. The lieutenant must be "MQS 2 Qualified" before he can be promoted to captain. The captain must then be "MQS 3 Qualified" *and* have completed CAS^3 in order to be promoted to major.

At present, the details of the MQS 1 Manual are still being worked out. The MQS 2 Manual for Armor officers is scheduled to appear in 1983, and the MQS 3 Manual in 1984. CAS^3 will begin in the spring of 1981. The first few classes will consist of resident instruction only, as the Non-Resident Instruction (NRI) is still being developed.

New Assignment Notification Procedure

In a major policy change, effective 1 December 1980, commanders and supervisors will be given an expanded role in the personnel management of their subordinates. Unit commanders and supervisors will play an integral role in informing their subordinate officers of forthcoming reassignments.

The new assignment notification procedure will apply to all warrant officers and commissioned officers through the rank of major. Only officers assigned in the Continental United States (CONUS) will be involved initially. Plans to include overseas units are still under study.

Following tests conducted between February and May 1980, involving units at Forts Riley, Benning, and Meade, MILPERCEN action officers recommended that unit commanders or supervisors (0-5 level and above) make the initial announcement to subordinate officers of their pending reassignment. Coordination of assignment information such as location, speciality, and reporting date will occur between the officer, his commander or supervisor, and the MILPERCEN assignment officer.

Under the current system, the assignment officer calls the officer at his home or unit and alerts him of a proposed move. After 1 December 1980, officers will be so informed by their commanders giving them an opportunity to discuss initially the assignment with someone other than their assignment officer. Additionally, the senior officer will be immediately aware of the possible loss of a subordinate officer.

Assignment officers will call a designated point of contact at each post or installation—usually within the G-1 office or the Directorate for Personnel and Community Activities (DPCA)—and inform him/her of the officer scheduled for a PCS move. The POC will be provided the name of the officer, his social security number, the date being considered, the utilization speciality, the location, and the name and telephone number of the assignment officer involved.

This information will be provided to the appropriate commander or supervisor for his use. He will make the initial announcement to the subject officer. If the commander or supervisor elects, he may call the assignment officer before, during, or after the counseling period for further information. The announcement is expected to be made to the officer within 3 working days after the alert notification is called to the post or installation.

The assignment officers will be prepared to discuss assignment rationale, professional development requirements, and the needs of the Army with the commander or supervisor or the officer. The officer's performance information will not be made available to the commander or supervisor unless the individual officer gives his or her approval to release that information.

If the assignment officer doesn't hear from either the commander or supervisor or the subject officer within 3 working days, he will prepare a request for orders and complete the assignment process.

The Officer Assignment Process

"How do they come up with assignments at MILPERCEN?" That question is raised nearly every time when one or more officers get together with someone from MILPERCEN. The answer is always truthful and to the point—but somehow not quite believed. Assignments are based on the

- Needs of the Army
- Officer's qualifications
- Officer's professional development
- Officer's assignment preferences

MILPERCEN receives requirements for officer positions throughout the Army. There are now, and have been for some time, more recognized positions than there are officers to fill them. The Officer Distribution Plan was designed to distribute this shortage equitably across the Army.

When a request is received at MILPERCEN, it is given to the Assignment Management Section corresponding to the speciality required for the position. The

Armor Management Section

Effective March 1981

LTC Tim Donovan	Chief and Lieutenant Colonel Assignments
MAJ Tom Surles	Major Assignments
MAJ Israel Anderson	Captain Assignments
CPT Craig Wheldon	Lieutenant Assignments
CPT John Daly	SC 28 Assignments Advanced Course/Advanced Assignments
Mr. Leo Leal	New Accessions

U.S. Army Military Personnel Center
ATTN: DAPC-OPE-R
200 Stovall Street
Alexandria, VA 22332

AUTOVON: 221-7849/9444/9658/9696
Commercial: (703)325-7849/9444/9658/9696

assignment officer then looks at his list of officers available for reassignment. This list is based upon the officer's Date of Availability (DTAV) for reassignment. The DTAV for an officer is figured as 36 months at an assignment plus 30 days travel and leave. This process gives the assignment officer the pool from which he must select an officer to fill a vacancy. The assignment officer further refines the pool by considering other items listed above. This is the key point: the assignment officer takes into account the qualifications, professional development, and assignment preferences of the officer available for reassignment to a required position. The reason for having an officer performing this function rather than a computer is to insure that each officer's needs and desires are cared for while still meeting the needs of the Army.

Officers Preference Statement. Assignment officers take into account an officer's desires before placing him on orders. He does this by first reading the Officers Preference Statement. Many officers are overwhelmed by the official nature of the form. They need not be! The form is really just a note from an officer to his assignment officer. The form is arranged in a manner to jog one's memory as it is completed. Every block does not have to be filled in, but it should contain enough information to let the assignment officer know where the individual submitting the form would like to go. Keep desired assignments reasonable and the chances of them being fulfilled are much better. (Second lieutenants don't go to the War College nor are there many Armor slots in Paris.)

The next thing the assignment officer looks for is a telephone number. As officers move from tank to tank park, orderly room to battalion staff, they should send a card with their new number to the Armor Management Branch.

ROTC/USARR Duty for Enlisted Men

Reserve Officer Training Corps (ROTC) and U.S. Army Readiness Region (USARR) assignments are high priority and highly selective positions.

ROTC positions are primarily instructor-type assignments at colleges, universities, military academies, and high schools that have an ROTC program. These assignments incur a 3-year stabilization.

USARR positions are primarily assignments as enlisted advisors to National Guard and Reserve units in a designated area. These positions involve some TDY travel and weekend duty. The initial period of stabilization is 2 years.

The basic qualifications for these assignments are outstanding performance, high moral standards and character, recent troop leading experience, total MOS qualification, and no financial problems.

Military installations are usually not readily accessible, so the majority of these positions require living on the civilian economy without any additional pay or allowances.

Most Armor positions are in grades E7 and E8, with limited requirements for grade E6. Soldiers interested in these assignments should submit applications through channels IAW AR 614-200, Chapter 8, Section VI.

What is a CMIF?

The Career Management Individual File (CMIF) is a record maintained by the Armor Branch for the primary purpose of making assignment and professional development decisions concerning E6, E7, and E8. The file contains a copy of the Official Military Personnel File (OMPF) microfiche, Efficiency Reports, MOS/SQT test evaluations, Enlisted Preference Statements (DA Form 2635), DA Forms 2 and 2-1, general assignment information, and correspondence.

The OMPF microfiche, efficiency reports, and test evaluations are provided to MILPERCEN by the Enlisted Records and Evaluation Center at Fort Benjamin Harrison, Indiana. This information is forwarded after it has been processed at Fort Benjamin Harrison, with the exception of the OMPF, which is sent after annual updating.

DA Forms 2635, 2 and 2-1 are forwarded by the servicing Military Personnel Office, Preference Statements (DA Form 2635) are initiated by whenever there is a change in areas of preference, or an update of information is desired. *The change made on the local Form 2 does not change the Preference Statement in the CMIF!* Here are examples of times when sending in a new DA Form 2635 should be considered.

- When marital status changes, especially if marriage to another service member is involved.
- When volunteering for Korea.
- Ten months prior to ending drill sergeant duty, ROTC/USARR duty, or a long tour overseas.

It must be emphasized that the CMIF is not used in any way by DA selection boards for promotion, schools, or quality management program (QMP). The OMPF is used for those boards which are convened at Fort Benjamin Harrison, Indiana.

BOOKS

NUMBERS, PREDICTIONS, & WAR: USING HISTORY TO EVALUATE COMBAT FACTORS AND PREDICT THE OUTCOME OF BATTLES by Colonel T. N. Dupuy. The Bobbs-Merrill Company, Inc. Indianapolis and New York. 1979. $13.95.

This book is aimed at military analysts, wargamers, and others interested in military history. It is a good shot at these. But, is it appropriate for ***ARMOR*** readers with other interests? This reviewer answers, "Yes." The book contains military savvy, a condensation of numerous battles and, most importantly, a way of examining them and others in order to measure their lessons. Unfortunately, the text is rather "heavy" and requires effort, interest, and knowledge of military history and science from the reader. A small group could approach it by reading it together and arguing the findings and their potential application to present and future training exercises/battles.

Science is based upon the reduction of observed happenings (such as an apple falling to the ground or the trajectory of a projectile) to representation by a mathematical formula. This is usually first done by what is termed an empirical method whereby you try to account for the effects of all the things you can measure. In the case of the book, this includes manpower, weapons, etc. You then examine how the various measured things appear to affect the outcome.

As an example, a projectile's impact point was known to be related to its muzzle velocity, weight, and diameter. For the same size and velocity, a heavier shot went farther. Thus, you could describe the relative fall of projectiles from some basic information without having a full knowledge of the science of aeroballistics.

The model in the book appears to be at the same early state. It explains, relatively well, the battles examined from Austerlitz in 1805 to the 1973 Arab-Israeli War. The book's model can provide a past/present/future rating for the effects of surprise, leadership, terrain, mobility, logistics, weapons effects, and more. The usefullness to ***ARMOR*** readers should be similar to range tables. The model should give a ballpark idea of what should happen in a future engagement. However, one should remember that both Murphy's Law and short rounds do happen.

The development of the analytic model has paid meticulous attention to both numerical information about battles and the insights recorded by their participants. This has helped it to accurately represent the past battles and generate some general trend information. However, the model can and will probably be improved with future use.

One particular improvement should be in the quantification of weapons effects which are loosely represented. At present, these include a ratio of maximum range for effective range which could be improved by use of effective-hit lethal footprints for the weapon's use against its potential targets. This will be more complicated than the analysis used at present; but it might help explain further why some armies have consistently shown an advantage over others. Still, in all fairness, the application of the present set of analytic rules to the entire weapons suites of both sides helps to smooth out the effect; and the model still gives very reasonable results.

The application of the book's model prior to some field exercises might suggest how to gain an edge. A review of the exercises using the model over a few beers should provide some quantification of what went wrong and what went well. The proof will only be found in the application and improvement of what appears to be a fine piece of work.

JOSEPH E. BACKOFEN, JR.
Battelle's Columbus Laboratories
Columbus, Ohio

FROM FLINTROCK TO RIFLE: INFANTRY TACTICS, 1740-1866, by Steven Ross. Rutherford: Fairleigh Dickinson University Press. 1979.

This book provides a well-written and incisive summary of the conflicting trends in infantry tactics from 1740-1866. During this period European armies experienced a revolution in infantry tactical doctrine. In 1740, armies resembled machines, since soldiers advanced in inflexible parade-like formations and exchanged volleys at point-blank ranges. More than a century later, the American Civil War demonstrated that tactical flexibility, open formations, individual initiative, and effective firepower would dominate future battlefields.

The author traces the major developments in infantry tactics and demonstrates that tactical adaptation did not occur easily. The changes involved social adaptation as well as technological and military innovations, and essential improvements were often obscured or overwhelmed by other ideas or methods. Yet, armies which recognized the need to change and successfully modernized themselves were usually more successful than their less adaptive and less fortunate rivals.

The value of the book resides less in its contribution to original historical research, than in its insights for professional military readers. The problems of changing tactics and adopting new weapons are not new, and military readers can add to their intellectual depth and understanding by studying previous periods of tactical change. In that sense, Steven Ross' book should be of interest to the Army professional.

ROBERT A. DOUGHTY
Major, Armor
HQ, 3d Squadron, 8th Cavalry

PRIMACY OR WORLD ORDER: AMERICAN FOREIGN POLICY SINCE THE COLD WAR by Stanley Hoffmann. McGraw-Hill, New York. 331 pp. Paper. $5.95.

America suddenly emerged as an international superpower and world policeman at the end of World War II. Postwar policy planners believed that U.S. economic and military superiority granted the nation the right and the duty to impose American ideals on the world order. At the heart of this world order, this *Pax Americana*, was the containment of communism. From 1946 through 1968, American foreign policy consisted of an ongoing attempt to contain communism in ever expanding areas of the globe. Ultimately, the policy failed; Vietnam provided the best example of the inadequacy of this approach.

Recognizing this failure, Henry Kissinger attempted to formulate a new structure of world order. The procedures were different but the goal of continued U.S. primacy in the world system remained constant. Despite short-run successes, Kissinger's vision also failed.

These are the conclusions of Stanley Hoffmann, professor of Government at Harvard and Chairman of the University's Center of European Studies. He argues that the era of American world primacy has passed; the quest is no longer viable. Present economic and social conditions demand a reorientation by American policy makers. The present choice is American primacy or world order. Hoffmann advocates an American policy which strives for a mid-position between the bipolar world of the cold war decades and the pragmatic opportunism of the Kissinger era, an America which is neither world policeman nor isolationist recluse. His plea is for cooperation and restraint. The second half of the book attempts to outline general principles which must form the basis for this new world order.

This is not an easy book. It is tightly written, well organized, and amazingly jargon free (rare among studies of the international system); but it is not written for the layman. It is intensely detailed and it develops a complex analytical model. Despite the author's claim in the preface that this is an essay written by a citizen to his fellow citizens, the book is written for the academic community. It may eschew detailed policy prescriptions and grand designs, but it is a sophisticated treatise. Above all, it is a good book, worthy of serious contemplation and a wide audience. This new paperback edition (the hardbound volume was published in 1978) will make the book readily available in the college classroom.

MARJORIE H. SMITH
Politics Major (Senior)
Converse College
Spartanburg, SC

HISTORICAL STUDY, SMALL UNIT ACTIONS DURING THE GERMAN CAMPAIGN IN RUSSIA. Department of the Army Pamphlet No. 20-269. Department of the Army, July 1953. Reprinted by the Government Printing Office. 289 pages, with maps, illustrated.

This paperbound book is the thirteenth publication in what is known as the German Report Series. It is based on German source material, in the form of personal narratives, which were written under the supervision of General Halder, Chief of The German Army General Staff from 1938 to 1942. As stated in the preface, the purpose of this pamphlet is to provide small unit leaders with instructional material on the war between Germany and Russia.

The book is presented in three parts, Part I being a brief introduction, and Parts II and III containing the substance of the book. Part II, entitled "Arms and Services," is further divided into three chapters. Chapter 1 recounts 15 infantry actions of units ranging in size from squad to battalion. Although much of the narrative focuses on the activities of the German troops, there is considerable detailed information on the tactics of the Russians as well. The actions are arranged chronologically from September 1941 to October 1943.

Chapter 2 describes 12 actions which involved either German or Soviet armored units. They are also arranged chronologically, and thus portray the improvement of Soviet employment of armor over a period of time. Chapter 3 depicts both the proper and improper utilization of engineer troops by German commanders.

Part II of the book covers "Special Operations." It describes actions in the far north; Soviet operations at river lines; combat in forests; and "anti-partisan warfare."

The real strength of the book lies in the clarity of the text, which is aided by maps on which are depicted the dispostion of forces and the scheme of maneuver of each side. Many of the narratives are also concluded with a "lessons learned" paragraph, in which the major tactical lesson to be derived is explained. The traditional German prejudices, which were clearly evident in earlier publications in the German Report Series, are barely, if at all, discernable in this book.

A central, but unstated, theme of the book is the high level of tactical training and technical competence of German soldiers and leaders at company level and below. There is a lesson in this for our junior leaders. It is that well-trained and competently led soldiers can fight and win over a numerically superior enemy. Of course, the Soviets triumphed ultimately, for reasons which are beyond the scope of this review. But the fact is that on many occasions, small German units, by their proper use of weapons and tactics, were able to defeat a numerically superior Soviet force.

This book is difficult to fault. One might wish that its scope were broadened to include actions of artillery, reconnaissance, and antitank formations, and more examples of special forces type of operations. But even without all of this, the book as written is a very useful document for any study of the war on the Eastern Front. it also has some applicability to our own time, in that the actions described in it can be used as teaching points in much of our tactical training.

As with all the other books in the German Report Series, this book was written by soldiers of the last army to fight against the Soviets in a large-scale conventional war. The actions they describe took place nearly 40 years ago. Though much has changed in the technology of warfare since that time, many of the training methods and leadership techniques have not. Our junior officers and noncommissioned officers would benefit by a careful study and analysis of the actions described in this book.

JAMES GEBHARDT
Captain, USA
Fort Benning, GA

A PICTORIAL HISTORY OF THE WORLD WAR I YEARS by Edward Jablonski. Doubleday and Company, New York, NY, 1978. 317 pages. $12.50

A companion work to *A Pictorial History of the World War II Years,* the World War I version contains over 400 photos and maps covering the war years 1914-1918. All aspects of the war are covered, from the Tommies and Doughboys on the frontlines and in the trenches, to the statemen and rulers back on the homefront. The photos were selected well to show all faces of the war, the devastated fields of Flanders, the mud and the trenches, and the soldiers who fought there.

New aspects of war of that time are also pictured. The U-boat war, *Zeppelins* and fragile biplanes, and a self-propelled, armored weapon system, called a tank, all find their places within this book.

An excellent, brief commentary accompanies the photos, and sets them in context of the war. The book is organized by year, with each year receiving a chapter of text and a chapter of photos.

This book, and its companion book on World War II, provide a brief but comprehensive look at the complexity of those wars. The photos take the place of many pages of dry text.

RICHARD MORRIS
PS Magazine

STAR ON MANY A BATTLEFIELD, by COL (Ret) Francis C. Kajencki. Fairleigh Dickinson University Press, 1980. $18.50.

Those interested in the Cavalry and the Civil War will find this book a "star." COL Kajencki has selected a relatively unknown Union officer, Joseph Karge, and produced a military biography about this cavalry leader.

The main focus of this book is on Karge, Polish patriot, immigrant, and soldier. He whipped his units into capable outfits through discipline, training, and leadership. Personally brave, he shared the dangers of combat and the hardships of campaigning with his men. His military acumen and aggressive leadership were prime reasons for his inflicting the first defeat that Confederate General Nathan Bedford Forrest suffered.

Karge commanded the 1st New Jersey Cavalry in the Valley Campaign and later raised and led the 2d New Jersey Cavalry which operated in Arkansas and Mississippi. In describing these campaigns Kajencki vividly portrays the difficulties faced by the cavalrymen. These included incredibly inept leadership, physical hardships, a capable enemy, and operating in the enemy's territory. Karge, later a brigade and division commander, kept his units disciplined and as they became combat-wise, they became aggressive. He participated in classic cavalry missions—raids, reconnaissance, screening, holding actions, dismounted roles, and even a mounted charge against a defended stockade.

Unlike many military books dealing with the Civil War, Kajencki has used regimental and brigade combat examples and tied them into the overall strategic scene rather than simply discussing grand strategy.

The historian will find this to be a well-researched and documented book, with incisive interpretation. The casual reader will enjoy the writer's style and descriptions of people and events. Kajencki does not attempt to portray Karge in only a favorable light. He points out that in its first major action the 1st New Jersey Cavalry was ambushed and fled in disorder due to the recklessness of junior leaders. But as Karge's units became seasoned they performed very well against their opponents even when outnumbered. For example, the 2d New Jersey Cavalry covered a Union retreat alone for almost 50 miles while fending off repeated attacks by superior Confederate forces.

The professional soldier will recognize the names of battlefields such as Cedar Mountain, Brandy Station, Fredericksburg, Egypt Station, Mobile, etc. Thanks to the author, the professional will now have a better understanding of the roles of Cavalry in these battles and the part Brevet Brigadier General Joseph Karge played in them.

JOSEPH P. FRANOSKI
Lieutenant Colonel (Ret)

THE APOSTLES OF MOBILITY: THEORY AND PRACTICE OF ARMOURED WARFARE by Field Marshall Lord Carver. Holmes & Meier, New York. 1979. Illus. $13.50.

The Apostles of Mobility is a thoughtful gem which in a few pages provides excellent insights into "the theory and practice of armoured warfare." The book is authored by Field Marshal Lord Carver who grew up in tanks in World War II and who some consider as Britain's most distinguished post-World War II soldier.

In actuality, the work is an edited version of the 1979 Lees Knowles Lectures, which are annual presentations given at Trinity College at Cambridge by senior officers of distinction.

In developing the presentations, Field Marshal Carver starts at the beginning—with Swinton. He then follows the progression of people, thoughts, and concepts from the development of the tank in World War I as a siege warfare machine to the establishment and employment of tank formations in World War I. Subsequently, he examines the evolution and then employment of armor formations from the inter-war years through World War II to the 1973 Arab-Israeli War. Unfortunately, he does not adequately address the major contributions to armor warfare by either Soviet or United States armies—past or present. No armor *tour de force* can be complete without addressing either Army's apostles or practitioners.

Throughout his presentations he also compares the concepts set forth by the theorists or "apostles" of the day versus the actual employment of armor by the practitioners. While admiring the men of vision in their fight to overcome military conservatism, he was not in the long run very kind to them. In essence, he concluded that the import of the apostles has been overplayed and, in fact, they even exerted a negative influence on those who faithfully followed their teachings to the letter.

This will rankle the followers of men such as Fuller and Hart; but like it or not, his treatment of all factors involved in the development and evolution of armor forces one to step back—disengage from the pursuits of the day, and reexamine basic fundamentals of why an armor force is needed and how it should be employed. Thus, rather than being a definitive history of armor warfare, it is more of a thought-provoking piece of work—which represents its major contribution to military thought.

DAVID K. DOYLE
Major General, U.S. Army

COMMANDERS

The following Armor officers command regiments, brigades, battalions, squadrons, or similar size units of the Active Army. The lists were provided by MILPERCEN and were current as of November 1980. A list of Armor officers commanding aviation units will be published in an upcoming issue of ARMOR, as will a list of the commanders of U.S. Marine Corps tank battalions. Future changes of command or other corrections will be reported as they occur. Corrections, deletions, or omissions should be reported to ARMOR.—Editor.

REGIMENTS AND BRIGADES

COL Nicholas A. Andreacchio
1st Bde, 1st Armd Div, Germany

COL Richard A. Behrenhausen
3d Bde, 4th Inf Div, Ft Carson

COL Patrick D. Chisholm
194th Armd Bde, Ft Knox

COL Claude L. Clark
1st Bde, 3d Inf Div, Germany

COL Jack T. Clark
3d Bde, 3d Armd Div, Germany

COL John S. Crow
11th Armd Cav Regt, Germany

COL Paris D. Davis
10th Special Forces Gp, Ft Devens

COL William A. Fitzgerald, Jr.
3d Armd Cav Regt, Ft Bliss

COL Lawrence B. Fitzmorris
Experimental Spt Cmd, Fort Ord

COL Charles E. Honore
1st Bde, 5th Inf Div, Ft Polk

COL Nicholas S. Krawciw
1st Bde, 3d Armd Div, Germany

COL Edwin S. Leland, Jr.
1st Bde, 24th Inf Div, Ft Stewart

COL Michael S. Liles
2d Bde, 2d Armd Div, Ft Hood

COL Edward W. Newell
2d Bde, 1st Inf Div, Ft Riley

COL Robert E. Oberg
HQ Cmd, Ft Stewart

COL Andrew P. O'Meara, Jr.
1st AIT/OSUT Bde, Ft Knox

COL Roy C. Price, Sr.
Lightning Bde, USAARMS, Ft Knox

COL William H. Roche
1st Bde, 1st Cav Div, Ft Hood

COL Paul R. Schwartz
1st Bde, 2d Armd Div, Ft Hood

COL Thomas H. Tait
3d Bde, 8th Inf Div, Germany

COL Robert E. Wagner
2d Armd Cav Regt, Germany

COL Robert M. Wiser
2d Bde, 1st Armd Div, Germany

COL Roger T. Macleod
1st Bde, 2d Inf Div, Korea

COL Sydney B. Britt
6th Bde (BCT), Ft Jackson

BATTALIONS AND SQUADRONS

LTC Louis Sturbois
2/11th Armd Cav Regt
Bad Kissingen

LTC James Wells
1-13th Armor
Illesheim

LTC Ross A. Johnson
1-32d Armor
Friedberg

LTC David Harbach
1-33d Armor
Gelnhausen

LTC Robert Taylor
1-35th Armor
Erlangen

LTC Gary R. Luff
1-37th Armor
Katterbach

LTC Lionel Ingram
1-64th Armor
Kitzingen

LTC William D. Swift
1-68th Armor
Wildflecken

LTC Ralph Barkman
1-70th Armor
Wiesbaden

LTC Claren Hartman
1/11th Armd Cav Regt
Fulda

LTC Ronald D. Copes
1-1st Cav
Schwabach

LTC Warner Stanley
1/2d Armd Cav Regt
Bindlach

LTC S. A. Woods
2-32d Armor
Kirchgoins

LTC William D. Chesarek
2-33d Armor
Kirchgoins

LTC Ronald Schmidt
2-37th Armor
Erlangen

LTC Robert Palmer
2-64th Armor
Schweinfurt

LTC Gary Roderick
2-66th Armor
Karlstadt

LTC Thomas J. Ritenour
2-68th Armor
Baumholder

LTC Don J. Peters
2-81st Armor
Erlangen

LTC James M. Lyle
2/2d Armd Cav Regt
Bamberg

LTC Fred E. Lyssy
3-32d Armor
Friedberg

LTC Jeffrey Larson
3-33d Armor
Kirch Goens

LTC James Schroeder
3-35th Armor
Bamberg

LTC Richard Byrkit
3-63d Armor
Augsburg

LTC Michael Davison, Jr.
3-64th Armor
Schweinfurt

LTC Glynn T. Decoteam
3-68th Armor
Mannheim

LTC Joe G. Driskill
3/11th Armd Cav Regt
Bad Hersfeld

LTC William Daugherty
3-12th Cav
Buedingen

LTC H. F. Koenigsbauer
3/2d Armd Cav Regt
Bamberg

LTC James J. Steele
3-7th Cav
Schweinfurt

LTC Norman Beatty
3-8th Cav
Sandhofen

LTC Norman A. MacClellan
4-64th Armor
Aschaffenburg

LTC Garrett Noyes
4-69th Armor
Gonsenheim

LTC George Murray
4-73d Armor
Boeblingen

LTC Thomas Barrett
5-68th Armor
Mannheim

LTC Thomas Stewart
C & C Sqdn (P), 11th ACR
Fulda

LTC Nicholas Vamvakias
1-34th Armor
Ft Riley

LTC James W. Tyler
1-40th Armor
Ft Polk

LTC Pat Morrissey
1-63d Armor
Ft Riley

LTC Robert Knight
1-66th Armor
Ft Hood

LTC Raymond Gordon
1-67th Armor
Ft Hood

LTC Wesley K. Clark
1-77th Armor
Ft Carson

LTC Malcolm D. Otis
1-7th Armor
Ft Hood

LTC John L. Kendall
1-8th Armor
Ft Hood

LTC James McWain
1-10th Cav
Ft Carson

LTC Robert Vogel
1/3d Armd Cav Regt
Ft Bliss

LTC William Griffiths
1-4th Cav
Ft Riley

LTC Malcom Gilchrist
1-9th Cav
Ft Hood

LTC Thomas Montgomery
2-34th Armor
Ft Carson

LTC Jon Collins
2-5th Armor
Ft Hood

LTC William Chadbourne
2-63d Armor
Ft Riley

LTC Lemos L. Fulmer
2-67th Armor
Ft Hood

LTC Donald H. Volta
2-69th Armor
Ft Benning

LTC Douglas Rogers
2-70th Armor
Ft Stewart

LTC Frederick Benson
2-77th Armor
Ft Lewis

LTC James Woodward
2-8th Armor
Ft Hood

LTC Eugene Daniel
2-1st Cav
Ft Hood

LTC Jarr Robertson
2/3d Armd Cav Regt
Ft Bliss

LTC William Murphy
2-9th Cav
Ft Stewart

LTC Joseph T. Snow
3-66th Armor
Ft Hood

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3-67th Armor
Ft Hood

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Ft Polk

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4-40th Armor
Ft Carson

LTC Jerry A. Thomas
4-63d Armor
Ft Riley

LTC Robert Haubrich
4-68th Armor
Ft Bragg

LTC C. Holcomb
4-12th Cav
Ft Polk

LTC Dorsey E. Rowe
5-32d Armor
Ft Stewart

LTC Edward Bruner
5-33d Armor
Ft Knox

LTC Ronald Hoffman
6-32d Armor
Ft Carson

LTC John T. Wells
1-72d Armor
Korea

LTC Jack C. Speedy
2-72d Armor
Korea

LTC Raymond Hartjen, Jr.
1/1st AIT/OSUT Bde
Ft Knox

LTC Robert Warren
2/1st AIT/OSUT Bde
Ft Knox

LTC John E. Corbett
3/1st AIT/OSUT Bde
Ft Knox

LTC Curtis Esposito
4/1st AIT/OSUT Bde
Ft Knox

LTC Carl W. Yates
5th Recon Sqdn, 1st AIT/OSUT
Ft Knox

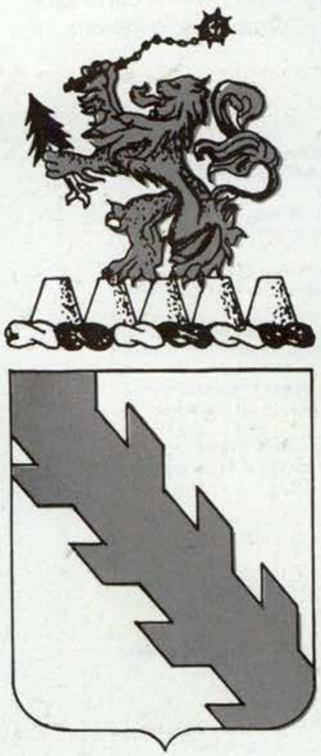
LTC William N. Simpson
6th Sqdn, 1st AIT/OSUT Bde
Ft Knox

LTC David S. Kelly
2/4th Tng Bde
Ft Knox

LTC Donald F. Borden
13/4th Tng Bde
Ft Knox

LTC Robert Korkin
2-6th Cav
Ft Knox

LTC J. B. Maharrey
1st Bn, Ltng Bde, USAARMS
Ft Knox



Symbolism

The shield is yellow for cavalry. The bend raguly in red symbolizes the cutting firepower of the regiment.

The truncated pyramids simulate dragon's teeth, tank obstacle, used to protect the Siegfried Line, the defenses of which were battered, pierced, and overrun by the unit, an action for which it was awarded the Presidential Unit Citation, alluded to by the chain mace (for armor) in the color (blue) of the citation award. The red lion and the uprooted pine tree refer to the Ardennes and Belgian campaigns for which the unit was cited in Orders of the Day of the Belgian Army and awarded the Belgian Fourragere, the predominating color of that award being red. The five truncated pyramids also refer to participation in five World War II campaigns.

32d Armor

Victory or Death.

Constituted 13 January 1941 in the Regular Army as 2d Armd Regt and assigned to 3d Armd Div. Activated 15 April 1941 at Camp Beauregard, LA. Redesignated 8 May 1941 as 32d Armd Regt. Inactivated 10 November 1945 in Germany.

Regiment broken up 7 July 1947 and reorganized and redesignated as follows: 32d Armd Regt (less certain elements) as 32d Tk Bn; HHC, 2d Bn, and Co B and G as HHC and Co D and A, respectively, 7th Tk Bn (concurrently, certain elements of the 33d Armd Regt were redesignated elements of the 7th Tk Bn); Recon Co as Trp D, 83d Mech Cav Recon Sqdn, an element of the 3d Armd Div; Svc Co as Svc Co, 13th Armd Inf Bn, an element of the 3d Armd Div. HHC, 3d Bn, and Co C, H, and I and Maint Co disbanded.

32d Tk Bn activated 15 July 1947 as an element of the 3d Armd Div at Fort Knox, KY. Redesignated 30 July 1948 as 32d Med Tk Bn. Redesignated 15 March 1955 as 32d Tk Bn. Relieved 1 October 1957 from assignment to 3d Armd Div; concurrently, Co D, 32d Tk Bn, redesignated as HHC, 1st Med Tk Bn, 32d Armor, and assigned to 3d Armd Div; remainder of 32d Tk Bn inactivated.

7th Tk Bn activated 15 July 1947 as an element of the 3d Armd Div at Fort Knox, KY. Redesignated 30 July 1948 as 7th Med Tk Bn. Redesignated 15 March 1955 as 7th Tk Bn. Inactivated 1 October 1957 in Europe and relieved from assignment to 3d Armored Division.

HHC, 3d Bn; Maint Co; and Co C, H, and I, 32d Armd Regt, reconstituted 28 May 1948 in the Regular Army and redesignated as 61st Hvy Tk Bn. Activated 12 July 1948 as an element of the 9th Inf Div at Fort Dix, NJ. Redesignated 25 May 1954 as 61st Tk Bn. Inactivated 1 December 1957 at Fort Carson, CO and relieved from assignment to 9th Inf Div.

Trp D, 83d Mech Cav Recon Sqdn, activated 15 July 1947 at Fort Knox, KY. Redesignated 30 July 1948 as Co D, 83d Recon Bn. Inactivated 1 October 1957 in Europe, and relieved from assignment to 3d Armd Div.

Svc Co, 13th Armd Inf Bn, activated 15 July 1947 at Fort Knox, KY. Redesignated 30 July 1948 as Co D, 13th Armd Inf Bn. Inactivated 1 October 1957 in Europe and relieved from assignment to the 3d Armd Div.

32d, 7th (less certain elements in 33d Armor), and 61st Tk Bn; Co D, 83d Recon Bn; and Co D, 13th Armd Inf Bn, consolidated and redesignated 1 December 1957 as 32d Armor, a parent regiment under the Combat Arms Regimental System (HSC, 32d Tk Bn, redesignated as HHC, 32d Armor).

Campaign Participation Credit

World War II

Normandy	Rhineland	Central Europe
Northern France	Ardennes-Alsace	

Decorations

Presidential Unit Citation (Army), Streamer embroidered SIEGFRIED LINE [2d Bn (with Co B, E, and F assigned), 32d Armd Regt, cited; WD GO 54, 1945]

Belgian Fourragere 1940 (32d Armd Regt cited; DA GO 43, 1950)

Cited in the Order of the Day of the Belgian Army for action in BELGIUM

Cited in the Order of the Day of the Belgian Army for action in the ARDENNES.

ARMOR

march-april 1981

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"To disseminate knowledge of the military arts and sciences, with special attention to mobility in ground warfare; to promote professional improvement of the Armor Community; and to preserve and foster the spirit, the traditions, and the solidarity of Armor in the Army of the United States."

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COVER

Infantrymen and a tank advance through Geiselhardt, Germany during World War II. Beginning on page 30, Major Adolf Carlson analyzes historical examples of the employment of tanks in urban combat and makes some recommendations regarding the role of armor in future battles that may be fought in city streets.

LETTERS

XM-1's Reliability

Dear Sir:

Your September-October issue carried an exchange of correspondence concerning the *XM-1* tank. Two letters contain the statement that the General Accounting Office has alleged that the Army "doctored" the results of the *XM-1* tests conducted last year at Fort Knox.

In fact, this office has not made any such allegation. We questioned use of the computed mean miles between failure as a true barometer of the *XM-1's* reliability for three reasons. First, we felt the Fort Knox tests were not as rigorous as operational tests. Second, we felt the tanks underwent periodic maintenance in excess of what they would experience in normal circumstances. Finally, the non-mobility test results, reflected in the reliability of calculation, did not represent the latest scores, which were lower than the ones used in the scoring.

While we questioned some of the methodology as seeming to weight the final reliability score in the *XM-1's* favor, we did not charge that there had been a deliberate distortion.

As we have stated many times in our reports and in Congressional testimony, a final judgment of the *XM-1's* reliability should await the outcome of its current operational testing.

HYMAN S. BARAS
Group Director, Land Warfare Audits
U.S. General Accounting Office

Don't Restructure

Dear Sir:

This letter is in response to Second Lieutenant Dinackus' article "Airborne Armor and Cavalry." Certainly LT Dinackus makes a convincing case for the reactivation of the ground cavalry troop in the airborne troop of the airborne division's air cavalry squadron. I also can't argue with his assessment of problem areas with the *M-551 Sheridan*. But I can't buy his idea for restructuring the armor battalion and air cavalry squadron.

The first point that needs to be made is that equipment and units in an airborne division do not have to be easily air deployable to be a necessary part of the division, although it is better if they are. Once on the ground, the air cavalry fulfills the role of the highly mobile forward reconnaissance and screening force, vital to the survival of the division. A mission the air cavalry could undertake is an economy of force airmobile attack. They also have 27 attack helicopters, an important antiarmor asset. The commander can always choose not to commit these forces if he can't or doesn't choose to airland them.

The second point is that an armor battalion is not useless only because it can't be employed forward with a ground attack. Some possible offensive missions for the armor battalion in the attack include flank security and screening and acting as a highly mobile reserve. Possible missions during the defense include forward reconnaissance, direct support to the infantry battalions, and again as a highly mobile reserve. For all of these roles the supporting infantry doesn't need to be mechanized, because they will already be where they're needed to support the armor.

While I've been at my current assignment, I've participated in two corps level CPXs that pitted elements of the XVIIIth Airborne Corps against heavily mechanized/armored forces. JRX Brave Shield 80 pitted the 3d Brigade of the 101st against an armor-heavy brigade of the 5th Infantry Division. Recently, there has been a lot of discussion about using light infantry in a Middle-East scenario. One look at the map shows the proximity of the U.S.S.R. to that area. The possibility of facing armor is a pretty important reason for retaining antitank weapons in an airborne division, particularly the highly mobile ones in the armor and air cavalry.

Assuming reactivation of the ground cavalry troop, an armor/air cavalry task force could be built to the design LT Dinackus proposes, with the exception that the armored cavalry troop would be replaced by the armor company. The trade-off would be the mounted attack capability versus the armored antitank weapons.

After committing such a task force to a committed brigade, the division commander still has two air cavalry troops and an armor battalion minus one company (or the opposite depending on which headquarters he commits). These assets are available to support the rest of the division or to further reinforce the committed brigade.

It is for these reasons I feel that adopting LT Dinackus' proposal of an airborne cavalry squadron in lieu of the present arrangement of an air cavalry squadron and an armor battalion is a bad idea.

JACK V. SCHERER
First Lieutenant
HHC, 326th Engineer Battalion

A Better Way to Train

Dear Sir:

Your "Pages from the Past" in the September-October issue of **ARMOR** have brought back memories. As a young armor officer in 1963, I wrote an article for **ARMOR**, "Reorganization for Training," November-December 1963. During my formative years while a lieutenant in Germany, I saw a need. Then later during a tour in the U.S., Korea, and again in Vietnam, I saw the same picture being painted again and again. In 1967, I made an attempt to determine if anything was being done in the Armor Community about what I conceived as a problem.

During my most recent experiences in Germany as Headquarters Commandant, V Corps and later as Deputy Commander of an Armor Brigade, I could still see the problem. Although now the acronym for testing has changed to ARTEP, the basic principles of combining forces into tank mechanized infantry platoons, company teams, a battalion task force, etc., to accomplish a mission, remains the same.

Talking from first-hand experience, I saw the same problems as chief ARTEP evaluator for an armored division while in Europe.

Tank and infantry units, when cross-attached, waste valuable time learning each others' ways. The "team" is only a team for a short time before and during the ARTEP, FTX, or whatever. Then they return to their lockstep pure armor or infantry training program and, for the most part, remain in that posture until FTX or ARTEP time comes around again. There is a better way.

DONALD R. PARKS
Lieutenant Colonel, GS

The quote to which Colonel Parks refers was taken from his article. Seventeen years later, attempts were made in the Division 86 Studies to form a combined arms battalion, but to no avail (see "Increased Combat Power," Nov-Dec 1980). Ed.

Tank Destroyer Association

Dear Sir:

A group of World War II veterans are in the process of organizing a national Tank Destroyer Association. Its purposes are to start a museum, locate an old *M-10* for a memorial, and plan a reunion. Anyone interested in becoming a charter member is asked to contact Marsh B. Hanks at the address below.

Tank Destroyer Association
P.O. Box "DG"
Tiburon, CA 94920

COMMANDER'S HATCH

MG Louis C. Wagner, Jr.
Commandant
U.S. Army Armor School

During recent visits to Armor units and major commands in Europe and the United States, it became evident to me that the unit's knowledge of the scope and nature of many of the Armor School's courses were either not known or were outdated. This article, on the Armor Officer Basic Course, is the first in a series of "Commander's Hatch" and "Forging The Thunderbolt" articles which will outline the various courses conducted at the Armor School. The intent is to provide some detail of what is taught, how the training is done, and what changes have been or will be made in order to clarify what a graduate should be able to do upon assignment to a unit and what further training or development must take place in the field. Specific course content is included in an accompanying "Forging The Thunderbolt" article beginning on page 53.

The Armor Officer Basic Course, now, as in the past, is one of the most important professional development courses at the Armor School. Approximately 1,000 new Armor second lieutenants attend this course each year. This includes Active Army, Army National Guard, Army Reserve, Marine Corps, and foreign officers. It is this course which prepares the newly commissioned officer *for duty as a tank or armored cavalry platoon leader.*

The Armor Officer Basic Course has undergone several major changes during the past few years. It is considerably different from the basic course attended by most senior company and field grade Armor officers in the Army today. The most significant differences are: first-assignment-specific training by type of unit (tank or armored cavalry); system-specific training by type tank; method of training (hands-on, field-oriented); and course length (15 weeks for the tank course and 16 weeks for the armored cavalry course). A similar, but considerably shortened (4 weeks) Armor Officer Basic Course is available for reserve component officers unable to attend the full-length course. The separate tank and armored cavalry courses, or unit and system-specific training, was instituted in 1978. With this methodology, students receive specific instruction on all platoon level equipment tactics, and techniques unique to their initial assignment. This approach also allows the Armor School to present intensive technical and tactical training that will be of immediate use upon the lieutenant's arrival in his unit. Approximately 65 percent of the course is conducted on-site or in a field environment. The hands-on, field-oriented method of training is designed to get the lieutenant out of the classroom and into a realistic environment. The student receives training in all crew positions as well as training in the duties and functions of a platoon leader. He learns by doing, with the equipment, in the field. The course length was also expanded from 12 weeks to the present 15 and 16 weeks in 1978 to allow time to train the student in additional technical, tactical, and leadership skills. The armored cavalry course is 1 week longer because there is more emphasis on fire direction center procedures; small arms firing; related night vision devices; and the tactical employment of the *M-113A1* armored personnel carrier, the *M-901* improved TOW vehicle, and the TOW and Dragon missile systems by the armored cavalry platoon.

Each academic department of the Armor School concentrates on its primary areas of interest and reinforces instruction given by other departments.

- The Maintenance Department presents 72 hours of maintenance training for the tank course and 78 hours for the armored cavalry course. This training includes crew maintenance, repair parts supply procedures, the Army Maintenance Management System, maintenance of turret systems, vehicle recovery and tracked vehicle driving. Each officer is taught to operate and maintain all vehicles organic to the platoon to which he is being assigned. Prior to licensing, additional training as required by local conditions and regulations will have to be conducted upon arrival in the gaining command.
- Committee Group presents 83 hours of instruction to the tank course students and 103 hours of instruction to the armored cavalry course students in tactical communications, land navigation, small arms and mortar training.
- The Weapons Department conducts 205 hours of tank gunnery training for both the tank and armored cavalry courses, including firing of Tables I-IV (laser or subcaliber), Table VA (subcaliber), Table VI (main gun), Table VII (subcaliber and main gun), Table VP (subcaliber), and Table IX (main gun, defensive scenario). Students are trained in all crew positions and each student is allocated 26 main gun rounds as gunner. The students are allocated an additional 6 main gun rounds as a crew on Table IX. Both courses also receive training in antitank missile systems (14 hours in the armored cavalry course and 6 hours in the tank course).
- The Command, Staff, and Doctrine Department presents 361 hours of instruction to tank course students

and 415 hours to armored cavalry course students. This instruction covers a wide spectrum of subjects, which include: leadership (combat and garrison); combat support and combat service support operations; the Battalion Training Management System; nuclear, biological, and chemical (NBC) operations; the Army Personnel Management System (enlisted and officer); the Army Supply System; and platoon tactical operations. As a capstone, the students participate in a continuous mounted tactical training exercise lasting 10 days and nights. During the exercise, all previous instruction is integrated and reinforced. Tank and cavalry platoons are formed from the students of each course and operate under realistic, stressful field conditions. Students must demonstrate proficiency in all areas, but especially in leadership tactics, maintenance, land navigation, NBC operations (individual, crew, and platoon), and tactical communications. Leadership positions are rotated frequently, with each student acting as a platoon leader or platoon sergeant several times. The exercise culminates with Table IX. During the entire exercise, the instructor to student ratio is 1:4. The instructors are experienced, highly proficient armor captains and senior combat arms noncommissioned officers who spend the exercise teaching, evaluating, and correcting the student. Development of a professional officer/noncommissioned officer relationship is emphasized during this period. Additionally, a seminar with company commanders and senior noncommissioned officers has been initiated to reinforce leadership functions at the platoon level.

Standards during all portions of the course have been toughened, but particularly in the areas of leadership, technical competence, tactics, physical conditioning, and weight control. The students must meet the standards or they are placed before an academic board to determine whether they are to be graduated, recycled through a following class, transferred to another branch, relieved from active duty, or have their commissions withdrawn. An incentive program to recognize outstanding performers has also been instituted. One officer from each class will be selected as the Distinguished Graduate and the top 20 percent will be selected for the Commandant's List.

The result of this intensive training effort, I believe, is a technically and tactically competent platoon leader equipped to lead. He still has much to learn since no academic environment, regardless of the effort toward realism, can duplicate conditions in the field. Unit commanders as well as senior noncommissioned officers still have, as they have always had, the responsibility to polish the skills of inexperienced officers. More than in the past, I believe that the Armor School is providing the lieutenant the basic tools to perform his job as an armor platoon leader. To do jobs other than that of a platoon leader—executive officer, adjutant, assistant staff officer, motor officer or scout, mortar or support platoon leader—will require additional training. These officers should be utilized initially as tank or armored cavalry platoon leaders for their and the Army's ultimate benefit. Recent reports on actual utilization indicate too many are sidetracked into non-armor staff positions that fail to use the armor skills in which they are trained, thus restricting their further development as armor officers. There are also instances where graduates are not being assigned to the type of platoons for which they were trained. Because of the specific orientation of the basic course, assignment to a type of platoon other than the one for which they were schooled will require additional training in the unit. If at all possible, malassignment should be avoided.

As for the future, the Armor School is preparing Armor Officer Basic Course instructional programs which will prepare armor lieutenants for duty in units equipped with the *XM-1* tank and cavalry fighting vehicle (CFV). The first *XM-1* tank course is scheduled for July of this year. The CFV will begin arriving at Fort Knox in 1982 and efforts are underway now to develop courses for officers assigned to units having CFVs. As the Army moves toward conversion to the new Division and Corps 86 structures, the courses will be modified to accommodate changes in equipment, tactics, and techniques. Additionally, new training devices for gunnery and tactics will be integrated into the instruction as they become available. Efforts are also underway to determine what additional training can be added in the areas of staff skills and other unit duties.

While this article and its companion "Forging The Thunderbolt" article cannot answer all questions concerning the training of armor lieutenants at the Armor School, it is hoped that they may answer some of the questions and reduce any misunderstandings that exist. Questions and comments on the quality of the graduate being produced or upon the training techniques being used are welcome. Continuing feedback from the field is vital to the Armor School's efforts in meeting the needs of the armor force.

Future articles in this series will address the Armor Officer Advanced Course, the Brigade and Battalion Commander's Pre-command Course, the Junior Officer Maintenance Course, the Advanced Noncommissioned Officer Course, the Basic Noncommissioned Officer Course, the Basic Armor Training Course, and the Basic Reconnaissance Training Course.

1981 ARMOR CONFERENCE—12-14 MAY

"Ensuring the Combat Readiness of Armor Today, Tomorrow, and Beyond"

General officer guest speakers have been invited to address the areas of structuring, manning, modernizing, training, and mobilizing the Armor Force. Presentations begin at 0800, 13 May, with General Donn A. Starry, Commanding General, U.S. Army Training and Doctrine Command, giving the Keynote Address.

The 91st General Membership Meeting of the U.S. Armor Association will be held during the conference.

Lieutenant General William R. Richardson, Commanding General, U.S. Army Combined Arms Training Development Activity, will be the speaker at the banquet scheduled for Wednesday evening, 13 May.

DRIVER'S SEAT

CSM John W. Gillis
Command Sergeant Major
U.S. Army Armor Center and Fort Knox

Recently, I have been asked on two occasions to comment on the Noncommissioned Officer (NCO) Corps. In the first instance, the request was for ideas on how to add to the prestige of the NCO Corps. The second was a request for comments/recommendations on NCO Corps enhancement, to include some "fresh and innovative ideas that will better the status, morale, and prestige of the sergeant and above."

What follows is my response to the second request, which also states most of what was included in the first. My views are those that have "become mine" as a result of my training by NCOs, of written and oral communication with the commanders and other officers with whom I have served, or whose articles I have read. But mainly it comes from my association with the professional NCOs in today's Army.

I don't believe anything I state will fall into the "fresh and innovative ideas" category. This category does not exist except through gimmicks, and gimmicks are the last thing we need to get us on the right track. The soldiers' "built-in crap detector" (every soldier has one!) has seen through, and will continue to see through, any gimmicks their leadership attempts.

The question, "What does the soldier think?", is important only if we remember that he thinks only what the chain of command has caused him to think. If the soldier thinks he has good NCO leadership and feels good about his chain of command, it is because he has *personally* evaluated his leaders and determined they are competent. The *soldier* defines good or bad leadership. It is *personal* with him as he reaps the rewards of professional leaders or suffers the effects of poor leaders.

Soldiers must look to their NCOs with confidence, and NCOs must be a trustworthy Corps of leaders believed in by their soldiers (and their officers). Soldiers will look to the NCO with confidence and believe we are a trustworthy corps by our *behavior,* not by our words.

The enhancement of the NCO Corps and "giving the young soldier something to look forward to and work in achieving NCO status" falls into seven categories: reenforcing the chain of command, education, standards, training, basic responsibilities of the NCO, time, and privileges. I will not comment separately on reenforcing the chain of command, as everything listed falls into that category. Education references the Noncommissioned Officer Education System (NCOES), and needs no further discussion other than our need to continue, improve, and support it. Setting and maintaining standards are accepted as the cornerstone of success and, as such, will be discussed only briefly.

We must get rid of the NCO who is just "hanging around;" also, the alcoholic, the "doper," and the overweight. If we do not do this, all else will fail. We will neither motivate the young NCO nor the soldier to become an NCO with these kind of role models. Motivation is our basic problem.

Training

Training leaders is the most important job in peacetime. In order to enhance the NCO Corps, we must train *all* leaders as well as the NCO. Examples:

Discuss (or train) and distribute FM 22-600-20 in Pre-Command and Command and General Staff Courses.

Train and distribute FM 22-600-20 in Officer Basic and Advanced Courses.

Train the commander and command sergeant major relationship in the Pre-Command Course and Officer Advanced Course.

Train the company/troop commander and 1SG relationship in the Officer Basic and Advanced Course. Discuss same in the Pre-Command Course.

Train those things the company/troop commander will encounter in his unit when he assumes command in the Officer Basic and Advanced Course. Discuss same in Pre-Command Course.

Demand *year-round* skill qualification training by NCOs at company level, not just 90 days before the skill qualification test (SQT). Recent high SQT scores show that the army has become expert on passing the test; but they do not measure the NCO as a trainer or the soldier's competence in skills, as we do not train year-round.

Demand *year-round* evaluation of company level skill qualification training by battalion/squadron.

NCO Development Program

The responsibility of NCODP must be at company/troop and battalion/squadron level. They must train on the identified weaknesses of NCOs at that level. Command levels above battalion/squadron level must not dictate subjects to be trained.

Basic Responsibilities of the NCO

Simply, the chain of command must identify what the basic responsibilities of the NCO are during the "everyday" running of the unit, and insist they be accomplished to the standard required. Examples:

Delegate the responsibility to CSMs and 1SGs to see that all drills and ceremonies are conducted IAW FM 22-

5. It is the "sergeants' business!"

Require NCOs to hold reviews, retreats, and reveille formations on a scheduled "two for one" basis, i.e., every third scheduled retreat ceremony is conducted by NCOs.

Require the battalion/squadron CSM to conduct an in-ranks inspection, unannounced, at first formation of each company/troop once a month.

Have the battalion/squadron CSM brief the new company/troop commander before he takes command.

Have the brigade CSM brief new battalion/squadron commanders before they take command.

Have the division/post CSM conduct leadership seminars at Primary NCO Course (PNCOC) and Primary Leadership Course (PLC).

When the E-8 population allows, *direct* E-8s to 1SG positions.

Delegate authority to the NCO to select soldiers for schools (PLC, PNCOC, BLC).

Define NCO responsibilities on any kind of alert and hold them to it.

Require *scheduled* coaching of soldiers by their NCOs.

Hold monthly musters.

Hold the first-line NCO responsible for the billet standards of his soldiers, supervision of extra training of his soldiers, being present in billets to maintain discipline when necessary, visiting soldiers in billets during "odd hours" and on weekends, picking up his soldiers from the MP Station, etc.

Require the first-line NCO to fulfill his responsibilities in the motor pool, thus eliminating the "mechanic chain of command."

Require the *first-line NCO* to train his soldiers in skill qualification training vs. the NCO "experts" training.

Time

Nothing can be done without the time to do it! We should constantly look at what we are doing, determining the necessity and priority. Examples:

Take a close look at mandatory training subjects as defined by DA, TRADOC, post, and even brigades. The more we define certain training as mandatory, the less time we have for other priorities. When the battalion commander has to assemble his entire command in a theater to give a lecture on cold weather injuries because some higher command has decided to require a mandatory one-hour class for all, we have done something dumb.

We should look at restructuring the duty day, where possible, to allow us to do what we have decided must be done.

Privileges

Privileges are really ways to get the NCO "away from the troops," mentally and physically. To put it another way, there are methods to impress upon the NCO that he is expected to be something different (a leader, instead of a follower) and a way to move him to another culture governed by a different set of rules, both *formal* and *informal*. For example: we want his "friends" to be other NCOs. NCO privileges will cause a commonality that will encourage this. We must remember and define properly the reasons for NCO privileges. Examples:

Separate Areas in Dining Facilities for NCOs Where Space Permits: Not officer/NCO areas. . . only NCO areas.

NCO Rooms in the Billets: The decision must be made to forget squad, platoon, section integrity (i.e., two NCOs and two SP4s living in the same room because the room is in their section of the billet where their soldiers live). Any kind of unit integrity is very difficult, if not impossible, due to our current "married Army," which results in as much as two-thirds of the platoon members living in quarters or "off post." One thing we can do, though, is have "NCO Corps integrity" in the company by insuring the NCOs living in the billets live with other NCOs.

NCO Clubs or NCO Lounges in Combined Clubs: To be established for and patronized solely by NCOs.

Designated Housing For NCOs (CPL, SGT, SSG, SFC, MSG): Forget all the housing officials' convenient reasons why this can't be done. Demand they do it! Housing supports us—we don't support housing. Do not accept "convenient leadership," which is exactly what "putting NCOs in the same areas as soldiers to help maintain discipline" is!

Designated Quarters for CSMs: Give priority to duplexes and/or separate dwellings to CSMs before captains, majors, and lieutenant colonels that are not commanders. All CSMs should be so recognized as senior enlisted leaders who have reached the top of their profession.

Designated Housing for 1SGs and SGMs: Recognize these top enlisted positions separately. We say it and do it in most other areas; then, we tell them to go live with lower ranking NCOs and soldiers. Let's get smart and have "our actions say the same as our works." (A CSM, SGM, 1SG housing area fits the bill!)

Note. We should make the "split" among NCOs as stated above. We do anyway with words and actions in other areas in the military. Admit it, say it, visibly show it; it exists! We cannot allow *all* NCOs to have the *same* privileges. Logical "RHIP" is a motivator!!

NCO Presentation of Awards in NCOES System (Where Applicable): PNCOC/Combat Arms, PLC, and BNCOC all have CSMs as commandants. The NCO leader of the distinguished graduate and/or the graduate receiving the leadership award should present the award (ARCOM, promotion, plaque, etc.) to *his* soldier. Put this in its proper perspective. The chain of command should present most awards; it reenforces the chain of command—but, in schools "commanded" by CSMs, insist that NCOs be the "presenters."

Promotion of NCOs at an NCO Ceremony: Have a formation of only NCOs conducted solely by NCOs. Schedule the battalion commander or battalion CSM (or higher) to be the promoter. Have the individual promoting talk about the solidarity and cohesion of that unit's NCO Corps, with that unit's NCO Corps in formation.

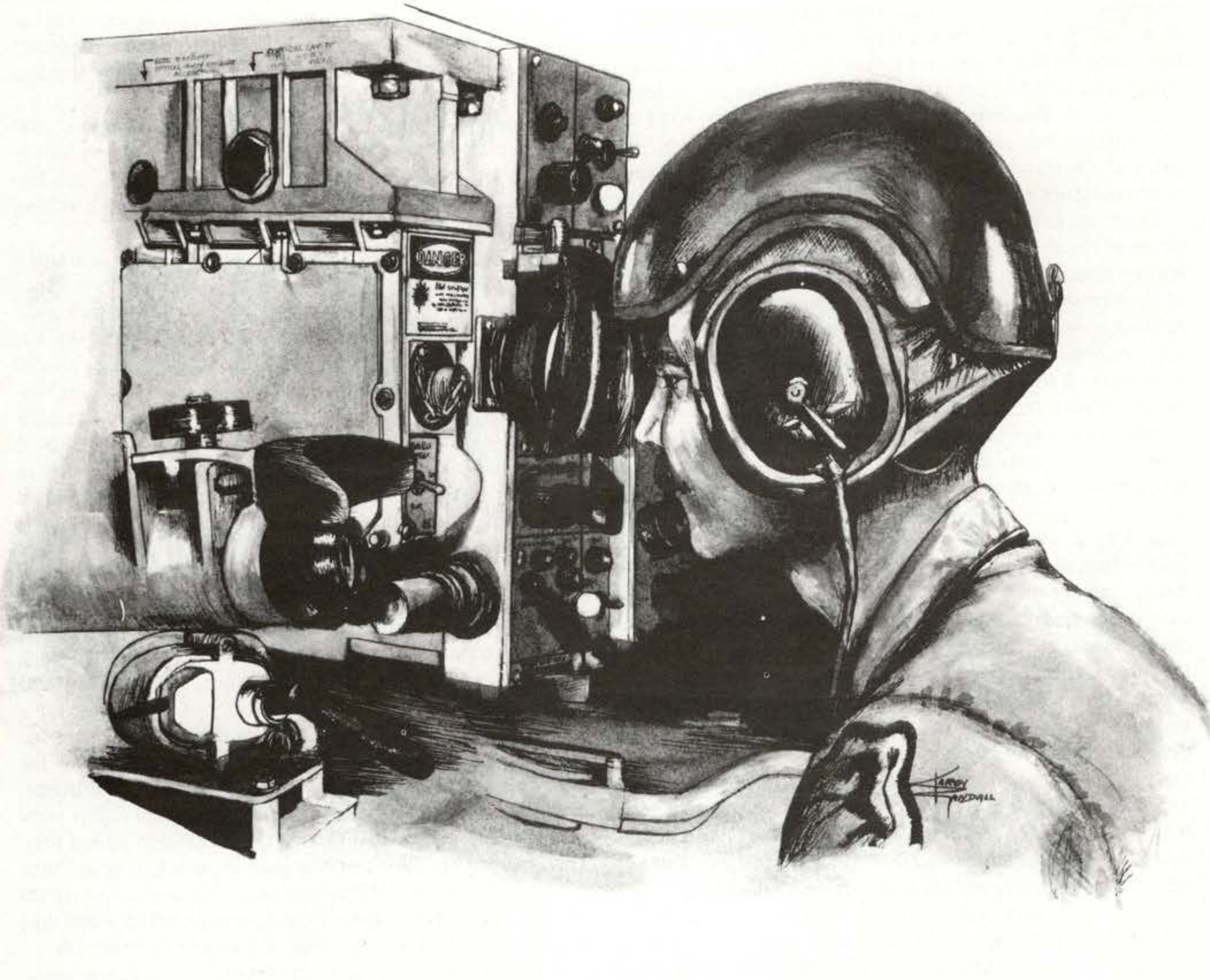
NCOs Only on Promotion Boards, Inefficiency Boards, Promotion List Removal Boards, etc. Let us be responsible for adding to and cleaning up our ranks. This does not detract from the chain of command, as the commander must convene the board, approve the board members, and approve the results.

Organizational Day: We should turn this entire operation over to the unit's NCOs. It should become traditional that a unit's organizational day be delegated by the chain of command to the NCO for organizing and implementing.

In summary, to enhance the NCO Corps and to "give the young soldier something to look forward to and work for in achieving NCO status," we need not look any further than the chain of command, who must:

- demand that the NCO meet all his responsibilities to a professional standard, and
- recognize the importance of the NCO leader by establishing privileges for the corps.

MASTER GUNNER'S CORNER



Boresighting and Zeroing

In 1977, the U.S. Army Research Institute for the Behavorial and Social Sciences (USARI) undertook a study to identify factors in standard armor training that affect efficiency of boresighting and zeroing performances. The study led to recommendations that commanders

- •Place greater emphasis on boresighting as a precision task.
- •Reinforce efficient zeroing.
- •Ensure crew understanding of the established zero.
- •Ensure that the tank commander properly supervises his crew during all phases of gunnery.

Perhaps the most valuable finding of the report is that, not only do crews exhibit severely limited knowledge of the practice of boresighting and zeroing, but the typical crewman sees himself as better than average, and therefore, not part of the problem! This is certainly true in the reserve components, where strength, crew turbulence, insufficient ammunition, and inadequate training time, are as much a problem as in the active forces.

Continuing ammunition constraints have forced training managers at all levels to reduce the number of rounds allocated to zeroing in an effort to better support the primary objective of annual crew on platoon gunnery qualification firing. But how effective can gunnery training be if our crews neither understand *how* to boresight and zero nor have the ammunition to do it? We, as leaders and training managers, must not only support our crews with the time and ammunition, but also with the training and leadership to conduct boresight and zero techniques efficiently and accurately.

The purpose of boresighting is to establish a reference condition of the gun from which its associated fire control system may be oriented. Or simply put, it establishes a convergent line of sight between the gun tube and the direct-fire sights. Boresighting is the basis for all sight adjustments and must be properly performed before zeroing. The simplest and most common method involves establishment of a line of sight that passes through the center of the breech and the center of the muzzle. This is normally accomplished using binoculars at the breech and a thread aiming cross taped on the muzzle end of the tube. Although this system has gained wide acceptance, it does not account for the slight bending (droop) of the tube caused by gravitational pull or thermal bending induced by uneven heat distribution within the metal. A muzzle boresight device, such as the Pye-Watson device, compensates for most tube droop and thermal bending, thus providing a more accurate boresight. This same line of sight, or reference point, is then duplicated by each of the direct-fire sights. When done properly, the extended axis of the tube will intersect with the various lines of sight at the boresight range. Because boresighting involves a linear extension of the bore axis, the range to the boresight target is immaterial. Practical limits are imposed, however, since virtually all tank systems use the boresighting procedure to establish the base reference condition for system parallax. In all U.S. 105-mm tank gun systems, this base reference condition is defined as convergence of line of sight with bore axis at 1,200 meters from the tank. Although boresighting may be employed as the sole input to the fire control system, it is most frequently used as a preliminary procedure in zeroing. Because of the more exciting nature of zeroing, the importance of boresighting is often overlooked. Most tank crews believe that boresighting is used only as a means of getting the initial shot "in the ball park" so that zeroing can begin in earnest. In today's world of ammunition shortages, nothing could be farther from the truth. The role of boresighting in establishing the base condition, or starting point, from which all fire control is referenced cannot be overstressed. *The final zero solution can be no better than the boresight upon which it is based.*

Once the fire control system is properly aligned with the gun tube via the boresighting procedure, a fire control solution can be introduced before firing. In the simplest systems, such as the *M-60A1* or *M-48A5,* the fire control solution may consist of no more than compensation (super-elevation) for gravity-induced drop of the projectile along its flight path. Zeroing establishes a definite relationship between the trajectory of a given projectile and the line of sight to the target. When the weapon is properly zeroed, the trajectory of a given round will intersect the line of sight at the target. The following statements, taken from a recent TRADOC report, "Concept Evaluation of Battlefield Boresight Techniques and Zero Retention," and based on my experience, appear to be valid.

•No evidence could be detected which supports the contention that use of a warmup round prior to zeroing improves the accuracy...of subsequent rounds fired on the same occasion.

•There is no universally correct number of rounds required to zero.

•Observing zeroing shot groups through tank sights at 1,200 meters (particularly groups made by APDS ammunition) is likely to introduce random errors of such magnitude and frequency that this practice is virtually useless in precision zeroing.

The zeroing sequence outlined in the tank operator's manual must be precisely followed by each tank crew. Since proper zeroing techniques are the key to accurate tank gunnery, I strongly recommend the use of the checklist provided in Chapter 4, FM 17-12. I have found the checklist to be helpful not only in range operation but also in conserving ammunition. After an accurate zero setting is established for each sight, these readings should be recorded on DA Form 2408-10 in the vehicle logbook, and also in a convenient location in each tank turret. When a accurate zero has been established and recorded for each sight, repeated zeroing for that tank is no longer necessary and wastes valuable ammunition. Unless the tube is changed, sight linkage is moved, or all the sights are removed, the established zero will remain valid.

Due to an unusual availability of HEP-TP-T ammunition, we have recently been using the independent zero technique described in FM 17-12. In this technique, the secondary and primary sights are zeroed independently of each other for a specific round. Since the telescope is the preferred sight for HEP ammunition, greater accuracy can be achieved if the telescope is zeroed with HEP independently of the periscope, which is zeroed with APDS (TPDS). However, if this technique is used, you must ensure that the HEP zero is fired first. This is to prevent the effect of a phenomenon known as "tube memory." The first HEP round fired after a series of APDS or HEAT rounds will have a higher muzzle velocity and thus impact higher on the target than subsequent HEP rounds.

In summary, the overall importance of accurate boresighting and zeroing procedures cannot be overemphasized. The collective reluctance to appreciate the need for more intensive gunnery training, particularly on the part of a population which already perceives itself as "above average," may be the most formidable challenge facing you as a trainer and leader. You must continually stress the importance of proper boresight and zero techniques and ensure your tank commanders properly supervise all phases of gunnery.

GEORGE G. SMITH
Captain, Armor
CALARNG

High Performance M-60A1 Developed

This article is based on information provided by the manufacturer. Ed.

Teledyne Continental Motors, General Products Division (TCM/GPD) has developed a high performance version of the *M-60* series tank. A standard *M-60A1* has been fitted with a 1,200 hp diesel engine, four-speed hydromechanical transmission, a hydropneumatic suspension system, and an add-on armor package. These improvements can be provided on new production tanks or retrofitted to existing tanks.

TCM/GPD's *AVCR-1790-1B* diesel engine is an increased horsepower version of the current *AVDS-1790* engine installed in current *M-60* series production vehicles. The *AVCR-1790-1B* is an air-cooled, 90-degree, upright-Vee, 12-cylinder, turbocharged diesel rated at 1,200 gross horsepower at 2,400 rpm. Air cooling for the engine cylinders, engine and transmission oil coolers, and induction aftercoolers, is provided by two engine-driven fans mounted in the center of the Vee.

The open-chamber engine incorporates the variable-compression-ratio piston that provides a high power-to-weight ratio and improved engine performance throughout the load and speed range by automatically adjusting compression ratio to specific engine loads. Extensive use of aluminum components is made throughout the engine and its design includes individual and easily replaceable cylinders. Overhead valves are used with an overhead camshaft in each cylinder bank. All scheduled maintenance items are easily accessible from the top of the engine to facilitate rapid servicing.

A West German Renk *RK-304* hydromechanical transmission coupled to the *AVCR-1790-1B* engine has been specifically designed to power medium and heavy-duty tracked vehicles. It features hydromechanical power shifting and integrated reversing and steering. A torque converter with a lock-up clutch is coupled directly to the engine crankshaft and eliminates the need for an engine flywheel.

Range selection is fully automatic instead of manual, as in the standard *M-60* tank, and the *RK-304's* steering system provides two steering radii for each of eight gear ranges for greater maneuverability. Since range selection is automatic, there is no need for the driver to down shift the transmission when he encounters a tight turn, as in the standard *M-60* tank. Pivot steer with the *RK-304* can be accomplished at two rotational speeds.

The original torsion bar suspension of the *M-60* series tank has been replaced by a hydropneumatic suspension system that allows the vehicle to travel at high speed over rough terrain. The high wheel travel and nonlinear spring rate of the hydropneumatic suspension system gives the *M-60* the capability to negotiate marginal terrain without bottoming on the bump stops. Each road wheel station has a hydropneumatic suspension unit mounted externally which provides for vehicle springing and damping.

The discomforting ground shock resonance associated with traditional torsion bars has been eliminated by the hydropneumatic suspension system, which not only aids crew comfort, but also increases the combat effectiveness of the tank and allows the *M-60* to fire on the move with improved accuracy.

The add-on Armor package includes an overall applique for the turret, including the turret top, an applique for the hull glacis, and hull side skirts to provide protection from shaped charge rounds. The turret is equipped with the low profile commander's cupola to reduce silhouette and weight.

CHARACTERISTICS

	HIGH PERFORMANCE M-60	STANDARD M-60A1
Top speed	45 mph	31 mph
Level cross country	30 mph	18 mph
Hilly cross country	25 mph	13 mph
Acceleration: 0-20 mph	9 sec	15 sec
Slope speeds: 10%	20 mph	10 mph
60%	4.5 mph	2 mph
Horsepower	1,200	750
Transmission gear ratios	4 fwd/2 rev	2 fwd/1 rev
Gear selection	Automatic	Semi-automatic
Final drive ratio	4.267	5.08
Road wheel vertical travel	13.5 in	6.5 in

No More PIPs for the M-60A1

by Colonel Sam Myers

Further production improvements to the M-60 series tank were considered by the U.S. Army but rejected for the reasons cited in this article. Ed.

In 1972, a Senior Officer Materiel Review Board reviewed the status of reliability and combat effectiveness characteristics of the *M-60A1* tank fleet and approved the development of a series of product improvements (PIPs). From this beginning evolved the PIPs of the *M-60A1,* which culminated in the *M-60A3* model.

Improvements were made in the reliability of the engine and power train, the track, air cleaners, alternator and regulator and, most importantly, the combat effectiveness was enhanced by an improved fire control system, which resulted in the model designation change.

During the period 1975 to 1977, as these PIPs were approved and released for production, a series of additional improvements were proposed. Each successive year's budget request contained a few more PIPs for the *M-60A1* tank fleet. These included an improved commander's station, an engine smoke generator, higher horsepower, improved suspension, special armor—the list kept growing.

Closely allied with the *M-60* series improvement program was the emerging *XM-1* tank program. It became apparent in the spring of 1977 that the Army did not have an up-to-date cohesive tank program. As a result, the Army Vice Chief of Staff directed in April 1977 that a Special Tank Task Force be established to develop a program that would provide the best available tank force in adequate numbers and in a timely manner to counter the current and projected threat. The Army Staff, Army Materiel Development and Readiness Command, Training and Doctrine Command, and other major commands provided membership or input to the task force.

A key driver in the establishment of the task force was concern for the allocation of money to the tank program in consideration of the oncoming "bow-wave" of major acquisition programs in the post-1979 time frame. The question was, "Can we really afford to continue improving *M-60s* and buy the number of *XM-1* tanks that the Army needs?" In addition to developing initial procurement objectives for the *XM-1* and *M-60A3* tanks, the task force developed alternatives for conversion of *M-60A1s* to *M-60A3s* and various PIP packages. These PIP packages were based on the expected buy of *XM-1s* and the degree to which the Army would depend on the *M-60A3* into the 1990's. The most combat effective mix based on probable fund availability consisted of over 7,000 *XM-1s* and in excess of 3,600 *M-60A3s.* It should be made clear at this point that the procurement of 7,000 *XM-1s* was an initial operational objective and by no means the total requirement over the life of the *XM-1* or follow-on improved versions. Based on the effectiveness of a fleet with this mix, the only improvements recommended for the limited number of *M-60A3s* were the tank thermal sight, muzzle reference system, an improved fire extinguisher system, and adaption hardware for a number of devices such as a chemical alarm.

At this point, it is worthwhile to note that the improved fire control and the highly-effective night vision systems of the *M-60A3* tank raise its combat effectiveness and make it more than a match for the Soviet *T-62.*

The increased combat effectiveness is derived from better target acquisition and more accurate firepower, but none of the PIPs except the Halon fire suppression system increased the tank's survivability. Increased survivability was considered and could have been provided by applique armor and special armor such as that used on the *XM-1,* but it was apparent that weight would be an inherent problem in that approach to obtaining better survivability. The original *M-60* tank was designed to weigh 51 tons. The *M-60A1* gained weight, the *M-60A1* RISE passive version grew heavier yet, and now the *M-60A3* weighs 57.3 tons—which is, in effect, the maximum weight carrying capability of its suspension system. It was recognized that this weight problem would create a significant threshold for further PIPs—to up-armor would require improved suspension; improving the suspension would mean the tank was no longer suspension-limited in cross-country speed and hence could use extra power; however, extra power would require a new transmission, new final drives, and new track.

Thus, a seemingly simple improvement in protection would mean a complete replacement of the tank's power train and running gear, plus hull modifications. The cost of this, unsurprisingly, was estimated to be rather significant. The cost data were considered by the Special Tank Task Force along with an estimate of the improvement in combat effectiveness that could be achieved by up-armoring the fleet. The timing of such improvements would have meant that an upgraded *M-60* would have been competing directly with *XM-1s* for funding in the critical "bow-wave" years. The task force's recommendation was not very hard to forecast. An improved *M-60A1,* created by retrofit, would have been a better *M-60* series tank, but would not have provided the quantum improvement in effectiveness of the *XM-1.*

The task force's recommended program was presented to the Army System Acquisition Review Committee (ASARC) in late summer 1977. After ASARC approval, it was subsequently approved by the Army Chief of Staff, Secretary of the Army, and Department of Defense for implementation. This decision has not been formally reviewed since 1977; however, there have been no major intervening changes in fiscal projections which would cause a change of heart. As a consequence, the program developed by that task force, with minor modifications, has been the direction followed by the Army Tank Program since that time. It appears that the program will be followed in the foreseeable future with only those minor changes necessitated by the current fiscal status and production status of the *XM-1.*

COLONEL SAM MYERS is presently Deputy for Combat Materiel in the Office of the Assistant Secretary of the Army for Research, Development and Acquisition; a position he assumed upon graduation from the Industrial College of the Armed Forces in 1979. Prior to that, and during the period of events related in this article, he was DA Systems Coordinator for *M-60* Product Improvements in the Office of the Deputy Chief of Staff for Research, Development and Acquisition. His military assignments since graduation from the USMA in 1958 have been in armored cavalry units in Germany and Vietnam, command of a tank battalion in Germany, in doctrine development at Fort Knox, and as Assistant Professor of Automotive Engineering at West Point.

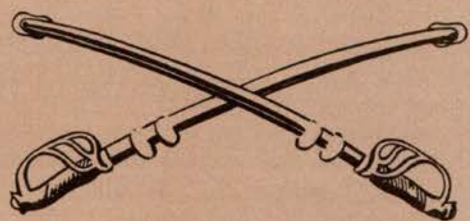
Frederic Remington's sketch, "Old Bill," has recently been donated to the U.S. Cavalry Museum, Fort Riley, Kansas.

Cavalry was a major subject of Remington's pen and brush. In the 1890's the U.S. Cavalry Association (now the U.S. Armor Association) recognized Remington's contributions to Cavalry by awarding him a life membership in the association.

In 1902, Remington took occasion to show his appreciation of this honor by presenting his sketch of Sergeant John Lannen, mounted on his horse with a carbine cradled in his arms, to the Cavalry Association. In January 1903, this drawing first appeared on the cover of the ***Cavalry Journal.*** And there it stayed for almost 40 years.

Always a branch of great esprit, highly conscious of history and tradition, the Cavalry took the Remington masterpiece to its heart. Somewhere through the years it picked up the label "Old Bill" and became a symbol of the "Spirit of Cavalry." Today, it appears on the masthead of each issue of ***ARMOR*** as a trademark of mobility in war.

"Old Bill" has remained for years in the possession of Colonel Karl Scherer, whose father, Colonel Louis Scherer, was the Secretary-Treasurer of the Cavalry Association when Remington presented the sketch to the association. Upon the death of Karl Scherer, the drawing was donated to the Cavalry Museum. It will be displayed in the museum's new fine arts gallery, scheduled to open in the spring of 1981. When displayed, the original ownership of "Old Bill" will be properly recognized.



2 x 2
The Regimental Cavalry Troop

by Major Marc A. King

"Two by two." It worked for Noah and it may rescue the regimental cavalry troop from the "flood" of criticism leveled against it by its critics.

Some background on the matter must be provided in order to appreciate the introductory comments. While it is evident to the cavalrymen that the current regimental organization is well suited to the roles and missions of the cavalry as currently outlined in FM 17-95, there are many critics who feel the organization is too large, unwieldy, and expensive. In an effort to address the questions raised by its critics, the Commander, U.S. Army Training and Doctrine Command (TRADOC),directed the U.S. Army Armor Center to take a hard look at the regiment with its associated squadrons and troops within the context of the Corps 86 study. The study itself is designed to look at troop organization, doctrine, and equipment in the time frame 1986 and beyond.

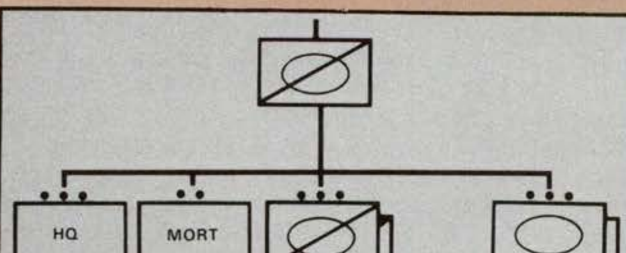


Figure 1. Troop organization

It was clear from the outset that one of the perceived problems with the organization was centered on the primary building block—the cavalry platoon, with criticism focused on the number and type of vehicles, and the span of control required from the platoon leader. The current organization did not seem to pose a significant problem, but, when the vehicles were envisioned being replaced with the Cavalry Fighting Vehicle (CFV) and the *Abrams* tank, there did, in fact, seem to be some additional considerations in maximizing the potential of the weapons in terms of organizational structure. With vehicles that could see farther, shoot farther, and move at significantly increased speeds, the idea of reducing the lieutenant's span of control and increasing the leader-to-led ratio was a move that would permit maximum use of the vehicle's capabilities while reducing traditional constraints. This approach, coupled with the TRADOC force structuring rules—rules that had been established to guide the overall study—set the stage for looking at alternative organizational structures from the squadron down. The guidance reflected the need to retain an organization capable of meeting the regiment's needs while accomplishing the goals previously stated.

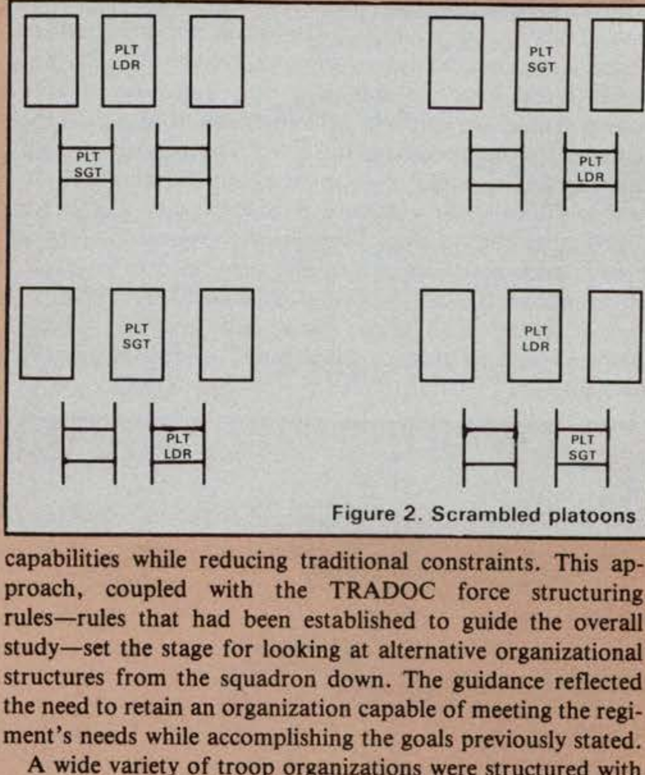


Figure 2. Scrambled platoons

A wide variety of troop organizations were structured with mixed vehicle and pure platoon configurations, then examined to determine their relative strengths and weaknesses as compared to the current organization. A principal tool used during this phase of development was a low-resolution, firepower-driven, computer simulation programed to simulate and evaluate a squadron defense in the covering force area (CFA) in Europe against a heavy threat organization. The computer simulation pointed out that to defeat both the first and second echelons of the first echelon divisions we had to provide roughly the same amount of firepower we had in the current organization. This point has become particularly significant when it is understood that we can significantly reduce the firepower and still destroy the first echelon. However, in doing so,

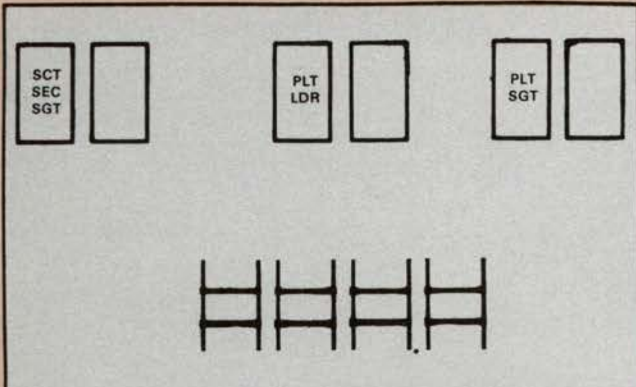


Figure 3. Pure platoons

the loss exchange ratio results in such losses for the defender that there is no chance of successfully defeating follow-on forces. At this point, it was summarized that it does little good to defeat the first echelon if you can anticipate success for the follow-on forces. Organizational structure, with emphasis on retaining combat power, became the focal point of our efforts.

Earlier study results had led us to the organization and adoption of the 4-tank, tank platoon in the tank battalion and the 6 scout-vehicle platoon in the scout platoons of the mechanized and tank battalions. These became the building blocks upon which the regimental cavalry squadron's structure

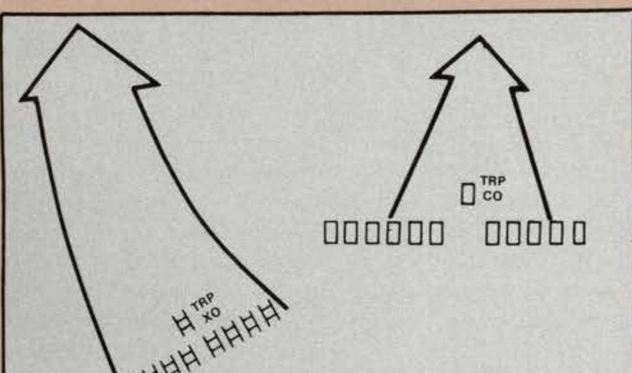


Figure 4. Consolidated scouts; tanks

would be based. Without going into great detail, the approach of common platoon organizations is strongly supported by the advantages gained through standardized training and simplification in the training base.

The final analysis resulted in a squadron organization consisting of three troops and a tank company. Each troop was configured with two platoons of tanks and two platoons of scouts (figure 1). The tank company consists of three 4-tank platoons and two tanks in the company headquarters. This structuring accomplished several significant goals. First, it reduced the span of control and increased substantially the leader-to-led ratio in the platoon. Consistent with these efforts, we also were able to retain the flexibility for task-organizing the platoons into a functional team similar to what we had under the old organization, while still retaining the advantages already cited.

The possibilities for such organizational "scrambling" should be considered within the context of the assigned mission. For the purpose of illustration and without indulging in a great amount of detail, some of the variations that could be applied within the current task requirements of FM 17-95 were reviewed. The most basic of these organizations is reflected in

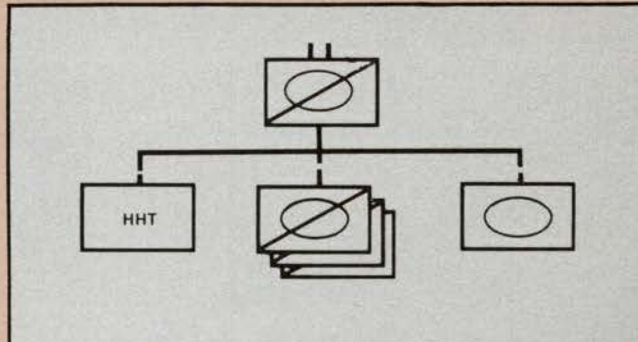


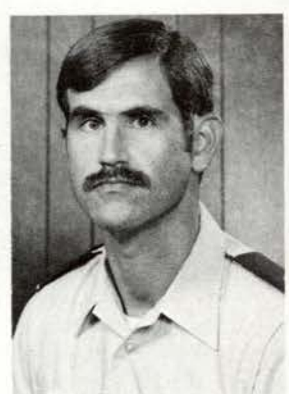
Figure 5. Armored cavalry squadron, corps ACR

figure 2. The team organization of three scout and two tank vehicles can be used to support mission requirements across the broad front of the defense. Such an organization can also be used in the offensive to conduct reconnaissance and exploitation/pursuit operations on multiple axes.

Should mission requirements dictate, the organizational arrangement could be modified to reflect a scout vehicle/tank teams as shown in figures 3 and 4. These variations are provided to demonstrate the flexibility inherent in the organization's structural base and do not reflect all the possible combinations of organization.

The troop headquarters remains basically unchanged, retaining its command and control elements as well as the indirect firepower of the improved 81-mm mortars (all mortars in Corps 86 will be improved 81-mm). The regimental cavalry squadron (figure 5) will be built on three troops, as well as a tank company with the appropriate headquarters elements for command, control, and communication.

In summary, it is clear that the structure of the regimental cavalry troop as proposed will meet the needs of the cavalry in the 1980's and beyond. The maintenance and maximization of its fighting capability, ability to react swiftly and violently to rapid and unpredictable situations, and the ability to provide commanders above division level with hard battlefield information is the mission that can be accomplished by the regimental cavalry. The "2x2" approach can get us there, and keep us there, despite the misgivings of the critics.



MAJOR MARC A. KING was commissioned in Armor in 1967 upon graduation from Armor OCS at Fort Knox. He served as a training officer, combat arms advisor to the 6th ROK Corps, assistant G-2 and company commander, 25th Inf. Div. in Vietnam. Major King has also served as assistant S-3 and troop commander 1st Sqdn 11th ACR in Fulda and is a graduate of AOAC and C&GSC. His recent assignments include a tour with the Directorate of Combat Developments, USAARMC,and he is currently assigned to Readiness Region IX, Fort Lewis Readiness Group.

The "V" Maneuver Technique

by Colonel (P) Robert E. Wagner

Maneuver is the essence of active defense. Effective movement of combat units to the flanks and rear of the enemy, where the ratio of combat power is locally in our favor, is a requirement for victory. Good shooting counts only after weapons have been moved to critical points of the battlefield, where they can kill. Communications and maintenance are vital, specifically because they support maneuver. In short, maneuver is the catalyst that makes a combined arms team work. If we cannot move, we cannot win.

Today, one of the most serious training problems encountered is teaching units at company level and below to maneuver cross country. I want to emphasize the word *maneuver.* Until lately, training publications made short shrift of this capability, usually discussing maneuver in terms of simultaneously moving combat formations and stereotyped battle drills. These publications totally ignored the restrictions of terrain, enemy, and the need for a mutually-supporting company formation.

In recent years, however, there has been a revolution that has produced a series of How-to-Fight manuals which discuss movement techniques. Unfortunately, the how-to-fight discussion does not go far enough. What follows assumes a working knowledge of these publications, because I am going to outline a maneuver technique called the "V." This technique starts where doctrine stops—it is an internal movement procedure for the bounding overwatch technique at company level. Because I believe that, in future battles, the bounding overwatch configuration will be habitual for maneuver teams, I consider this technique the *how* to achieving a maneuver capability. The "V" has been field-tested by numerous maneuver battalions and cavalry squadrons and has resulted in a vast improvement in those unit's capability to maneuver cross country.

This paper addresses movement techniques for company teams only. Obviously, platoon maneuver training must provide the foundation for much that is written here. If readers desire to know how this technique applies to platoon level formations, armored cavalry organizations, or how it can be used as a basis for battlefield training, please write to the Commander, 2d Armored Cavalry Regiment, APO NY 09411 for a copy of the regiment's maneuver pamphlet.

Why the "V"

Though current manuals describe movement techniques in excruciating detail, they never tell us how to get there. Current doctrine on movement techniques represents a paradox to the title of "How-to-Fight": They describe the *what,* but never the *how* to get there. The "V" attempts to fill that gap.

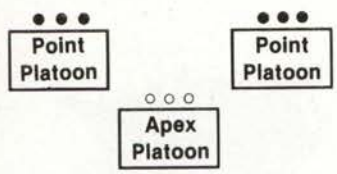
The "V" technique is a structured approach to bounding overwatch. It incorporates the characteristics of control, mutual support, and delivery of maximum firepower forward. The "V" should be the basic fighting formation for mounted units for the following reasons:

• The formation lends itself to mutual support. It is easy to visualize the point platoons at the point of the "V" moving in a mutually supporting formation.

• The formation possesses tremendous flexibility. Changing formation from the "V" is extremely easy. For example, the point platoons can advance on line if necessary, supported by the platoon at the apex of the "V"; or either one of the point platoons can establish a fire position before going into a designated battle drill.

• Most importantly, this is the only mounted formation that combines the capabilities of maximum firepower forward with depth. The company commander has control over a formation that combines mutually supporting maneuver with the delivery of maximum firepower forward.

Figure 1. The basic "V" Formation



How It Works

The basic "V" maneuver is executed by having the point platoons move by mutually supporting bounds and the apex platoon key automatically on the advance of the point platoons. The first platoon starts moving and reports, "SIX, THIS IS ONE-SIX, MOVING, OUT." The first platoon establishes a bound position and reports, "SIX, THIS IS ONE-SIX, SET, OUT." The other point monitors 16's reports, moves, and reports, "SIX, THIS IS TWO-SIX, MOVING, OUT." This platoon reports "SET" when its bound position is established, which in turn triggers 16 to start its move and report. The apex platoon continues to move automatically, keying its advance on the movement of the point platoons. Note that no response is required from the company commander, unless of course he wants to issue an order. Nothing is heard over the company command net other than the above transmissions, unless the enemy or an obstacle is encountered or a change in orders is necessary.

Some of the technique's major advantages are:

- The formation displaces automatically without placing strong reliance on FM voice communications. In fact, a training level can be achieved where no communications are necessary—a capability called "SILENT RUNNING."
- Platoon leaders are allowed to command. They decide what formation to employ and what bound position to occupy.
- Most importantly, the company commander is allowed to anticipate future action without being preoccupied with the basic movement of his command. However, he can step in at any time and issue an order. This is critical in a fast moving environment.

Teaching the "V"

The "V" is taught in the following graduated steps:

1. Sand table demonstrations, butcher paper, or blackboard drawings are used to illustrate graphically the "V" maneuver linked with oral commands.

2. In an open area measuring approximately 3,000 by 1,500 meters, the company team is placed in a "V" formation. All tank commanders and infantry squad leaders acquaint themselves with the formation.

3. The company executes SET-MOVE drills described previously over a short distance to familiarize all personnel with basic movement. This can be practiced dismounted with platoon leaders calling out the basic orders.

4. The formation is then dispersed, tied to the terrain, and oriented on an objective area. Good firing positions and speed during bound movement are emphasized. Step 4 is an expanded version of Step 3 and is practiced over different types of terrain until completely mastered. At this point, the company should begin to achieve a maneuver capability.

5. The team executes DELAY DRILL, basically the SET-MOVE drill in reverse, with the exception that the apex platoon reports SET and MOVE. DELAY DRILL is practiced over increasingly more difficult terrain until mastered.

6. This step graduates the company team from basic maneuver to the more complicated BATTLE DRILLS. SET-MOVE drills and DELAY DRILLS integrated with BATTLE DRILLS are executed over different types of terrain. During Step 5, the companies should begin to demonstrate a confidence to maneuver over any type of terrain and execute a variety of battle drills.

Note: In case of a fuel shortage, the entire training sequence can be "JEEP EXED." Additionally, SET-MOVE drills can be practiced on the run as part of the daily PT program.

The "V" technique is deceptively simple. I have found, however, that amazing training results can be achieved in a short time. In 3 training days, a highly motivated company that has learned other basic professional skills, such as map reading, can achieve a maneuver capability.

Conclusion

In our manuals, there is a dangerous dearth of maneuver doctrine. Even *FM 100-5* describes maneuver in terms of applied firepower and does not discuss the critical role of maneuver in active defense to bring that firepower to bear. That is, not only to destroy the enemy through physical destruction, but to sap his psychological will to fight by striking his vulnerable areas, disrupting his schedule for attack, and cutting across his lines of communication. This lack of emphasis on maneuver is probably the result of previous wars where our primary weapon was firepower and maneuver played a secondary role. We will not enjoy this luxury in the 1980's where good maneuver tactics could prove decisive against an enemy whose firepower mitigates against a toe-to-toe, linear slugging match. Toward this end, I am advocating an escape from the habitual column we see in most exercises. Company teams must learn to deploy and move in mutally supporting formations. There is more to mounted combat and to the execution of active defense than merely marching around the countryside. In short, *if we cannot maneuver, we cannot win.* The "V" technique represents a field-tested technique designed to produce that battle winning capability.

COLONEL ROBERT E. WAGNER is a graduate of the Virginia Military Institute and the National War College and has earned an MA degree from George Washington University. His assignments include command of an armor battalion, cavalry squadron, and, with the British Army of the Rhine, a Squadron of Royal Hussars (Queen Mary's Own). In Vietnam he served as both a sub-sector and province senior advisor. COL Wagner has also served in a variety of staff positions, including a tour with the NATO Policy Branch, J-5, Joint Staff and most recently as the chief of staff, 8th Infantry Division. COL Wagner currently commands the 2d Armored Cavalry Regiment.

SIBMAS Wheeled Armored Vehicle

by Raymond Surlémont

Belgium is challenging the world's leading producers of wheeled armored vehicles with a new six-wheeled armored combat car introduced by the *Constructions Ferroviaires et Metalliques* Company, formerly known as the *S.A. La Brugeoise et Nivelles* (BN).

Constructions Ferroviaires et Metalliques (BN) is not a newcomer to the production of armored vehicles and its Familleureux plant has had considerable experience in this special field, having built armored vehicles under license since before World War II. This experience gave the *Societe Industrielle Belge de Materiels Automobiles Speciaux* (SIBMAS), a subsidiary of the *BN* industrial group set up for that purpose—the basis for designing a new wheeled armored vehicle that is technologically advanced in conception and realization.

The vehicle was designed by SIBMAS in 1975 and delivered in 1976. Since then, it has been extensively and successfully tested over the most difficult terrain, in severe climatic conditions, and during difficult cross-country runs in tests held in Belguim in 1977, Malaysia in 1978 and 1979, and in the Republic of the Philippines in 1979. It is now ready for series production.

Design Philosophy

The SIBMAS armored personnel carrier has been designed to meet the needs of modern armies for increased mobility, adequate firepower, a capacity to perform a wide range of missions, and easy maintenance and servicing. All these requirements have been met successfully. The basic vehicle combines a superior cross-country performance with high cruising speed and an ultra-long range of action. Its high payload and sturdiness allow it to be fitted with a wide range of armament. It is suited for fighting, raiding, and patrolling border zones, as well as for transportation and other special military purposes.

It embodies standard, proven mechanical components of high quality provided by the German firm of *Maschienenfabriek Ausburg-Nurnberg* (MAN), a company well-known for its heavy, diesel-powered military trucks. This assures a continuous availability of spare parts and maintenance facilities worldwide.

The 6-wheel drive SIBMAS armored personnel carrier has a maximum road speed of 116 kmph and a range of 1,200 km. Normally, it seats from 9 to 12 men, but, in case of need, it can provide room for 16.

Off-the-road Performance

The power unit consists of a 6-cylinder MAN diesel engine located in the right rear of the vehicle. This engine is turbocharged for better performance at high altitude and is coupled to a 6-speed, fully automatic, power-shift gearbox fitted with a hydrodynamic torque converter. The latter is only activated during a short drive-off period and is provided with a built-in lockup clutch that disengages it automatically afterwards. Power and torque are transmitted to the driving axles in two stages, i.e., in the special toothed bevel gearing in the axle center and in the planetary final drives of the wheel hubs. The

three transverse axles are each provided with their own lockable differential and a further advantage allows longitudinal differential locking for locking the three axles together.

The SIBMAS armored car has a double-hydraulical-circuit braking system that can be assisted by an exhaust brake provided through the engine. The engine becomes an efficient vehicle retarder that adds braking control and results in less wear on the conventional brakes.

The SIBMAS vehicle is provided with a highly efficient suspension system that gives it a "go-anywhere" performance. The suspension design is based upon the use of progressively acting longstroke helical springs and provides 1 meter total movement for each wheel. All wheel stations are fitted with overdimensioned hydraulic shock absorbers. These features undoubtedly account for the SIBMAS' ability to deal with the most difficult terrain that may be encountered.

The vehicle can climb a 70-percent grade, operate on a 40-percent side slope, and its 400-mm ground clearance allows exceptional mobility through ditches and over stumps.

In addition to its high performance on land, the SIBMAS is an excellent amphibian. Completely watertight, it propels itself in water, without any preparation, by means of its wheels at a speed of about 5 kmph. This capability can be enhanced by fitting additional amphibious equipment, including two propellers that can swivel 360 degrees. The propellers make the vehicle highly maneuverable in water, whatever the speed and power of the current. These propellers are provided with a direct engine power takeoff through a transmission gear with steering arms. Thus, when the vehicle has to leave the water by climbing a steep bank, the propellers, still in water and actuated by their independent driving shaft, are supplementing the traction of the wheels. Two bilge pumps and a one-piece trim vane round out the amphibious equipment that gives the vehicle a maximum speed of 11 kmph in water.

Protection and Comfort

A self-supporting armored hull affords protection against rifle-caliber, armor-piercing projectiles, grenades and antipersonnel mines, and mortar and artillery shell fragments. The vehicle can be fully sealed to protect the crew and passengers against napalm, Molotov cocktails, and incendiary ammunition. The vehicle can also be fitted with an NBC filter pack to allow it to operate under nuclear, biological, and chemical fighting conditions. The driver's cockpit is provided with bulletproof armored glass windshields and hinged shutters.

Special care has been given to the comfort of the crew and passengers to allow them to remain fit and active even after long periods of closed-hatch or "buttoned-up" operations. The driver is seated in a roomy driving compartment in the front center of the vehicle. Both his seat and steering wheel are adjustable to provide him with optimum comfort and driving control. The fighting team is seated back to back in the center of the vehicle and can use the ball-mounted firing ports when the car is in motion or halted. Other equipment can be installed to reduce crew fatigue. An air conditioning and ventilating device can be provided for operations in hot climates. The device consists of a condenser, evaporator and compressor, tank, and drier. The air of the crew compartment is drawn through the evaporator, cooled, and recirculated into the vehicle. By condensation the air conditioning device can also provide drinking water at the rate of 1/2 liter per hour for the crew.

The SIBMAS car runs on Michelin combat tires filled with Hutchinson Veil Picard honeycombed inserts. The design combines the use of low-pressure tires, required for maximum cross-country performance, with a safety system that allows the vehicle to cover 80 km at a medium speed when its tires are punctured by fire.

The SIBMAS vehicle has 2 side doors, 1 rear door and 3 roof hatches for entrance and exit from it. When using all 3 doors, the entire crew can leave the vehicle in just 4 seconds.

Armament

When used as an Armored Personnel Carrier (APC) or as an Armored Infantry Fighting Vehicle (AIFV) the SIBMAS car is normally armed with either a 20- or a 30-mm automatic cannon. The cannon is housed in a 2-man turret together with a rifle-caliber coaxial machinegun. In this configuration, the car normally carries a 9-man rifle squad in addition to a crew composed of the commander, gunner, and driver.

To fulfill the mission of a Fire Support Vehicle (FSV) the SIBMAS can be equipped with a newly developed 90-mm gun and a coaxial machinegun also housed in a 2-man turret. This gun, also of Belgian make, has been selected by the Brazilian *Engesa* company to be fitted to its *Cascavel* armored car. Designed and developed by the Belgian Cockerill Company—a well-known European steel producer—the gun is a 90-mm low-pressure, smoothbore. The tube, breechblock and triple-baffle muzzle brake are made of a new Cockerill high-strength ESR, special steel. This relatively light gun emphasizes simplicity and sturdiness that reduce the amount of maintenance it requires. It can fire five types of projectiles made by the *PRB* Company, a 200-year-old Belgian manufacturer specializing in ammunition.

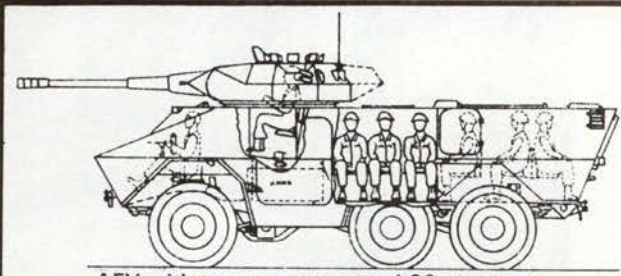
In the role of an Armored Internal Security Vehicle (AISV) the SIBMAS car is foreseen as being fitted with a 1-man turret, mounting a machinegun and, optionally, a grenade launcher which can fire tear gas or smoke grenades. In this configuration, the vehicle can carry up to 16 men, including the 3-man crew.

The car is also fitted with 3 ball-mount firing ports on each side, plus 1 at the rear, allowing the rifle squad to use its individual weapons for close-in protection, even when the vehicle is in motion.

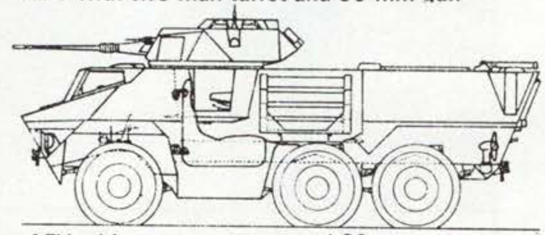
Design Adaptability

The basic SIBMAS car can be modified to perform very different functions, thus forming a complete "family" of armored vehicles. Presently, the following variants are being offered.

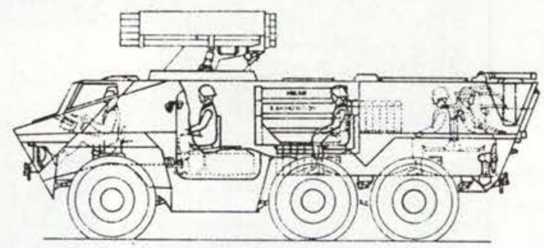
- An antiaircraft armored vehicle fitted either with a 20-mm twin-gun turret or with four .50 caliber machineguns
- An 80-mm to 120-mm mortar carrier
- An antitank guided weapon or rocket launcher vehicle that can use TOW, HOT, or MILAN weapon systems, as well as foreseeable new designs
- An armored mobile command post equipped with long-range communications equipment for command and control of armor, mechanized infantry, and artillery formations
- An armored logistical support vehicle which can be



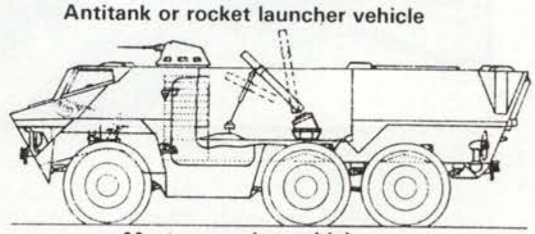
AFV with two-man turret and 90-mm gun



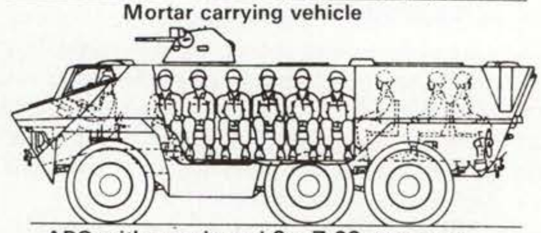
AFV with two-man turret and 20-mm gun



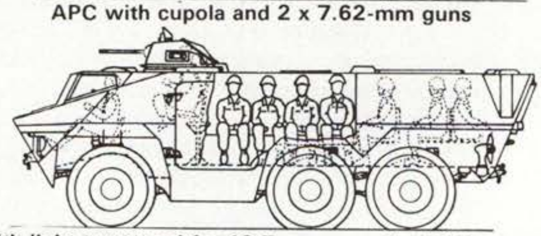
Antitank or rocket launcher vehicle



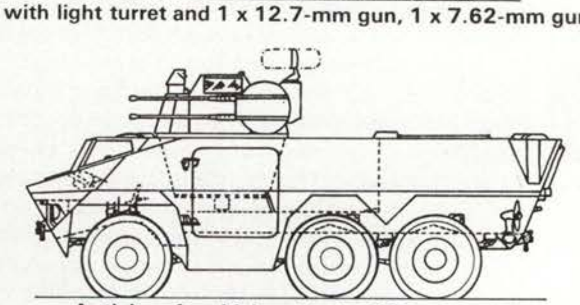
Mortar carrying vehicle



APC with cupola and 2 x 7.62-mm guns



APC with light turret and 1 x 12.7-mm gun, 1 x 7.62-mm gun



Antiaircraft vehicle with 4 x 12.7-mm gun

Dimensions and weights

Length	7,320 mm
Height (without armament)	2,240 mm
Height (with armament)	approx. 2,770 mm (depending on fighting trim)
Width, overall	2,500 mm
Width, over tracks	2,070 mm
Wheelbase	2,800 mm/1,400 mm
Ground clearance	400 mm
Angle of approach	52°
Angle of departure	47°
Weight (empty)	12,500 kg
Battle weight (depending on fighting trim)	from 14,500 kg to 16,500 kg
Payload	4,000 kg

Performance

Power/weight ratio	14,7 KW/T (20 HP/T) DIN
Maximum gradient	70%
Maximum side slope	40%
Trench crossing	1,200 mm
Vertical step	600 mm
Ground clearance	400 mm
Maximum speed on road	110 km/hr
Cross-country speed	60 km/hr
Acceleration	0-60 km/hr in 22 sec
Water speed	
—with propellers	11 km/hr
—without propellers	4 km/hr
Fordability	1,500 mm
Road operating range	>1,100 km
Road fuel consumption	36 liter/100 km
Turning circle	16 m
Large carrying capacity	
• Personnel: AFV ... Commander, gunner, driver + 9 soldiers	
APC .... Commander, driver + 14 soldiers	
•Armament ammunition stores or suppliers	up to 3 tons

Engine and transmission

Model	MAN D 2566 MKF turbocharged 6-cylinder in-line engine
Working cycle	4-stroke Diesel
Type	direct injection
Power rating	235 KW (320 HP) at 1,900 rpm
	137 Kpm (1,350 Nm) at 1,600 rpm
Rated-speed	2,200 rpm
Fuel tanks	Number 3
	Capacity: 425 L
Gearbox	type ZF HP 500 with hydrodynamic torque convertor

Axles and suspension

1st axle	steering axle with steering damper and intermediate steering arm, lockable differential.
2d axle	nonsteering with transfer train, lockable differentials (transverse + longitudinal).
3d axle	nonsteering with lockable differential.

Brake system and tires

Foot brake	air-hydraulic simplex system
Auxiliary brake or hill-start brake	parking brake is integrated in gearbox
Continous brake	exhaust brake system
Radial tires	14.00-20 X with Hutchinson VPPV (run flat elements)

Amphibious operation equipment

Direct engine power take off
2 swivelling propellers 360 degrees
2 bilge pumps—one piece trim vane
Operating temperature range: —30° C + 50° C

adapted either as a cargo carrier or a recovery vehicle

• An armored ambulance that can accommodate 5 stretchers, or 3 sitting casualties and 4 stretchers, and 2 medical corpsmen.

Besides its projected long service life, the SIBMAS vehicle also includes a considerable built-in capacity for adapting itself to future military requirements.

Optional Equipment

The SIBMAS can be fitted with special devices for night driving, such as infrared headlamps; an infrared night driving periscope; or a passive, light-intensifier driving periscope. The former type of periscope usually consists of 2 telescopes set in a light alloy case, converting the reflected infrared light into a visible image. The latter type, which also can detect the sources of infrared light, is interchangeable with the normal driving periscope. The headlamps also can be fitted at will with infrared lenses.

Another useful auxiliary piece of equipment foreseen for the SIBMAS car is a front-mounted hydraulic winch. This has a wire rope length of 60 meters and a pulling capacity ranging from 7 to 14 metric tons.

The SIBMAS vehicle can be equipped with either HF or VHF radio sets complemented by an elaborate intercommunication system. This system includes a 24-volt power supply unit, an intercom control unit, 2 remote control units, 2 fixed loudspeaker units installed in the crew compartment, and 3 headsets with microphones for the commander, driver, and gunner.

Maintenance and Servicing

The SIBMAS vehicle has been designed to keep crew maintenance to a minimum and to make necessary tasks as simple as possible. The entire power unit can be easily removed and replaced by another through a roof flap. This work requires less than one-half hour for 2 men using the standard vehicle tool kit and a truck-mounted light crane. This is made possible by quick-disconnect couplings and connectors in the power and hydraulic circuits.

The SIBMAS vehicle needs a major overhaul only every 5,000 km of mixed running on roads and trails. Spares are easily available just as are MAN repair and maintenance facilities throughout the world. This ensures comparatively low cost operation and a long vehicle service life.

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TOW In The 80's

by Captain Donald B. Smith

The following is an examination of the TOW weapon system and its doctrinal use today, and possible alternatives in the 1980 time frame. This addresses the TOW in its ground role as a part of the main battle. It does not consider the use of TOW by the battalion's scouts, because, by doctrine, they should not be used by the commander in the main battle; i.e., scouts are scouts, not maneuver platoons. The information used in compiling this study was limited by available sources, research time, and classification. In addition, a great deal of it is based on my personal experiences, opinions, and observations, and is therefore biased. This article will examine three major points:

- The TOW system in European type terrain is going to be severely limited by intervisibility; i.e., the 2,500-3,500 meter shot is going to be the *exception* rather than the rule.
- There is a definite conflict in tactical (individual weapon) and organizational employment doctrine.
- In light of recent trends in armor protection, the role of the TOW as an *antitank* weapon needs to be reevaluated.

There are two assumptions that form the basis for this examination:

- The TOW will continue to be a valuable weapon system (and so will its intended victim—the Armored Fighting Vehicle (AFV)) through the 1980's.
- U.S. doctrine will continue to be oriented toward operations in the Central European environment against a Soviet style threat (massed armor).

There are three advantages to the TOW weapon system. First, it provides its user with a lightweight weapon having a very high probability of first round hit and kill against armored targets at extended ranges (300+ m), well out of the maximum effective range of an AFV's weapons. Second, it is relatively easy and cheap to use. The gunner simply puts the crosshairs on the target, presses the trigger, and keeps it there until missile impact. Third, it does not need an expensive, sophisticated firing platform. As noted above, it is man portable by its crew or it can be mounted on a vehicle as inexpensive as a $10,000 jeep; as opposed to a $200,000-300,000 armored fighting vehicle. Unfortunately, the cheaper vehicles are correspondingly less survivable on the moderate to high intensity battlefield.

There are a number of disadvantages of the TOW system as well. It is a fair weather, daylight weapon. The new thermal night sight will remedy this considerably, but not completely. The weapon has a slow rate of fire (1-3 rounds per minute at 2,000-3,750 m), a long time of flight (16.5 sec at 3,000 m), and a need for the gunner to track the target during the entire flight of the missile; all of which impacts on the reliability and survivability of the weapon in combat.

The system, as it is now, is highly vulnerable to suppression by weapons ranging from small arms to artillery because the gunner and weapon are exposed during the time of the missile's flight. The introduction of the *M-901* Improved TOW Vehicle (ITV), taking place now, will help remedy the problem, but the *M-113* chassis, which is the base vehicle for the ITV, is inherently vulnerable to artillery fragments and remains a problem. The high bulk-to-weight ratio of the ammunition results in a considerable resupply problem in transportation and handling. It also results in a small basic load per weapon which may well be expended in the first engagement. This further compounds the resupply problems.

The weapon itself is sophisticated and requires direct support (DS), general support (GS), and depot maintenance. Maintenance at user level is limited to dusting and a self-test. This is a crewmember's dream in peacetime, but could turn into a nightmare in combat when DS maintenance is scarce. On this weapon, the soldier's legendary juryrigging with a screwdriver and commo wire just won't work. Additionally, some TOW users have voiced a reservation about the delicacy of the round and launcher—will they stand up to intense, continuous use; the shock of artillery and air bombardment; and suppression? No information is available to answer that question.

Finally, the high cost per round makes the procurement of large quantities of TOW ammunition expensive. This results in few rounds being available for live fire practice, which in turn limits the quality of gunnery training. (For comparison, a tank gunner could fire about 25 rounds of training practice ammunition at approximately $120.00 per round for about the same cost as firing *one* TOW practice round at approximately $3,000.00 per round. All the above disadvantages do not cancel out the two major advantages of the TOW, but they do restrict them—in some cases severely!

The factor that will impact tne most on TOW engagements and the range at which they take place is intervisibility.[1] Intervisibility is, very simply, the ability to see between two points. It is a function of differences in terrain elevation between the two points as well as intervening natural objects, such as vegetation and forests, or manmade obstructions such as buildings, cities, and smoke. The TOW is also influenced by the time of day and vagaries of the weather such as rain, fog, snow, and dust. Simply put, intervisibility will reduce the range capability of the weapon to the range at which the gunner can see and track the target. The general concensus of all sources is that while 2,500 + m shots are available in Central Europe, they are the exception rather than the rule. A majority of the engagements will be in the 1,000-2,000 m ranges where the standoff advantage of the TOW over the tank is greatly reduced or is in fact reversed.[2,3,4]

Intervisibility will most likely present the TOW gunner with one or more "engagement windows" in his area of responsibility in which he must acquire, track, and defeat his target before it leaves the window.[5] Table 1 is taken from FM 100-5 and shows the size window necessary for successful engagement at various ranges, target speeds and acquisition times.

Table 1.

TYPICAL MINIMUM SEGMENT LENGTHS (METERS) FOR SUCCESSFUL ENGAGEMENTS

RANGE (METERS)	APPROX MISSILE FLIGHT TIME (SECONDS)	TANK SPEEDS (MILES PER HOUR)	DETECTION AND ACQUISITION TIMES (SECONDS) 10	20	30	40	60
			SEGMENT LENGTH IN METERS				
1000	5	4	27	45	63	81	117
		8	54	90	126	162	234
		13	90	150	210	270	390
2000	10	4	36	54	72	90	126
		8	72	108	144	180	252
		13	120	180	240	300	420
3000	15	4	45	63	81	99	135
		8	90	126	162	198	270
		13	150	210	270	330	450

As an example, if an ATGM attacks a target at 2000 meters, the missile time of flight is 10 seconds. If the gunner acquires and fires in 10 seconds at a tank moving toward him at a rate of 8 mph, the tank must remain exposed for 72 meters to score a hit.

Intervisibility then will be one of the principal limiting factors in the employment of the TOW. In order, then, to reduce this limiting factor as much as possible and make maximum use of the long-range advantage of the weapon, the best possible intervisibility conditions must be sought. In my opinion, this is highly dependent on the choice of defensive sites[6] by battalion, task force, or higher level commanders.

Presently, there is a conflict in the U.S. Army in the doctrinal employment of the TOW weapon system and the way it is incorporated into the combat organization. The infantry battalion is ideally employed in armor-restrictive terrain, generally with more restricted fields of fire than the armor battalion, which is ideally employed in more open terrain with less restricted fields of fire.

Doctrinally, the "TOW should be positioned to engage the enemy... at long ranges...."[7] Long ranges require good intervisibility conditions. Therefore, TOW should be an organizational part of the armor battalion. However, the infantry battalion is the unit with the TOW organic and the armor battalion has none! (Remember—scout platoons are not considered here.) The immediate solution is cross-attachment by the brigade commander and this, in fact, commonly occurs now. But, this is hampered by the organization of the current brigades as shown by the following comparison:

- Pure mechanized brigade—3 *mechanized* battalions, most restricted armor terrain, most TOWs (54).
- Mechanized-heavy brigade—2 mechanized battalions, 1 tank battalion, next most restricted terrain, next greatest number of TOWs (36).
- Tank-heavy brigade—2 tank battalions, 1 mechanized battalion, more open terrain, fewer TOWs (18).

• Pure tank brigade—3 tank battalions, most open terrain, no TOWs!

In short, brigade commanders with the most suitable terrain for TOWs have the least assets to work with! The next logical remedy then is the cross-attachment by the division commander, but as now organized this would present virtually unacceptable problems with accountability, command and control, and maintenance and logistical support of the cross-attached forces. What then is the solution? The infantry needs the TOW (or a comparable tank killer), but in *most* cases cannot use the weapon to its full potential. The armor has no TOWs, but could more *nearly* employ the weapon to its full potential. The logical answer is to have TOWs organic to both infantry and armor battalions. In spite of recommendations along these lines by the Division Restructuring Study (DRS),[8] this idea was killed by a mixture of parochialism and money and manpower constraints.[9,10,11] Consequently, this conflict of tactical and organizational employment doctrine is not solved by the Division 86 reorganization rather, it is perpetuated by it. (See ***ARMOR,*** Nov-Dec 80.) There are three possible solutions.

First, a TOW antitank company would be organic to each mechanized and armor battalion.

The advantages of this include:

• TOW capability is given to all maneuver elements.

• TOW fires are massed at the battalion level with attendant command, control, communication, and support—C³S.

• Problems of cross-attachment within the brigade and perhaps within the division are eased because whole companies can be shifted to mass TOW fires.

Possible disadvantages are:

• The span of control problems of the battalion and brigade commander are extended.

• Increased manpower overhead (headquarters & support personnel).

• The problem of matching massed ATGM fires with best possible terrain and heaviest concentration of attacking forces is not completely solved.

Secondly, a TOW antitank battalion would be at brigade level. This option has practically the same advantages and disadvantages as the first one, with these exceptions: It would facilitate, somewhat, cross-attachment by the division commander at a higher cost in terms of manpower overhead. It is, however, apparently not viable as long as the concept of a brigade headquarters is that of a maneuver headquarters with no organic combat assets.

Thirdly, a TOW antitank group or brigade would be at division level.

The advantages of this alternative include:

• Maximum use of the weapons capabilities is allowed by matching it with the most vulnerable targets (massed armor) and the most suitable terrain with attendant C³S.

• It would allow the most efficient use of training assets in the training environment.

Possible disadvantages are:

• Probably less responsive to the needs of the maneuver battalions and companies due simply to the separation involved.

• The much higher cost in terms of manpower overhead would be prohibitive and practically rule out this option.

A "quick-fix" solution while waiting for the changes to take place—if, in fact, they do—is for battalion and brigade commanders and S-3s to start thinking about and using TOWs as a maneuver element rather than as supporting weapons. To do this, the battalion's TOWs could be combined into a single unit—through the antitank platoon in the combat support company or by using the platoon as now organized as a maximum of two maneuver-type units. This gives the commander massed antiarmor fire under the control of one or two individuals (the TOW platoon leader and/or platoon sergeant), who are concerned only with maneuvering TOWs—as opposed to a company commander, who must divide his attention among assigned or attached TOWs and his maneuver platoons. These two individuals are also supposed to be the battalion's TOW experts.

An example of how well this could work is found in a Computer Assisted Tactical Training Simulation (CATTS) exercise conducted at Fort Leavenworth in 1977. It involved a game in which a light infantry battalion defended the Mitla Pass in the Sinai against a Soviet-style, mechanized attack. The TOW platoon, under the command of the TOW platoon leader, had been withdrawn from the high ground south of the pass and directed by the S-3 to position itself to best defend the pass.

While the rest of the battalion was fighting the first wave from the high ground south of the pass, the lieutenant positioned his TOWs on the high ground east of the pass in a very dominant position. As the Threat second wave tank battalion (reinforced with a motorized rifle company) bypassed the pinned-down companies of the battalion and entered the pass, it came under the massed fires of the TOW platoon.

Through great tactical brilliance or sheer dumb luck, the platoon leader had so positioned his platoon that the Soviet-made tanks could not elevate their guns sufficiently to take the platoon under direct fire. In less than 5 minutes, the second wave battalion, opposed by only a TOW platoon and artillery, had turned back, lost over 25 vehicles damaged or destroyed, and destroyed only 3 of the opposing guns. During the *entire battle,* including the first and second waves and counterattack by the battalion, TOWs organic or attached to the companies (8 in all) got only *3* kills. The TOW platoon, maneuvered as a unit under the control of the platoon leader, was credited with over 35 armored fighting vehicles (AFV) damaged or destroyed!

This is probably an extreme example. The platoon leader had an ideal situation with near perfect intervisibility conditions, and the Threat artillery was being used to tie down and destroy the known bulk of the battalion and so was not a major problem to him. But it does go to show what a good commander or S-3 can do by massing his available antitank fires under a single individual who can devote *all* his attention to positioning and controlling those massed fires.

The TOW's capability as a *tank* killer needs to be reevaluated in light of new armor developments. The TOW is a HEAT round, getting its penetrating power from a chemically produced jet of hot gases. The U.S. has already produced a special armor on the *XM-1* that greatly reduces the penetrating power of the HEAT round, and is in fact impervious to all current Soviet Block ammuntion! (Based on an unclassified briefing on the *XM-1* given to Armor Officer Advanced Course students at Fort Knox, Kentucky, Jan 1980).

The Soviets have fielded similar armor improvements. The Division 86 paper in fact predicts that the Soviet *T-80,* the follow-on to the current Soviet *T-72,* will have armor similar to the *XM-1.*[12] This seriously reduces the capability of the TOW as a *tank* killer!

Against newer tanks, effective current TOW engagements will be limited to flank and rear shots, making positioning and intelligent use of terrain all the more important.[13] The TOW will continue to be effective against older tanks and lighter AFVs (*BMP, BRDM,* SP-122, *ZSU,* etc). In situations where U.S. forces are faced with special-armor tanks, target priorities should be established to strip away the lighter AFVs and allow friendly tanks to concentrate on enemy tanks or allow the tanks to penetrate, stripped of their accompanying vehicles, until they expose their flanks and rear to tank and TOW positions or dismounted infantry.

If the situation dictates that tanks be engaged and frontal shots are all that are available, gunners should seek mobility or firepower kills by shooting for the suspension or gun. This is, in reality, the same doctrine that has been used in the past—destroy the combined arms integrity of the enemy force and exploit its known weaknesses.

Three problem areas for the TOW have been examined here, the first two of which are inextricably interrelated. Problems of intervisibility seriously limit the capabilities of the TOW weapon system. The intelligent and skillful use of terrain by not only the gun crews, but, even more, by higher level commanders is the only solution, short of rebuilding the terrain of West Germany.

However, the conflict between tactical employment and organization employment compounds the problem for the commander, limiting his choices. Finally, technological advances in armor protection make it necessary for us to reevaluate the TOW as a tank killer and to adjust our tactics accordingly. The Army, as a whole, and individual commanders need to address these problems and use their individual and combined resources to overcome them and so use this excellent weapon to its best advantage in the coming decade.

Footnotes

[1]Angolia, LTC J. R., U.S. Army Command and General Staff College, "TOW Engagement in the Active Defense—3,000 meters or less." Department of the Army, Ft. Leavenworth, KS, 9 June 1978. Page 35.

[2]Ibid, Pages 38, 85.

[3]U.S. Army Combined Arms Center: TETAM Evaluation, Final Report, *Executive Summary,* Volume I. Department of the Army, Ft. Leavenworth, KS, 1979. Pages 2, 11.

[4]Darling, LTC M. D., TRADOC Combined Arms Test Activity, Ft. Hood, TX. Subject: "TOW Engagement Ranges." Memorandum for Colonel Kelly, 17 January 1978. Page 3.

[5]Ibid, U.S. Army Combined Arms Center, Page 2.

[6]Ibid, Page 13.

[7]FM 71-2, *The Tank and Mechanized Infantry Battalion Task Force.* Washington, D.C. Department of the Army, 1977. Pages 4-4, 5-25/26.

[8]U.S. Army Training and Doctrine Command. Division Restructuring Study Group. Division Restructuring Study Phase I Report, Vol I, *Executive Summary.* Department of Army, Fort Monroe, VA, 1 March 1977. Page 4.

[9]Lynch, MG Thomas P.; CG USAARMC & Ft. Knox. Message to MG Menetrey, Subject: "Division Restructuring Evaluation," 6 April 1978. Pages 3-4.

[10]Menetrey, MG Louis C. DCG, CACDA Ft. Leavenworth, KS. Message to MG Lynch, Subject: "Division Restructuring Evaluation," 15 May 1978. Pages 1-2.

[11]Lynch, MG Thomas P.; CG USAARMC & Ft. Knox. Information message to CDR, TRADOC: CDR, III Corps; CDR, OTEA: CDR, TCATA: CDR, USAIC; Subject: "Division Restructuring Study," 6 April 1978. Page 6-7.

[12]U.S. Army Armor Center, Director of Combat Developments. Division 86, Section IV, "Mechanized Infantry Battalion Organizational and Operational Concepts." Department of the Army, Fort Knox, 1979. Page 2.

[13]U.S. Army Training and Doctrine Command, Bulletin No. 12, "Battle Report: Combat Vehicle Engagements." Department of the Army, Ft. Monroe, VA, 31 August 1979. Page 2.

TEMAWS

by Lieutenant Colonel Richard D. Wandke

The results of an evaluation of the Tactical Effectiveness of Minefields in the Antiarmor Weapons System (TEMAWS) indicate that scatterable mines will contribute significantly to an antiarmor defense.

TEMAWS evolved from the Family of Scatterable Mines (FASCAM) study made by the U.S. Army Training and Doctrine Command (TRADOC).

The evaluation of TEMAWS was based on a two-sided, force-on-force operation during a series of trials conducted by the U.S. Army Combat Developments Experimentation Command (CDEC), Fort Hunter Liggett Reservation, CA. The Threat force was a simulated Soviet reinforced tank company that conducted a quick attack against a defensive force made up of selected antitank elements representing a U.S. mechanized infantry team defending the main battle area.

The experiment involved the play of direct and indirect fire weapons (equipped with eye-safe lasers), scatterable mines (emitting radio signals instead of explosives), tanks and APCs (equipped with laser receptors and eye-safe lasers) and a continuous radio communications system—all tied into CDEC's sophisticated computer system.

To determine the effectiveness of scatterable minefields and the ability of tank crews to detect and avoid the mines at various minefield densities and tank speeds, a realistic battlefield environment was created and casualties were assessed.

The experiment was kept manageable during the 143 trials by examining only that portion of the battle which took place within a 3,000 x 1,500-meter rectangle. Player familiarity with the area was minimized by using six different player sets, three different terrain sites, and a random placement of the rectangle within the three terrain sites.

Player Training

Before the experiment, each player group was trained by CDEC personnel in specific Threat tactics to be employed and taught to operate the *M-60A1* tank with all hatches closed (buttoned up). The defense players were given TOW and *Dragon* missile qualification training and were taught defensive employment of their respective weapon systems before the record trials began.[1]

Experiment Objectives

The experiment objectives were to:

- Evaluate the effectiveness of selected scatterable minefield densities under both clean and dirty battlefield conditions.[2]
- Assess the capability of armor crews to detect visually and avoid scatterable mines.
- Examine the effectiveness of the mine-clearing plow and line charge in breaching a scatterable minefield.
- Compare the effectiveness of belted and continuous minefields.

• Determine whether the total armor kills from the combined use of the scatterable minefield and covering direct fire antiarmor weapons is greater than the sum of kills from the scatterable minefield used separately and direct fire weapons used separately (i.e., whether there is a synergistic effect from the combined use).

• Evaluate the effectiveness of two levels of mine detectability.

Experiment Results

Results of the TEMAWS indicated that

• Scatterable mines would contribute to the effectiveness of the antiarmor defense at all densities and detectability levels tested. As expected, as the minefield's density increased or detectability decreased, mine kills increased. It was possible to obtain more mine kills for a given density at low detectability (mines partially buried in the ground) than at high detectability (mines lying on top of the ground).

• During the experiment, tank crews appeared to achieve a high level of ability in detecting and avoiding mines, and toward the end of the experiment, the probability of tank crews detecting and avoiding mines seemed little affected by being buttoned-up or unbuttoned. In the low-density/high-detectability trials (i.e., one mine per every 2,000 square meters to one mine every 200 square meters, mines not concealed) the probability of detecting ranged from 65 to 95 percent while that in low-detectability, low-density trials ranged from 62 to 88 percent. At the highest density studies (one mine every 100 square meters), the probability of detection fell to 43 percent. This result is probably best explained by stating that at a high density of mines, there are simply too many mines for the tank crews to avoid. (The effectiveness of mine-clearing devices is classified SECRET and will not be discussed in this article.)

• The belted minefield appeared to be more effective than continuous minefields, even though the minefield kills were about the same. A belted minefield had a psychological effect; the crew felt that they were clear of the minefield after passing through the first belt of mines and would tend to relax before entering the second belt. The second belt would cause them to start looking for mines again. A belted minefield also appeared to cause the tank crews to slow down.

Side Test

During one of the many side tests conducted by CDEC to answer specific questions that arose during the trials, it was interesting to note that drivers were better able to detect and avoid mines at speeds between 6-9 mph than at 3-5 mph or 10-12 mph. The opinion of the drivers and the experimenters was that the driver was able to see the mine at 3-5 mph but he became bored and the tank became less maneuverable at the slow speed. At the high speed of 10-12 mph, his concentration shifted from looking for mines to maintaining control of the tank and negotiating the terrain. The driver either did not see the mines or failed to react quickly enough to avoid the mine at the higher speed.

Observations

One aspect of special note was the military observations of experienced officers and NCOs who participated in the experiment. The observations were collected during the experiment to be used in training, tactics, doctrine, and equipment that have applicability to a particular unit employing or countering the concepts studied by CDEC.

Buttoned-up Operations. One observation of special significance that will have a lasting effect on the training of U.S. tank crews involves the operation of a tank while buttoned up. It was observed that the decentralization of command and control of the armor company was essential in order for armor crews to operate successfully when all hatches were closed. It was further observed that the tank company commander could not control the battle while his hatch was closed because his observation of the battlefield through the periscope was limited. The company commander had to rely on each platoon leader to execute his portion of the battle plan independently. The reduction in control by the company commander during the battle forced him to ensure that every tank commander (TC) was briefed and had a clear picture of the plan, and that a detailed map reconnaissance was made before the trial.

During training, tank crews were forced to practice their formations in both unbuttoned and buttoned-up modes until leaders felt comfortable with the movement of their units. Once proficiency was obtained with the hatches open, the tank crews began their training with the hatches closed. It was observed that up to 5 weeks of buttoned-up training were required before tank crews felt comfortable operating the tank in this mode. Even then it was noted that during record trials, buttoned-up tank crews became more concerned with negotiating the terrain than with locating and avoiding mines or engaging targets.

Tank Crew Location. The driver had the best location for observing mines and was able to detect enemy positions more quickly than the TC or gunner. The significance of this observation is that current U.S. Army tank crew target handoff procedures need to be revised. Current doctrine is for the initial fire command to be given by the TC for a battlesight engagement. The command sequence consists of an order to the driver, DRIVER STOP (if appropriate); the alert,GUNNER; the weapons and ammunition selection, BATTLESIGHT (meaning that the main gun is to fire a preselected round already loaded in the breach); target description, TANK; and command of execution, FIRE. The time of execution under normal daylight conditions for a BATTLESIGHT engagement has been determined to be about 5 seconds from the time the commander identifies the target until the first round is fired.

In TEMAWS when the target was detected by either the gunner or the driver and handed off to the TC for the fire command, the engagement times were extended from 5 seconds to as much as 30 seconds. The time increased principally because the TC's ability to detect and confirm the target while buttoned up was seriously reduced. One unit commander developed an abbreviated fire command which allowed the gunner, when he detected the target first, to give part of the fire command. (Target confirmation and override were reserved by the commander.) The abbreviated fire command greatly speeded up the time for engagement.

Modified Fire Command. The abbreviated fire command procedures follow: As soon as the gunner identifies a target, or as soon as the driver identifies a target and hands the target off to the gunner, the gunner commands DRIVER STOP. The TC immediately drops to the range finder and confirms the target. (The tank driver uses the clock reference system to speed up the target handoff between himself, the TC, and the gunner. The front of the tank is always considered to be 1200 on the face of the clock. If the target is confirmed by the TC, he commands FIRE and the gunner fires. If the TC determines that there is no target, he commands CEASE FIRE, DRIVER MOVE OUT. The engagement is aborted and the tank begins

The Track-width Tank-Mounted Mine Clearing Roller System is designed to be about 85 percent effective against pressure-fused mines.

to move across the battle area once again.[3]

Limitations in Target Detection. Due to the rough terrain, the restricted field of vision while looking through the vision blocks and the altered depth perception, the TC encountered difficulty in detecting targets. The TC was able to observe 50 percent of the targets observed by the crew, but his preoccupation with control of the formation prevented him from controlling the engagements of his tank in the same manner as when operating with his hatch open.

Minefield Emplacement, Detection, and Penetration

The observations concerning minefields by CDEC during the TEMAWS trials follow.

- The bulling technique was the best tactic to use in crossing a minefield. (Tank crews negotiated the minefield by attempting to avoid mines, without benefit of a mine-clearing device.)
- The best method of employing antitank guided missiles (ATGM) was from an overwatch position.
- The Threat could best suppress defensive weapons by placing artillery in group concentrations on the desired objective.
- When smoke was employed over the minefield, the performance of the Threat and defensive players was affected, but in different ways. The Threat tanks became more vulnerable when emerging from the smoke-covered minefield. On the other hand, smoke over the minefield allowed tank crews to penetrate deeper into the battle area by providing them with concealment.
- Threat tank crews played down the effects of the mines but were concerned about direct and indirect fire weapons.
- TOW and *Dragon* training should include tactical employment considerations during the early stages as well as the use of meteorological conditions (haze, glare, dust, and shadows) in selecting firing positions.
- After firing, direct fire weapons must be ready to move. The threat force was able to locate the position of the direct fire weapons after the weapons had fired.
- The standard infrared driving system on the *M-60A1* tank needs improvement in order to detect mines during low-light periods.
- Smoke placed over known defensive positions provided tank crews with better concealment (defensive positions during wartime will not necessarily be known).

Recommendations

Upon the completion of the TEMAWS experiment, CDEC provided the following recommendations to the U.S. Army Engineer School and U.S. Army Combined Arms Combat Development Activity.

- Modify the tank to give the TC a 360-degree field of vision while giving him overhead cover from artillery fire.
- Use scatterable mines as an economy-of-force measure to assist commanders in controlling the battlefield.
- Modify fire commands used while operating buttoned up.
- Decentralize command and control to the maximum extent when operating buttoned up.
- Train U.S. armor units to operate buttoned up so that tank crews receive the maximum protection possible when conducting military operations through enemy artillery fire.

LIEUTENANT COLONEL RICHARD D. WANDKE was graduated from the University of Maine as a Distinguished Military Student in 1963. He has served as a platoon leader, company commander, and staff officer from battalion to combined field army level. He served three combat tours in Vietnam that included duty as an advisor, company commander long range reconnaissance unit commander, and as a staff officer at division level. LTC Wandke returned from Korea where he served as the operations officer of a combined field army. He is currently assigned as the Chief of Experimentation Division, Office of the Deputy Chief of Staff for Experimentation, CDEC, Fort Ord, California.

Footnotes

[1]USACDEC Military Observations, Experiment FC 026, Tactical Effectiveness of Mine Fields in the Antiarmor Weapons System, (TEMAWS), April 1977.

[2]Final Report, Volume 1, USACDEC Experiment FC 206, June 1977.

[3]Master Test Report No. 290, Mine Dispensing Skysystem. Aircraft; NS6 dated 17 October 1975.

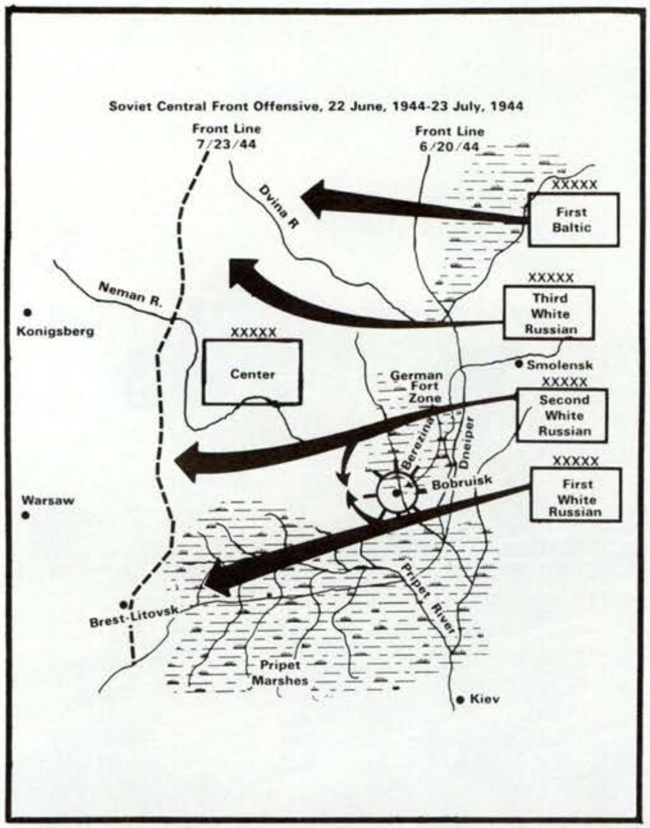
Collapse in the East

by Robert C. Smith

The Soviet 1943 Summer Counteroffensive and the Soviet Fall/Winter 1943-1944 Offensive had caused disastrous German losses south of the Pripet Marshes, yet north of this area, the offensives had been relatively limited. In fact, the only serious alteration in positions was the Soviet offensive that drove German and Axis troops away from the city of Leningrad.

For the troops of German Army Group Center, the war seemed to be some faraway event. Most of their time was spent in the development of densely fortified positions around strategic towns and cities, and guarding key river crossings. The troops were handicapped by the persistent combing of their ranks to find combat-ready troops to send in as replacements in the south. Everyone assumed that, given enough time, they could make up in strength and tenacity of their fortified positions what they were losing in manpower and equipment, especially mobile units.

The Soviet successes during the preceding summer had imposed yet another constraint on the troops, namely that as the troops on the southern flank of the Army Group were forced



to withdraw, the troops from Army Group Center were forced to extend themselves and guard the exposed flank. Fortunately for the Germans, the terrain favored their defense efforts, since they could easily use the Pripet River and its tributaries as terrain reinforcements for their positions. Even so, the 400,000 men of Army Group Center were stretched out thinly, covering a front that extended in a sweeping curve from near Polotosk south around Bobruisk and then along the Pripet River. This amounted to almost 600 kilometers of front for the troops to defend, as well as innumerable salients, strong points, and, above all, the rear areas.

The terrain tended to favor the defense. Virtually all the major rivers in the area ran north-south; only the Pripet ran east-west. Many areas were heavily forested, a factor that favored the defense; but other areas were marsh, a factor that hindered the movement of friend and foe alike and made the cohesive operation of large forces difficult. The Germans had carefully taken advantage of terrain in their development of fortifications. Most fortified localities included a variety of trenches, earth-reinforced pillboxes, dense minefields, and special fighting positions where the turrets of spare or severely damaged tanks were used as the artillery for the area. The problem facing the Germans was not so much the power of the individual fortifications, but the fact that the whole front could not be covered in anything like the desired troop density. The command of Army Group Center hoped that the available *Panzer* and *Panzergrenadier* units would be able to cover the thinly held gaps along the front.

Strategically, the task of Army Group Center was to prevent the advance of Soviet units along the easy campaigning terrain of westernmost Russia and eastern Poland. After taking a leaf from the Soviet book on the defense, it was hoped that the defenses would allow the Germans to hold out indefinitely against the Soviet Summer Offensive, while mobile units were rushed into position to deliver the *coup*. This decision had been made at the highest political level—by Hitler himself.

Hitler made a careful examination of the front, trying to guess where the Soviets, now with the initiative firmly in their grasp, would strike in their inevitable Summer Offensive. Given the weak hold that the Germans maintained along the Pripet River to the south of Army Group Center, and the fact that any other attack would have to cross numerous defended river lines, it was logical to assume that the Soviets would take the easy way out, the one that offered the greatest advantage for the least cost. It was assumed that the Soviets would attempt to force the Pripet River line, then roll up the southern flank of Army Group Center.

Unfortunately for the troops in Army Group Center, the assumptions were wrong. The Soviets planned to make a head-on assault against Army Group Center and its fortified localities. Although there was considerable evidence that the Soviets were planning a truly massive attack against the face of Army Group Center, a combination of Soviet diversionary operations (that would later develop into offensives in their own right) and careful control of radio traffic preserved both tactical and strategic surprise.

With a fine sense of history and irony, the Soviets launched their attack on 22 June 1944, the third anniversary of the German invasion of the USSR. In manpower alone, the Soviets outnumbered the Germans six-to-one, and they dominated all other categories in the same manner. Massive attacks by Soviet artillery divisions tore huge holes in the weakened German lines, while infantry assaults, backed up by armored units, ripped the gaps wider. Tank and mechanized corps poured through the gaps, plunging deep into the German rear, severing communications everywhere. While portions of the Soviet attackers rolled onward, others curved in behind the Germans in their fortified localities and trapped them.

The huge manpower losses inflicted on Army Group Center, as well as the materiel losses, had so weakened the horse cavalry units, while the river obstacles were bridged by wooden submerged bridges and crossed underwater by sealed tanks. Each of the fortified localities was completely surrounded by the end of the first week, and most had been captured, the troops inside them either killed or captured. The brutal combination of very heavy artillery bombardment and skillful use of combat teams of armor, infantry, engineers, and antitank guns made a mockery of the German defenses. With the front collapsing around them, just one though filled the minds of the German defenders—*Escape!*

During the first week of the offensive, over 20 German divisions were eliminated totally. Over 100,000 German soldiers died, and another 40,000 were captured—at one blow, over a third of the forces of Army Group Center had ceased to exist.

The pursuit that followed was as skillful as it was merciless. Frantic to stop the Soviet hordes, the Germans threw in everything they could scrape together in a series of uncoordinated counterattacks. The Soviets stood firm and allowed the attacks to batter themselves against their hasty defenses, then they counterattacked in turn, destroying the men who tried to block their path. During the third week of the offensive, the Soviet pursuit formed yet another pocket.

German troops, driven back and funneled into the city of Minsk, were surrounded after a fierce series of tank battles that enclosed them in a monstrous pocket—over a 100,000 German troops were trapped. Within a few days, the soldiers in the pocket had joined their comrades in death or captivity.

The hugh manpower losses inflicted on Army Group

A Russian *T-34* tank burns after being hit by German antitank fire. Although the Soviets lost many tanks to Army Group Center, their massive attacks overwhelmed the Germans and entrapped them.

Center, as well as the material losses, had so weakened the German Army that to resist was suicidal, yet still had to be done, no matter what the cost. The tables of 3 years before had been turned, and now it was the turn of the German Army to stand and die to protect its homeland. Reinforcements from the west, originally earmarked for the defense of Normandy, were hastily thrown in front of the Soviet offense. Finally, after just more than a month of fighting, the Soviets took a well-deserved rest.

In 32 days of heavy fighting, the Soviets had killed more than 400,000 German troops (i.e., the original strength of Army Group Center), captured another 150,000 men, and inflicted an immense number of casualties, destroying forever the trained offensive power of nearly 30 German divisions. From now on, the half-trained man- and boy-power of the Reich would suffer needless losses while the enemy still advanced without any serious opposition. Besides the heavy manpower losses, the materiel loss was enormous: huge supply dumps, railroad locomotives and rolling stock, more than 630 aircraft, 16,000 pieces of artillery, 60,000 vehicles of all sorts, and, most important, 2,500 tanks and assault guns—the equipment for five *Panzer* divisions.

What was even more significant for the future was not the fact that the Soviets had effectively emasculated the German Army, but that they had proven, without qualification, that they could conduct a *Blitzkrieg* attack against heavily reinforced positions—and win. To demonstrate the depth of the offensive, along a 400-kilometer front, the Soviets had managed to drive up to 500-kilometers deep into the German rear in 32 days, and the Soviets didn't make the same mistakes the Germans had commited in *Barbarossa*.

Besides developing effective tactics that integrated tanks, infantry, engineers, and antitank artillery into comprehensive assault groups reminiscent of the units formed for the assaults on the Mannerheim Line in the Winter War, the Soviets had developed adequate air-ground support tactics and massive employment of artillery that shattered even the stoutest defenses. Once the defenses broke, the Soviets plunged deep into the German rear, and when counterattacks struck at their lightly guarded flanks, the Soviets smashed them with ease. The pursuit was conducted over marginally suitable terrain for a large portion of the time, yet was most effective, destroying the German Army everywhere it tried to stand fast.

But most significant of all for the future was the fact that the Soviets demonstrated that they had learned the lessons of the *Blitzkrieg* better than their tutors. When the advance reached the limits of its supply lines, the Soviets stopped, rather than advance in a series of aimless, pointless, strategically insignificant attacks that would only wear out their trained manpower. Contrast this to the German dithering and aimless pursuit of tactical victories in the first few months of the Eastern Campaign.

Before the collapse of Army Group Center, the Soviets had demonstrated their ability as fighters; now they demonstrated their abilities as soldiers, and quite capable soldiers at that.

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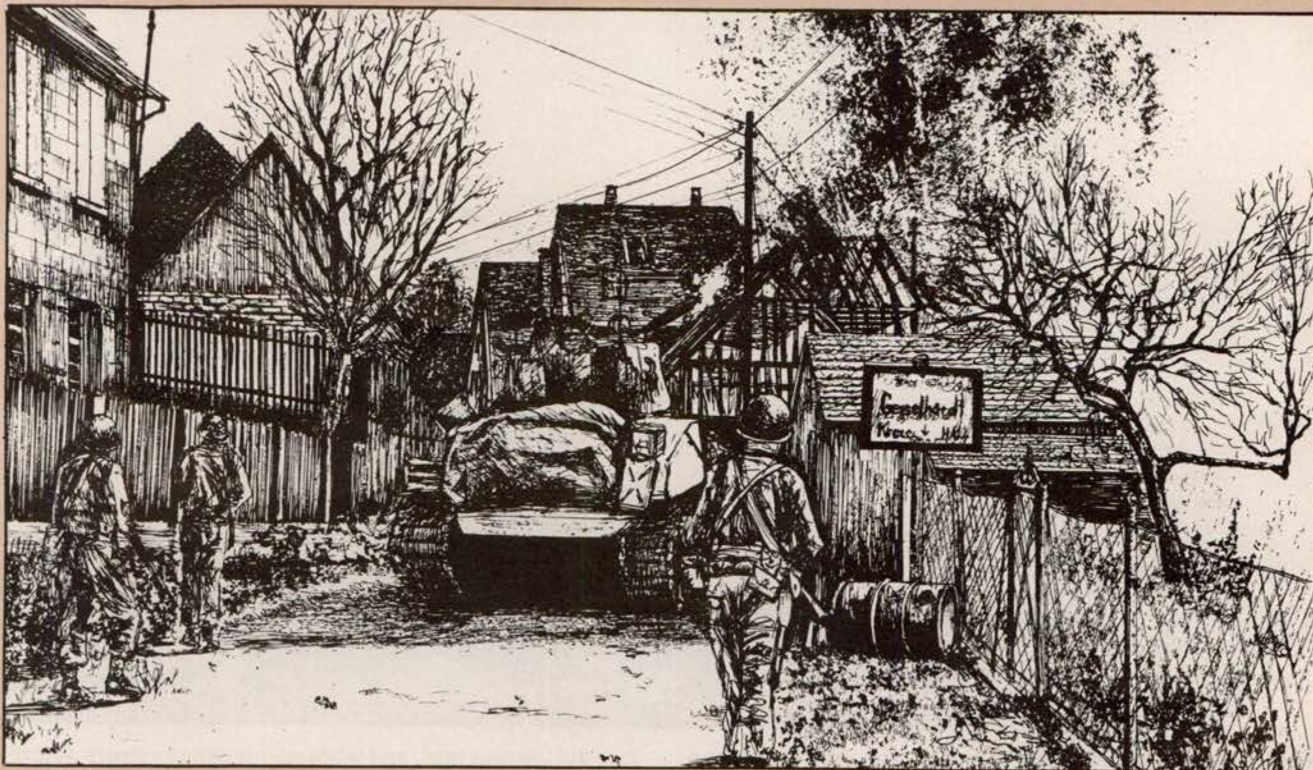


Tanks In Urban Combat

by Major Adolf Carlson

Late October 1973 found Major General Bren Adan's division racing to complete the encirclement of the Egyptian Third Army. After a crossing of the Suez Canal and a rapid drive south, Adan's tanks stood ready to cut the Cairo-Suez road, the Third Army's only line of communication. If Adan's forces could capture the City of Suez, they would not only isolate the Third Army, but would also consolidate Israeli control on the western bank of the Canal prior to the UN ceasefire.

To the Israelis, Suez City seemed a tempting target. They saw little evidence of Egyptian defensive preparations. In fact, this view of the situation was very much in error. The Egyptians had established a number of antiarmor kill zones in the town, covered by an array of *Sagger, RPG-7s,* antitank grenades, and Molotov cocktails.

On the afternoon of 24 October, an Israeli armored brigade, reinforced with a battalion of half-track mounted paratroops, attacked on two axes into the town. Because they wanted to seize the town quickly, the Israelis attacked with the tanks leading, advancing in column down the street. This desire to beat the clock was the brigade's undoing.

The main column proceeded without incident until it reached the first Egyptian kill zone. At that point, Egyptian *RPG* gunners destroyed the three leading tanks. Simultaneously, the last vehicles in column were hit, trapping the attackers. Once they realized they had been ambushed, the Israelis tried to escape into the side streets. After about an hour, however, the Egyptians, using the cover of the buildings, had destroyed or damaged all the column's vehicles. (See photo 1.)

The other Israeli column ran into a series of smaller ambushes rather than into one big kill zone, but the net result was the same. When the Israelis withdrew, they left 28 tanks and half-tracks in the town, while Egyptian losses were negligible. Other attempts to penetrate into Suez City were no more successful, and resulted in the loss of still more tanks. When UN forces arrived on the scene, the city of Suez was still firmly in Egyptian hands.

The battle for Suez City exemplifies the image that many tankers have of city fighting. Indeed, it illustrates all the vulnerabilities of the tank in urban areas, and does so even more vividly when one asks whether the battle need have been fought at all. In order, then, to understand the impact of urban terrain on the tank, let us begin by examining these vulnerabilities in greater detail.

FM 90-10, *Military Operations on Urbanized Terrain,* points out that armored forces "have been trained to avoid built-up areas whenever possible," but goes on to say, "Tank crews must expect to fight in built-up areas as an integral part of the combined arms team." This article will describe the nature of urban combat, as the tanker might experience it, and suggest ways to enhance the contribution of armor to the urban battle.

There is a World War II British manual on house-to-house fighting in the Infantry School Library that says: "The motto for soldiers fighting tanks amongst houses is 'keep *Above* it or keep *Below* it.'" This advice is based on the inability of tanks to fire into upper stories or into basements at close range. Main gun elevation for modern tanks varies from 11 degrees to 20 degrees above the horizontal, while depression varies from 3 degrees to 10 degrees below the horizontal (Table 1).

Let us look at the urban vulnerabilities of an illustrative imaginary tank, with a main gun elevation/depression of +18 degrees to −10 degrees.

Table 1. Main gun elevation and depression

Tank	Caliber	Elevation (Degrees)	Depression (Degrees)
M-60	105-mm	+19	−10
T-62	115-mm	+15	− 3
Leopard	105-mm	+20	− 9
Chieftan	105-mm	+20	−10
S-Tank	105-mm	+11	−11
AMX-30	105-mm	+20	− 8

On a street 16 meters wide, which is fairly common in European cities, we can see that there is a zone at or near street level into which the tank cannot fire. (See figure 1.) Similarly, there is also a zone overhead into which the tank cannot fire. (See figure 2.) These dead spaces are the ideal locations of short-range antiarmor systems, because the antitank gunner can take advantage of the cover and concealment of the buildings, can fire at the tank when the tank cannot return fire, and can engage the tank's weakest points: the flanks, rear, and top.

In addition to these shortcomings, tanks are at a further disadvantage because of their dimensions. City streets, corners, overpasses, underpasses, and alleys are not normally designed for vehicles that weigh 40-60 tons and measure 8-11 feet high, 12 feet wide, and 30 feet long.

These factors impact not only on the effectiveness of the vehicle itself, but still more significantly on the man-machine system. For tankers buttoned up in an area in which a mortal blow could come from any one of a number of unseen locations, the result is a claustrophobic hesitancy. In his *Notes on Urban Warfare,* S.L.A. Marshall contends further that "when they are taken under fire, claustrophobia intensifies, and their fears about the situation become phantasmagoric."

It is entirely understandable, then, that tankers don't care to fight in urban areas, and only compelling circumstances would suggest that they should. Yet, especially on a European battlefield, two factors make the employment of tanks in urban areas not only a likely contingency, but an absolute necessity.

The first factor is the spread of urbanization itself. In the last 30 years "urban sprawl" has altered the nature of potential battlefields, especially in West Germany. This is because urban growth and mechanized armies seek the same types of terrain: relatively flat, open, and firm. As a result, the classic maneuver routes into West Germany are blocked, canalized, or dominated at many locations by villages, towns, or cities. These urban areas are potential obstructions with which an attacker must contend. By themselves, they constitute only a minor impediment to movement. Exploited by resolute defenders, however, they can be transformed into the most formidable of obstacles.

The second factor is the infantry's need for the support of tanks. As might be inferred from the foregoing discussion, the infantry is the element of the combined arms team that assumes the major role in urban fighting. There is one key requirement for success, however, that the infantry cannot provide for itself—heavy direct fire support. To understand why requires a closer look at how direct fire contributes to the urban battle.

Fire Support in Urban Combat

In October 1944, elements of the First U.S. Army were fighting to encircle the German city of Aachen. Because the city's commandant had been ordered to defend to the last man, he refused an American surrender ultimatum. Thus fell to the U.S. 1st Infantry Division the mission of clearing the city. Since the bulk of the division was engaged in breaching the Siegfried Line, only two battalions of the 26th Infantry were available to attack Aachen. The Germans in Aachen consisted of 5,000 troops, mostly from the 246th Volks Grenadier Division.

To compensate for this numerical disparity, the 26th Infantry's commander, Colonel John F. R. Seitz, planned to make maximum use of armor, artillery, and air support, which the Germans could not match. He attached a number of tanks and tank destroyers to the two assault battalions. The Germans had only 5 tanks and about 30 artillery pieces in the town.

On 11 October, U.S. Forces began a massive preparation. *P-38s* and *P-47s* dropped some 62 tons of bombs on targets in the town. This bombardment was followed by an artillery preparation by 1st Division artillery and 12 battalions of VII Corps artillery, about 5,000 rounds in all. On 12 October, 99 more tons of bombs and 5,000 more artillery rounds were fired on Aachen. Although most of the bombing and shelling was accurate, patrols reported no appreciable reduction in German fire.

The assault battalions jumped off early on 13 October. Each of the commanders had taken measures to insure the greatest possible mutual support and coordination between elements.

Photo 1. This Israeli *Centurion* fell victim to an Egyptian ambush in Suez City during the October 1973 war. When the Israelis withdrew from the city, they left 28 tanks and halftracks behind.

Photo courtesy of Military Review

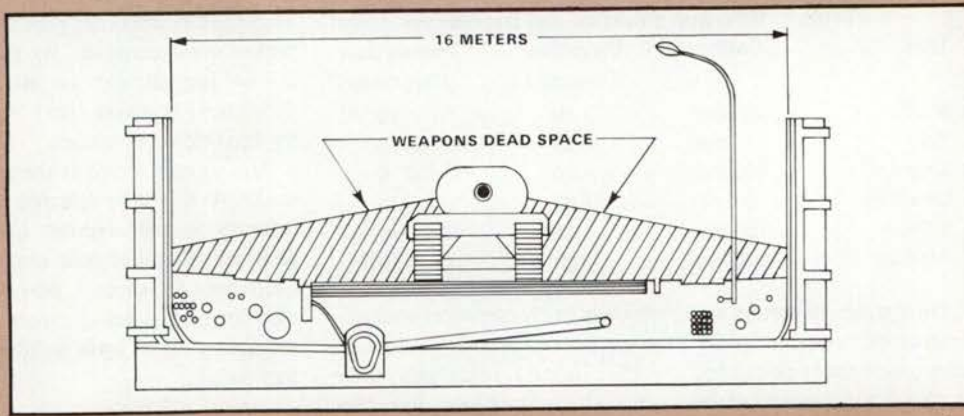


Figure 1. Tank main gun dead space at or near street level.

In Lieutenant Colonel Derrill M. Daniel's 2d Battalion, for example, small assault teams were formed, each consisting of a rifle platoon and a tank or tank destroyer. Each assault team was tasked to clear along one street. The infantry provided security for the tanks, while the tanks provided heavy direct fire against buildings identified as targets by the infantry. The result of this shelling was to drive the Germans into the cellars, where the infantry was able to storm them after a barrage of hand grenades. Flame or demolition teams would be brought forward from company headquarters to engage particularly tough strongpoints. Contact points designated at street intersections prevented any assault team from moving so far ahead of the others that it could be encircled. The 3d Battalion, commanded by Lieutenant Colonel John T. Corley, operated similarly.

Fighting in Aachen continued until 21 October, with both sides able to commit more forces to the battle. American tactics were basically effective, but not without some unfortunate incidents. In Company K's zone, for example, a German 20-mm cannon forced the riflemen off the street. Two accompanying tanks were left exposed, and were soon knocked out by German *Panzerfausts*. In general, however, the effective low level cooperation between tanks and infantry was key to the hard won victory of the 26th Infantry. The official history said "few units, German or American, experienced much success unless tanks were on hand."

The Battle for Aachen illustrates a number of key features about fire support in urban areas.

The first is the relative ineffectiveness of indirect fire support. Artillery rounds landing in the midst of buildings are difficult to sense and adjust, especially against targets located in the middle floors of a building. Furthermore, the buildings themselves provide those targets with a rather good degree of protection. As was experienced in Aachen, buildings which are rubbled can be used effectively for cover. Even huge expenditures of artillery will have relatively little effect on troops in buildings.

In contrast, the second feature of urban fire support is the effectiveness of direct fire support. Once a target can be located in a building, one or two direct fire rounds can do what entire salvos of artillery can not do. Direct fire support has in recent history been a key to success in urban fighting, most of it provided by armor.

The third feature of urban fire support is the requirement to protect direct fire weapons. As was seen in Company K's unfortunate incident, once the infantry moving with the tanks is suppressed, even for a very short time, the tanks become extremely vulnerable.

There are, of course, direct fire systems organic to infantry battalions, mainly Antitank Guided Missiles (ATGM) (recoilless rifles in some units), and Light Antitank Weapons (LAW). In tests conducted by the U.S. Army Materiel Development and Readiness Command (DARCOM), however, these systems were not as effective as tank rounds for neutralizing targets behind walls. Their findings were that antitank missiles and Armor-Piercing, Discarding-Sabot (APDS) rounds would neutralize a target only if that target were located directly opposite the point of impact. The tank High Explosive Antitank (HEAT) rounds, however, displaced a large amount of wall material into the room in the form of incapacitating fragments, thereby neutralizing or suppressing anyone in the room. This phenomenon is what suppressed the Germans at Aachen. It would occur with even more reliability with today's 105-mm HEAT round, but not with any of the infantry's current antitank rounds. (See figure 3.) ATGMs are at a further disadvantage because of their 65-m arming distance, which limits employment in the very close range engagements characteristic of urban fighting, as opposed to 25-30 feet for the 105-mm HEAT round.

The tank's main gun rounds can also be used to blast holes

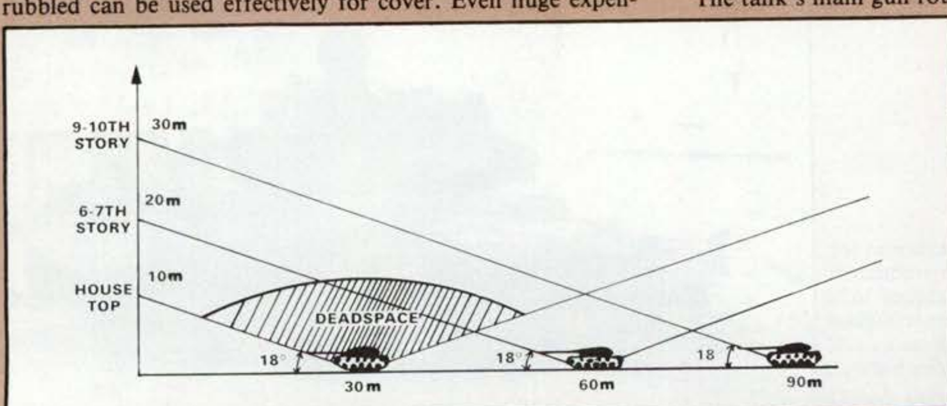


Figure 2. Tank main gun dead space above street level.

in walls for entry of assault forces. During the fighting in Manila, for example, the Japanese established a strongpoint in the bleachers of Rizal Baseball Stadium. Troopers of the 1st Cavalry Division cleared the stadium with the support of three tanks which blasted a hole in the concrete wall. (See photo 2.) Based on BRL's research, today's *M-60* tank would have been even more effective. Most of our current family of antitank weapons, on the other hand, would have been able only to punch little holes in the wall. (One caveat which should be mentioned here is that none of the weapons tested would remove the steel reinforcing bars from reinforced concrete walls.)

The foregoing examples of the effectiveness of infantry assault teams supported by tanks call for a reassessment of our concept of combined arms for urban combat.

The Soviet View of Tanks in Urban Combat

The Soviets hold that motorized rifle troops play the key role in urban fighting. But unlike some U.S. military thinking, Soviet handbooks stress that no branch of the Army can operate on the modern battlefield without the support of the others—especially in built-up areas.

Soviet tactics, as outlined in the manual *Combat Action of a Motorized Risk Battalion in a City,* are based on hard combat lessons learned on urban battlefields during World War II. It was during the Battle for Stalingrad that the main Soviet urban combat tactic emerged: the action of combined arms assault or storm groups. This tactic was tested in city battles all the way to Berlin, and has emerged virtually unchanged as the modern Soviet approach to urban combat.

The Soviet assault group consists of a motorized rifle company or platoon, with a platoon of tanks and other support elements attached. In the offense, these tanks support the infantry's assault; in the defense, they contribute to antitank fires. Where possible, these tanks are committed by platoons, but, if the terrain requires, as often happens in urban fighting, they can be committed in pairs or as individual tanks. The act of attaching tanks to motorized rifle troops clearly establishes that the motorized rifle company commander or platoon leader is in charge, regardless of the ranks of the individuals involved. (See photo 3.)

These Soviet tactics impact on U.S. forces in two ways. First, U.S. forces committed to combat Soviet forces in urban areas must protect themselves from the heavy fire support of Soviet tanks. Second, U.S. forces fighting in urban areas will encounter a great number of armored targets, requiring carefully coordinated antiarmor fires.

Combined Arms Tactics in Urban Areas

A comparison of Israeli experiences in Suez City and the U.S. in Aachen would indicate that tank-heavy forces may be at a severe disadvantage in urban combat, but that a few tanks working with the infantry can be extremely effective, especially if the tanks and infantry work well together at the small unit

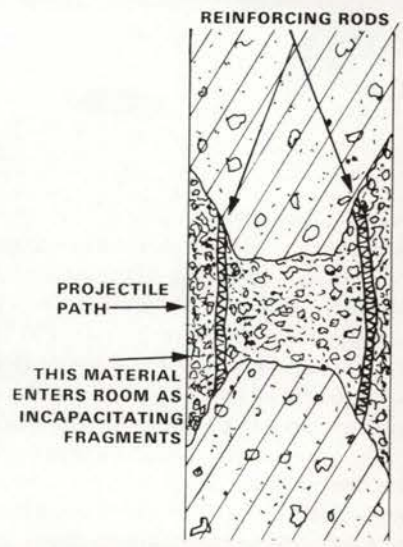


Figure 3. The spall created by a HEAT round striking a reinforced concrete wall will inflict casualties inside a building.

Photo 2. Troopers of the 1st Cavalry Division enter Rizal Stadium in Manila through a hole blasted out of a concrete wall by tank main gun fire.

Photo 3. When tanks or tank units are attached to Soviet motorized rifle elements, the commander of the motorized unit is in charge regardless of the ranks involved.

level. Patton once said that "the purpose of tanks in an infantry division is to get the infantry forward...," and nowhere is that more true than in urban areas. Our current combined arms doctrine recognizes this fact. FM 71-1, for example, says that "...tanks must use the cover of cleared buildings to support infantry by fire," and later that "individual tanks or tank sections may work together with a platoon or squad...."

The problem here is that this advice fixes neither authority nor responsibility. Does the tank commander look to the rifle platoon leader or to the tank platoon leader for fire control information? Who resupplies the tank, the rifle platoon leader or the tank platoon leader? That these matters can cause problems is borne out by Marine Corps reports from fighting in Seoul and Hue. If, for example, an infantryman on the ground does not point out a target for the tank commander, the tank will be exposed for a longer interval than necessary trying to acquire it. Likewise, tankers in Seoul and Hue were reluctant to rely on the infantry to bring their ammunition forward, and while they withdrew to rearm, the battle slowed to a halt.

The Soviet technique of attachment may not be the answer for us. The term does not mean the same thing as used in Soviet and U.S. military parlance. We do not, for example, attach an element to another of like size. Nor does a rifle platoon normally have the capability to support tanks logistically, as our use of the term would require. Neither would it be adequate to hold that a tank platoon leader will always control his tanks in urban fighting. Platoon leaders in cities can normally control only what is on one street—an area that is too narrow for maneuvering a tank platoon.

I would like to propose that a better command relationship is operational control (OPCON)—a tank OPCON to a squad, a section OPCON to a platoon, or whatever the situation requires. OPCON would give the infantry leader fire control authority. He could communicate target information over the tank's external telephone. The infantry would incur the responsibility of securing the tanks, moving dismounted in front to clear the way, with perhaps a fire team moving with the tanks for close-in protection. Rearming responsibility would remain with the parent tank unit.

Against targets protected by structures, the tanks would be brought up to the most covered location providing a shot at the target. On-the-spot instructions, given by the infantry leader, would insure that the tank's fire is accurate and that the tank's exposure is minimized. Against armored targets, the tank would engage the lead vehicle, which will normally present its front as a target area. With that vehicle blocking the street, the infantry would climb into the buildings for overhead and flank shots on subsequent targets.

In a critical area, the tank platoon might receive a mission of insuring that one of its sections is continuously OPCON to an infantry unit. The advantage of this arrangement is that as the section must go back to rearm, the other can take its place, thus providing continuous mobile fire support. The uncommitted section can be used to react to contingencies, if necessary.

Finally, one way in which a tank platoon leader might be able to control his entire platoon is in an armored ambush, a concept developed in a French study on urban combat. This tactic could be employed at an urban chokepoint, such as an overpass. Infantry observation posts, under operational control of the tank platoon leader, detect the oncoming enemy armor while the tanks wait in hide positions. As the enemy approaches the kill zone, the tanks move into position where they can fire down streets at about a 500-m range. High-velocity tank ammunition would enable them to shoot and move to other firing positions before the enemy could counterfire. (The TOW's time of flight would be too slow.) By shooting and moving, the tanks reduce the chance that they will be neutralized or suppressed. Other infantry troops, screening forward, can detect enemy reaction to the ambush. (See figure 4.)

Training

One characteristic of many urban combat experiences has been a general lack of adequate prior training. Even in such a well-executed campaign as the German invasion of Poland, this shortcoming was evident. Von Manstein tells us, "...individual units had occasionally shown signs of jitters, particularly when fighting in built-up areas." In the next war, we may not be able to make up for such jitters.

It follows, then, that the Army must develop training objectives for tank crews working with infantry in urban areas. A proposed example might be written as follows:

Task: Engage an enemy machinegun firing from a loophole in a masonry building.

Conditions: Tank is in a hide position, supporting a dismounted rifle platoon attacking in an urban area. The target is acquired by the infantry. Target data is relayed to the tank commander via the tank's external telephone. Elements of the rifle platoon provide security for the tank.

Standards: Crew moves tank to a firing position, exposes as little of tank as possible, engages target with HEAT ammunition within 10 seconds of moving into firing position.

This type of a training objective also has implications regarding the design of training facilities and training devices. Urban training facilities must be durable enough to support the weight of tanks. Also, fire simulation means must be developed to judge the speed and accuracy of tank crews engaging urban targets.

Other Fire Support

In light of the vulnerabilities already identified for tanks in urban areas, a fair question might be to ask what other weapons might be used to provide direct fire support to the infantry.

In the battle for Aachen, the 3d Battalion, 26th Infantry found that some of the stronger buildings and shelters could withstand the fires of tanks and tank destroyers. The battalion commander, LTC Corley, called for the support of a self-propelled 155-mm artillery piece. This weapon soon proved its merit, almost demolishing a building with its first shot. The regimental commander was so impressed that he ordered another 155-mm gun to support the 2d Battalion as well. When one of these weapons drove up to fire on the German headquarters in Aachen, the German commander surrendered with the observation: "When the Americans start using their 155s as sniper weapons, it is time to give up."

Although self-propelled artillery pieces are not as heavily armored as tanks, they still can be used in urban combat if adequately secured by infantry. As we have already seen, it is the armament, not the armor, which gives a weapon its urban combat capability. The scarcity of U.S. artillery pieces, however, will probably be a more limiting factor.

In a Soviet motorized rifle division, for example, there are 108 tubes of 100-, 122-, and 152-mm artillery which could be used for direct fire support. If, as they claim they did on occasion during World War II, the Soviets devote 40 percent of those pieces to direct fire support, 65 tubes would still remain for use as conventional artillery, one less than the number of 155-mm and 8-in pieces in a U.S. mechanized infantry division. Add to the Soviet side another 18 multiple rocket

Figure 4. This sketch illustrates how a platoon leader might control his platoon during an armored ambush. Note the use of an infantry observation post to give early warning of approaching enemy tanks.

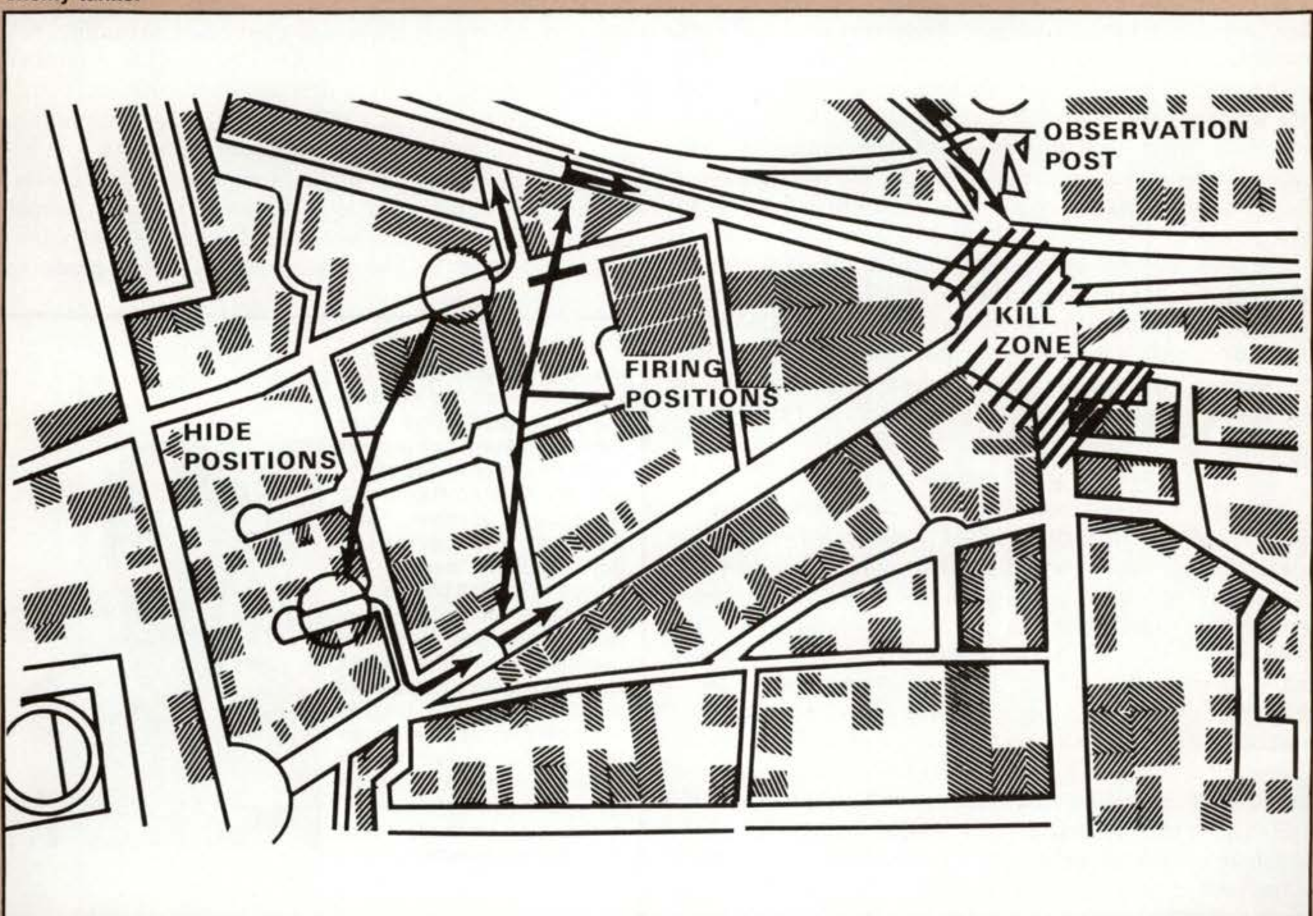


Photo 4. Although self-propelled artillery pieces are not heavily armored, they can be used in urban combat. Here, a Soviet assault gun moves through a city during World War II.

launchers, and it becomes apparent why the Soviets feel they can afford to use artillery pieces to reinforce the tanks' direct fire in urban areas.

An additional point which should be made here is that most of the accounts of self-propelled artillery in Soviet World War II literature refer to self-propelled assault guns, designed on tank chassis for the specific purpose of supporting infantry assaults. There is no U.S. equivalent. (See photo 4.)

The most likely use of U.S. artillery in an urban direct fire role will be to reinforce tank fires against very tough or very important urban targets. Because of their availability and habitual relationship with infantry, tanks will remain a more common direct fire support means than artillery in urban areas.

The same applies to the Combat Engineer Vehicle (CEV). In addition to its 165-mm gun, the CEV's blade and hoist give it a significant urban support capability. There are few CEVs in a division; therefore, they would be used best to reinforce direct fire support against tough or high priority targets, and not to replace the tank as the common means of direct fire support.

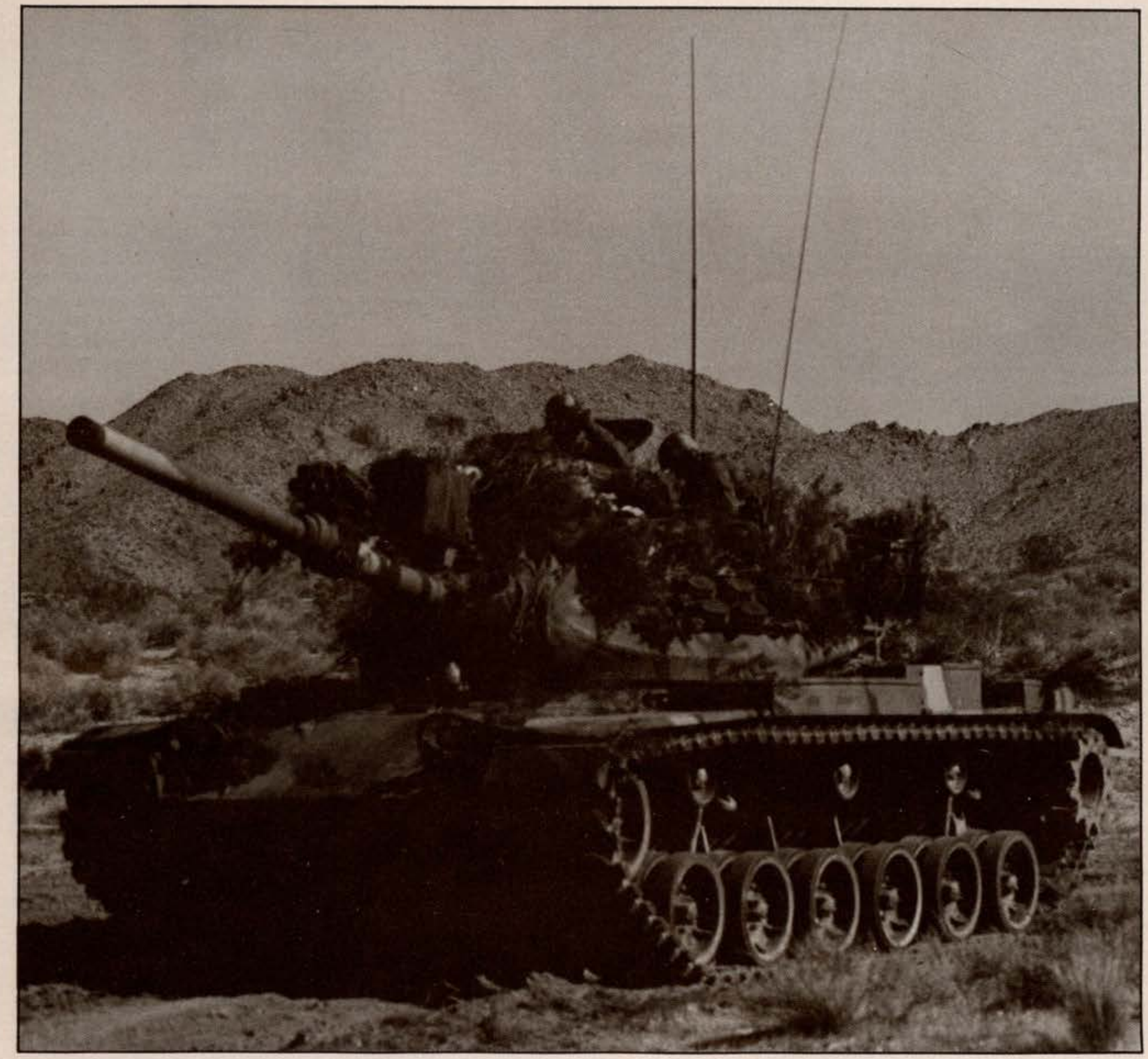
Tank Design

Although it is too late to change the characteristics of fielded tanks, the Army should look closely at those characteristics which would enhance the urban combat capabilities of tanks designed in the future. To reduce vulnerability in an urban area, for instance, developers might consider such measures as hull mounted machineguns and firing port weapons. These features are somewhat of a throwback to the early days of tank design when defense against infantry was an important feature of tank armament. Likewise, an innovative design of the tank's main gun might increase its maximum elevation/depression above today's +20-degree to −10-degree range. Other characteristics that should be considered include the size and weight, vision equipment, and exposure of the vehicle when engaging urban targets. Finally, we need to test gun systems to insure that we retain an adequate antistructure capability and short enough projectile-arming distance for effectiveness against urban targets.

Conclusions

If war were to break out in Europe tomorrow, which army would be the best prepared to fight in the urban areas? There is no way of answering that question short of actual conflict. But we can say that the basic ingredients of the U.S. combined arms team, the tank and the rifle squad, are at least as well-suited to city fighting as can be found in any army in the world. The only place in which we may be lacking is in interest—the mutual desire of the armor and infantry communities to solve the urban combat problem together. I would like to conclude this article by urging all tankers and all infantrymen to do what they can to develop the teamwork necessary to win the urban battle.

MAJOR ADOLF CARLSON was commissioned in Infantry upon graduation from the U.S. Military Academy in 1969. He is a graduate of the Infantry Officer Basic and Advanced Courses, and Ranger and Airborne Schools. His service includes duty with the 1st Cav Div in Vietnam and as a platoon leader and company commander in the Berlin Brigade. He also has served as a battalion and brigade staff officer, and as an urban combat subject matter expert at the U.S. Army Infantry School. He is currently assigned to the G-3 Section, Berlin Brigade.



Improving Combat Skills— The National Training Center

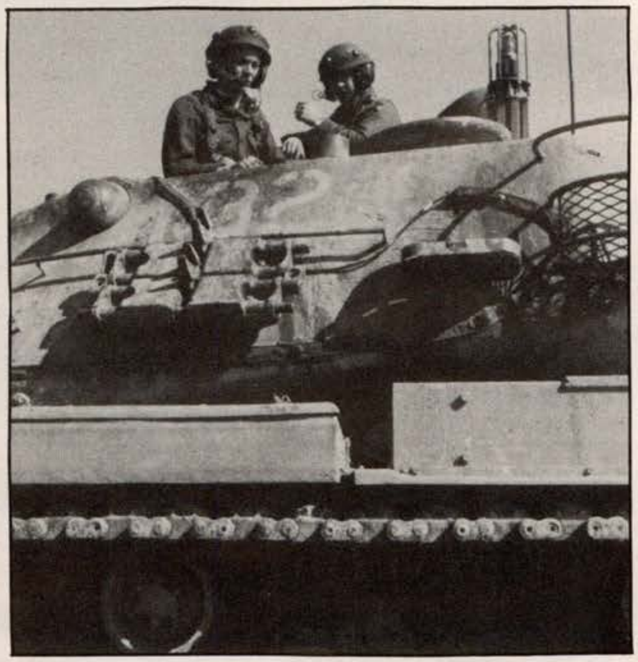
by Captain Mark Chaney and Captain Michael W. Cannon

The concept of a National Training Center (NTC) is rapidly becoming a reality at Fort Irwin, located in a remote section of California. For those not familiar with the program, the NTC is to be a combined arms training area through which active army battalions will proceed in increments of 2 weeks per battalion. The NTC will provide extensive maneuver areas (almost 650,000 acres), a live fire range, and an instrumented maneuver area. The overall concept and development is covered in the February 1980 issue of *ARMY* magazine. The live fire portion of the NTC is discussed in the March 1980 issue of *Military Review.* The thrust of this article will be directed toward the instrumented portion of NTC, giving a detailed discussion of the major parts. The experiences of Troop F, 2/3d Armored Cavalry Regiment during the initial phases of the system testing will also be covered as will some of the "lessons" brought out by the training.

The instrumentation package consists of three distinct parts; the Multiple Integrated Engagement System (MILES), trans-

Photos By Richard Morris

Soldiers mounted in *M-113* APCs maneuver over the varied desert terrain of the U.S. Army's newest and finest training area—the National Training Center. The Center's 650,000 acres provide room for battalion exercises involving opposing forces that employ threat tactics.

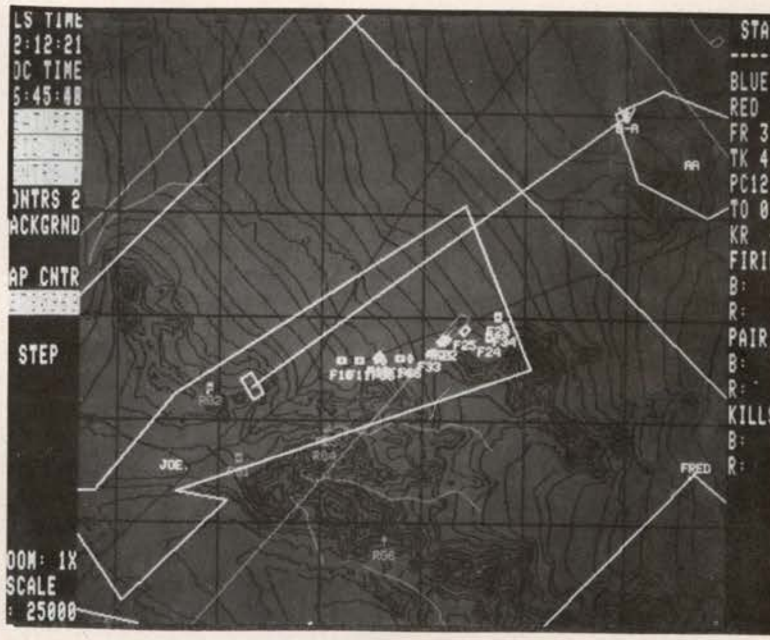


This tank and its crewmen are equipped with the MILES sensors mounted in straps attached to the base of the turret and on the helmets and web gear of the crew. When the sensors are struck by a "killing" round from a laser main gun simulator of an opposing tank, the tank's master switch is automatically turned off, a colored smoke grenade is discharged, and a flashing yellow beacon mounted above the turret is activated.

mitting and receiving devices, and a computer setup with audio, video, and recording capability.

MILES, developed by Xerox Electro-Optical Systems, provides the capability to conduct tactical engagement simulation in realtime, using low-powered (eye-safe) laser transmitters, detectors, audio alarms, and visual cues to simulate live weapons and their effects. Weapon systems, including the coaxial and cupola, have a low-power laser transmitter which emits a split beam that allows the engaged target to be hit or placed under suppressive fire. Additionally, the laser coding allows for kill differentiation (for example an *M-16* will not disable or kill a tank).

Target troops or target combat vehicles are made aware of a kill or near miss by means of audio alarms. Detectors worn by individuals are mounted on harnesses approximating webgear. Detectors are mounted on combat vehicles on strips of fabric secured to the vehicle by Velcro. On the *M-113* armored personnel carrier (APC), plastic strips are also mounted with Velcro to protect the detectors. When a near miss occurs, a short audio cue is emitted by an alarm attached to the soldier's webgear or by the combat vehicle's intercom. When a kill is made, the tone is continuous. Additionally, the engaging weapon system is presented a visual cue that indicates a hit or near miss by a strobe light mounted on the target vehicle. The light blinks twice in the event of a near miss, and continuously when a kill is made. The tone is silenced during tactical play by taking a key from the weapon system laser transmitter and inserting it into a specific receptacle for each type of MILES



A video display of the instrumented maneuver area can be used to project a color-coded trafficability study or to present a contour map. Units are represented by conventional symbols or as individual vehicles identified by bumper markings. Graphics of operations overlays can also be shown.

system. This disables the laser transmitter and removes the "casualty" from play.

Each controller is equipped with a hand-held controller gun designed to test the detectors before the tactical exercise begins. It also gives the controller the capability of inflicting a near miss or kill on any weapon system with a 3-kilometer range. Although useful as a testing device, it also provides the controller with a method of keeping the participants from doing things that would be unacceptable in combat, but, due to system anomalies, unpunishable in problem play. The controller gun also allows indirect fire to be introduced into the problem through the controller.

Antitank weapons and their characteristics are also brought into play. Xerox has developed an Antitank Weapons Effects Signature Simulator (ATWESS) to provide the smoke, flash, and report for the family of antitank (AT) weapons (TOW, *Dragon*, and *Viper*). The laser transmitters for the TOW and *Dragon* have been designed to replace the tracker head and missile transmitter, respectively. It requires that a realistic firing procedure be followed and that the gunner track the target. A TOW gunner must successfully track the target for 10 seconds while a *Dragon* gunner must track for 7 seconds.

The first link between the MILES system and main computer is a series of 19 solar powered "A" stations, located on prominent terrain features in the area. Each combat vehicle has its own Range Measuring System (RMS), Micro "B" unit, and battery box which are approximately the size of two .50 caliber machinegun ammunition boxes. The Micro "B" unit transmits engagement event information to the "A" stations, which determine range measurements to each combat vehicle and retransmit this data to the "C" station. The "C" station controls the RMS and, by so doing, provides combat vehicle position location coverage and engagement registration. The "C" station transmits its data to the central processing unit which correlates all the data from "A" and "C" stations to determine vehicle location and correlate engagement events in time.

The final, and by far the most impressive, part of the system is the core instrumentation system or main computer. Our purpose here is to describe only what the computer can provide to the user as the authors of this article are self-professed "subject matter non-experts" on the technical considerations and characteristics. Data received from the central processing unit is fed into the main computer and selectively displayed on video monitors. There is also a large screen where the display can be projected. Figure 1 shows a sample photograph taken of the actual video display. The background for the picture can be a color-coded trafficability key or a contour map having a scale of 1:25,000; 1:50,000; or 1:100,000. Terrain features such as roads, trails, and rivers are also indicated. Units can be shown by their respective symbology or an individual vehicles, represented by a symbol and its bumper number. As the vehicles move on the ground, their symbols move on the video display at the appropriate speed. The computer has the ability to shift the center of the display so that different parts of the maneuver area can be observed. Graphics for overlays provided by the commander or staff can be superimposed on the map at the viewer's discretion. Artillery fire is represented by showing the battery location, line-of-flight, and impact area.

Various data are provided adjacent to the map display. On the left side of the screen, the Position Location System (PLS) shows actual exercise time and below that the local (LOC) time is indicated. A color-coded trafficability key or terrain features are also displayed on the left. Grid coordinates for display center and the map scale area are also shown. Information portrayed to the right of the screen shows the overall picture in terms of force ratios and number of kills versus ammunition usage (firings). It also computes the number of rounds fired, the number of kills, and the pairings.

Although the total system is targeted on battalion commanders, the individual vehicle displays provide a learning potential for company commanders, platoon leaders, and soldiers. As the vehicle moves during the problem, the computer-generated symbol moves on the display. This enables the commander to scrutinize assembly area dispersal, terrain usage, response to oral orders, and road march intervals. MILES data is also reflected in that when a vehicle fires and achieves a hit, an arrow moves from the firing vehicle toward the target vehicle. If a kill is made, a black box surrounds the vehicle that was hit. A near miss shows only the arrow. Firing data, listing the vehicle firing, range, target, and

results are also reported. Every radio net is recorded at the same time as the video display so that radio traffic can be correlated with vehicle movement during the replay. When played back, tape and audio recordings provide valuable feedback for all personnel involved in the problem in much the same way as a football game film does. Movement techniques, coordination problems, accurate spot reports, calls for fire, and firing effects are all there for the crews and leaders to study and discuss.

Another valuable aspect is the interaction and discussion between the opposing force (OPFOR) and friendly units as to what each did right or wrong. These discussions reinforce the training received during the day and bring good techniques or errors into sharp focus. Although Troop F was in reality a cavalry troop slightly augmented for the exercise, it was organized at Fort Irwin as a tank-heavy team (equipped with *M-48A5s,* not *M-60s*). Two TOW vehicles were put under the control of the infantry platoon leader. These were usually taken under control by the company commander when maneuvering. The normal sequence of events was a morning maneuver followed by an afternoon critique. The exercises that Troop F went through validated many doctrinal concepts and at the same time questioned the validity of many others.

Perhaps the primary lesson that was driven home was the value of combined arms tactics. Extensive trial and error showed the fallacy of the idea that, due to their firepower and flexibility, tanks should always lead during movements to contact. In order to clear out long-range AT weapons or dismounted infantry with AT weapons, the infantry has to be up front. If not leading, the infantrymen should be at least even with the lead element so that they can react swiftly. Even in the desert, the supposed hunting ground of the tank, dismounted infantry can wreak havoc on mounted forces. This is especially true when vehicles encounter subtle terrain irregularities that limit their movement.

The weaknesses of the tank and infantry at extended ranges have to be counterbalanced by the judicious employment of the TOW. Consolidation under the company commander usually proved to be the most effective means of its employment. In this manner the TOWs maneuver to cover the team and are more responsive to changes in the tactical situation.

This brings us to the second most important lesson gleaned from the training. The long-range heavy antitank weapon (HAW) dominates the battlefield. The diehard tankers are probably drawing their swords in protest, uttering many valid comments. Some are saying that the HAW was employed in an area where visibility was much more extended than will ever be encountered in Europe, where the maximum engagement ranges are around 2,000 meters. This is true. Others will undoubtedly say that the tank can get off several well-aimed rounds in the time required for one complete TOW shot. This is also true. The advantages that cause the TOW to dominate revolve arounds its size, mobility, range, and signature (yes, signature).

The mobility and size of the TOW speak for themselves and need no further explanation.

The range gives it an advantage over tanks even when not employed at its maximum range. Time and again at Fort Irwin the TOW would rack up kills at 2,000-3,000 meters while the tanks and infantry were closing to their effective range. The options of the attacker were severely limited. He could close rapidly with the enemy, reducing his time in the open while restricting his ability to provide effective countermeasures, or he could stage a more methodical advance that would offer him some counterfire capabilities but would keep him at a range disadvantage for a longer period of time.

The other points are not quite so obvious. The TOW's signature was not as revealing as some have claimed. Unexpectedly, the best way to sight the TOW was to place it in a hide position with only the launcher showing. Surprisingly, it was better to skyline the launcher than to blend it into the background. The resultant smoke then appeared to be clouds and was much less noticeable.

The efficacy of the TOW and limitations of the tank at extended ranges call into question the use of the TOW in the present-day cavalry platoon. A more effective way to employ the TOWs than in a scout section leading the platoon might be to consolidate the TOWs at troop level or have the TOWs overwatch movement of the scouts and tanks as they maneuver within the platoon. One possible organization may be to have two tanks and two TOWs in one section and two tanks and two scouts in the other. This would give the scout section a rapid fire suppressive capability while providing the overwatch section with accurate long-range fires.

The AT system can be defeated if the target crew is alert. Zigzagging or choppy movements make a vehicle much more difficult to track and thus to hit. The TOW requires a smooth tracking for a hit unless the gunner is extremely proficient. Another weakness of the TOW is the limited field of vision of its optics. Inside 1,500 meters, if the target vehicle can move generally toward the missile system and zigzag, there is a good chance that it may move outside the gunner's vision.

During the first few days of the maneuver, the friendly force commander found to his amazement that he was getting beaten severely by a much smaller force (force ratios of up to 6:1 were common). His ultimate solution—an analysis of the mission, enemy, terrain, and troops and time available (METT). Yes, METT, the butt of many a classroom joke. The more detailed the analysis of the enemy forces (and the possible actions) and scrutiny of the terrain, the better the unit's performance was. Minor topographic irregularities on the map became likely enemy hide positions. Conversely, they also became good overwatch positions or covered or concealed routes. The MILES system forced the attacker to slow down and hug the terrain, thus rewarding good map reconnaissance and study. It also forced the commander to stick to the basics.

Fancy or grandiose schemes should be left to generals. Small unit commanders must concentrate on covered and concealed maneuvers, finding the enemy, fighting his flanks or weak areas, and using fire and maneuver to achieve superiority. The unit must meet the enemy "head on" with the smallest force possible and destroy him, constantly applying pressure if he delays so that he cannot break contact and regroup.

Overwatch was found to be an indispensible part of any move where contact was found to be remotely possible, no matter what size the unit. Crews that are in overwatch positions provide the maneuver element with extra sets of eyes that increase the chances of leading elements surviving enemy contact. A tank commander cannot move, tell his driver where to go, read a map, talk on the radio, and look for the enemy all at the same time.

The benefits of overwatch are negated, however, unless constant communications can be maintained between overwatching and bounding elements. This was made clear on several occasions at Fort Irwin, but none so obvious as during one OPFOR withdrawal. An OPFOR tank was making a high speed "rearward displacement" when it was taken under fire by a force of friendly tanks and TOWs. An overwatching OPFOR vehicle could see the weapon signatures of the friendly force pursuers and informed the tank when it was being "fired" at. This enabled the defender to couple evasive maneuvers with straight line movements and reach cover safely even though several rounds were fired.

Artillery as a suppressive fire and as a counter to direct fire and observation proved its worth many times. The most effective tactic was to first use indirect fire to force the enemy to button up and then hit him with concentrated fires. The impact on morale caused by sudden casualties was heightened by the limited visibility inherent in a buttoned-up posture. Artillery-delivered smoke often enabled the attacking commander to strip away the defender's position advantage. Whenever possible, the company commander should be allowed to employ smoke when and where he needs it. Restricting smoke to the use or approval of battalion and higher level commanders drastically increases the unit's vulnerability.

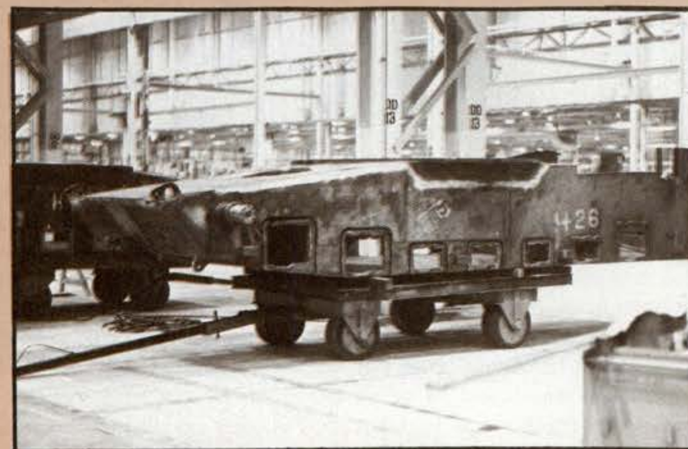
The weaknesses of a unit in full Mission-Oriented Protection Posture (MOPP) were brought into stark relief. Units undergoing chemical attacks while engaged in a reconnaissance, movement to contact, or an attack will probably be forced to assume a defensive posture. If the chemicals do not seriously impair the unit, then the protective measures will. Visibility and thus target detection capabilities are reduced, and a unit that attempts more than limited movement will suffer at the hands of a competent defender. This was proven at Fort Irwin. Once in a defensive status or full MOPP, harassing and interdicting fires should be used to suppress positions where the enemy may have dismounted AT teams or weapons.

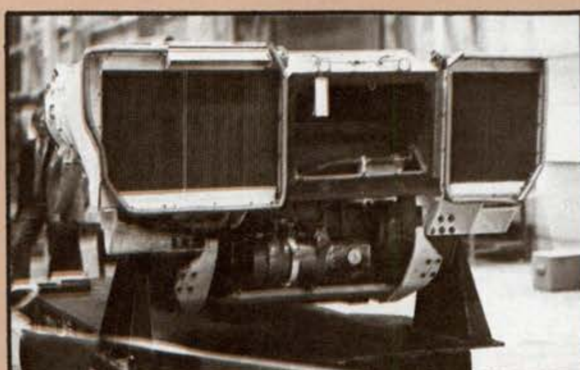
As we look back at our Fort Irwin experiences and evaluate the foregoing lessons learned, we appreciate even more fully the value of the National Training Center. Its vast expanse and rugged terrain may well be the Army's finest training aid, and instrumentation of the facility alone develops combat skills that regular FTXs will never be able to. This was shown by Troop F during the month following its Fort Irwin training by its superior performance on the Scout Squad Proficiency Test and Tank Gunnery Tables. The NTC will benefit soldiers at every level from private to battalion commander. It is especially valuable in training platoon leaders and company commanders in how to coordinate valuable assets. We realize that our position as company grade officers might predispose us toward this view; yet, we feel it is a valid point. We offer Troop F's proficiency test results and gunnery scores as proof.

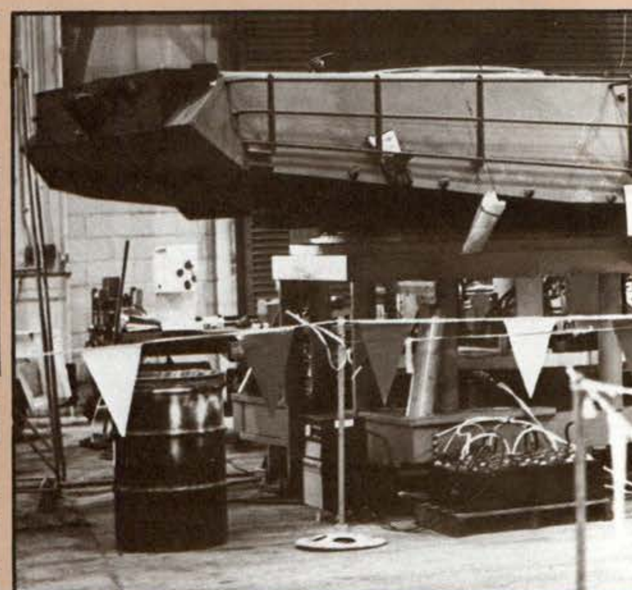
CAPTAIN MARK CHANEY served as an enlisted man from 1969 to 1975 with the 1st Cav Div and 1-6th Cav. Following his commissioning in 1975, he served with the 2/3d ACR as a platoon leader, company executive officer, S-3 air, gunnery officer, and squadron motor officer. He also participated in OT II of the XM-1. He is now attending IOAC 2-81 at Fort Benning, GA.

CAPTAIN MICHAEL W. CANNON was commissioned in Armor upon graduation from the U.S. Military Academy in 1975. A Graduate of Armor Officer Basic, Organizational Motor Officer, and Infantry Officer Advanced Courses, he has served as a platoon leader, Trp A and XO, HHT, 1/11th ACR and as chief of housing, Fulda Military Community. He served as S4, 2/3d ACR and is currently commanding Co H, 2/3d ACR.

The *XM-1* in various stages of production at the Lima Army Tank Center, Lima, Ohio.







World Tank Production

by Captain Gerald A. Halbert

This article does not reflect Official Department of Defense or Department of the Army views or opinions. Ed.

Over the years, many countries have produced tanks, but relatively few countries are currently capable of tank production. Even fewer countries maintain the engineering and technical expertise required to design tanks with no outside assistance. Considering the complexity of tanks, it should be no surprise that few countries can afford to produce them.

Table 1 lists the only 20 countries in the world that possess a tank production capability and that are currently producing tanks. Brazil is a newcomer, having begun production of the *X-1A2*. The *X-1A2* resembles the *X-1A*, which was a radically rebuilt *M-3A1 Stuart* light tank, and uses a gun designed in Belgium.

Austria produces the *4KH6FA FL-12 Kurassier* light tank. This tank combines a Austrian hull with the French-designed turret from the *AMX-13*.

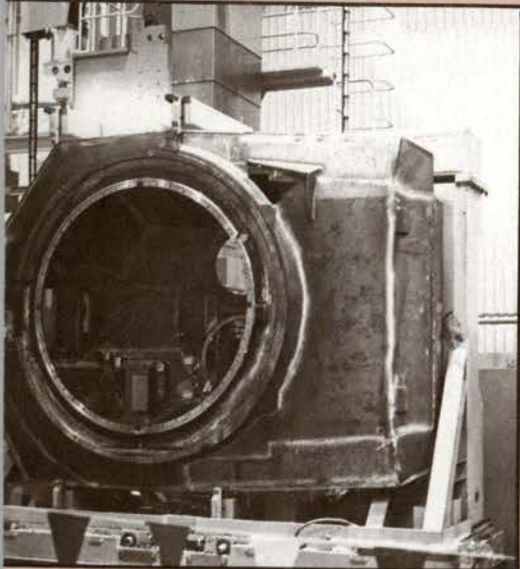
North Korea is reportedly producing the *T-62* tank. If true, it is possible that the Soviet Union supplied the tooling from the factory currently producing the *T-64*.

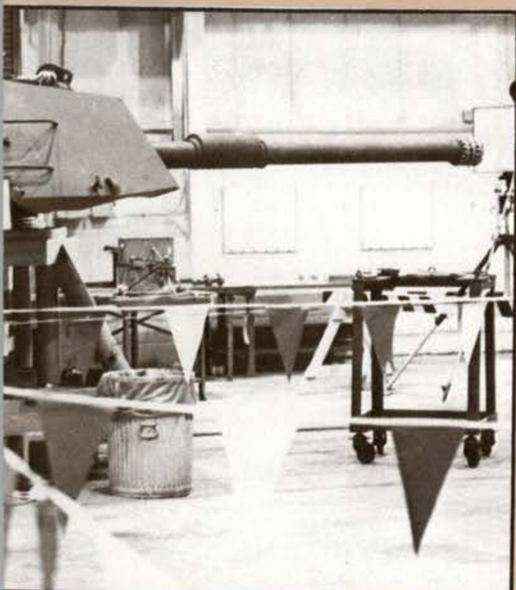
Argentina is now producing the *Tanque Argentino Mediano* (TAM) in Argentina. The TAM's gun is derived from the French *AMX-13*'s 105-mm gun. The TAM was designed in West Germany and is based on the Marder chassis.

Romania has developed a new tank, based on the *T-55*, with a more powerful engine and return roller track suspension system. It is not known if Romania will produce this tank in large numbers or buy *T-72s*.

Italy produced 200 *M-60A1s* under license from the U.S. Italy now produces the *Lion* main battle tank (MBT), a variant of the *Leopard I*. Over 600 *Lions* have been completed of an order of 720.[1] Spain has produced over 380 *AMX-30* variants under license from France.[2]

India produces the British-designed





Vickers MBT known in India as the *Vijayanta.* India is reported to be designing a new tank, but may produce the *T-72* under license.

Czechslovakia and Poland both produce the *T-55* tank. They will probably begin *T-72* production in the next few years.

The Peoples Republic of China (PRC) manufactures several tanks—the *T-59,* a copy of the *T-54* and several models of light tanks that are based on Soviet designs. The PRC is reported to be developing a new main battle tank.

Israel has rebuilt many tanks it purchased, incorporating more powerful engines and guns. Israel recently began production of the *Merkava,* an indigenously-designed tank using a

Table 1. Tank Producing Countries

Producer	Design & Produce With Assistance	Design & Produce No Assistance
USA		USA
USSR		USSR
UK		UK
FRG		FRG
France		France
Switzerland	Switzerland*	
Sweden		Sweden
Poland		
Czechslovakia		
Romania	Romania	
Israel	Israel	
PRC	PRC*	
Brazil	Brazil	
North Korea		
India		
Italy		
Argentina		
Austria	Austria	
Spain		
Japan	Japan*	

*Probably could design and produce with no assistance; current tanks are not completely developed in country.

Table 2. World Tank Production Capability, 1979

Country	Type Tank	Capacity Monthly	Capacity Annual	Total Production To 1979
USSR	*T-64*	50	600[9]	------
USSR	*T-72*	167	2,000[10]	10,000 (T-64 & T-72)[11]
USSR	*T-55*	Unknown	Unknown[12]	40,000?[13]
USSR	*T-62**	333	4,000[14]	40,000?[15]
USA	*M-60***	80	960	13,211
USA	*XM-1***	60 Normal 150 Surge	720 Normal 1,800 Surge	7,058
UK	*Vickers MBT*	2	24	70[16]
UK	*Chieftain*	8	93	1,935[17]
India	*Vijayanta*	6	71	1,000[18]
FRG	*Leopard I**	68	765	6,110[19]
FRG	*Leopard II*	35	300	2,245[20]
France	*AMX-30*	20	240	2,000[21]
Israel	*Merkava*	4(?)	40(?)	40(?)[22]
Czechoslovakia	*T-55*	Unknown	Unknown	Unknown[23]
Poland	*T-55*	Unknown	Unknown	Unknown[24]
Romania	*T-55* Mod	Unknown	Unknown	Unknown[25]
N. Korea	*T-62* Mod	Unknown	Unknown	Unknown[26]
Japan	*Type-74*	12	48	15[27]
Japan	*Type-61**	3	30	540[28]
Italy	*Lion (Leo I variant)*	10	120	720[29]
China	*T-59*	Unknown	Unknown	Unknown
Brazil	*X1A2*	4(?)	50(?)	Unknown[30]
Argentina	*TAM*	Unknown	Unknown	200[31]
Austria	*Kurassier*	3	31	248[32]
Spain	*AMX-30*	10	120	380[33]
Sweden	*S-tank**	3	38	310[34]
Switzerland	*PZ-68*	5	55	390[35]
Switzerland	*PZ-61**	6	75	150[36]

* Out of production
** Planned production
? Estimate - reliability unknown
\+ Still in production

Table 3. US Medium Tank Production 1941-1959

M-3	Apr 1941	Dec 1942	6,258
M-4	1941	1945	48,064
M-26	Dec 1944	Jun 1945	2,428
M-47	1952	Jul 1954	8,679
M-48	Apr 1952	Oct 1959	11,703
			77,132

Table 4. *M-60* Production (Fiscal Year)

FY	M-60	M-60A1	M-60A2 (Retro)	M-60A3	CEV	AVLB	Annual	Total
1959	0	0	0	0	0	0	0	0
1960	120	0	0	0	0	0	120	120
1961	735	0	0	0	0	0	735	855
1962	1,075	0	0	0	0	0	1,075	1,930
1963	275	505	0	0	0	0	780	2,710
1964	0	580	0	0	0	1	701	3,411
		120 1/						
1965	0	431	0	0	0	128	559	3,970
1966	0	256	0	0	60	44	360	4,330
1967	0	278	0	0	46	18	342	4,672
1968	0	10	0	0	30	28	68	4,740
1969	0	290	0	0	27	15	332	5,072
1970	0	135	0	0	0	12	147	5,219
1971	0	283	0	0	42	7 1/	363	5,582
		25 1/						
1972	0	172	0	0	12	30	357	5,939
		125 1/			4 1/	14 1/		
1973	0	194	85	0	18	60	399	6,338
		28 1/			4 1/	10 1/		
1974	0	211	404	0	0	0	615	6,953
1975	0	379	48	0	0	0	547	7,500
		120 2/						
1976	0	456	3	0	0	0	820	8,320
		225 1/						
		136 2/						
197T	0	228	0	0	0	0	228	8,548
1977	0	753	0	0	0	0	905	9,453
		30 1/						
		122 2/						
1978	0	974	0	19	0	14 1/3/	1,200	10,653
		142 1/						
		51 2/						
1979	0	361	0	450	0	0	1,118	11,771
		179 1/						
		128 2/						
1980	0	7 2/	0	486	0	0	493	12,264
Oct-Apr *1980	0	14 2/	0	294	0	2 1/	310	12,574
May-Sep *1981	0	0	0	312	27	4 1/	505	13,079
				147 1/	15 1/			
*1982	0	0	0	103 1/	29	0	132	13,211
Total:								
Army	2,205	6,496	540	1,561	291	342	0	11,435
FMS	0	874	0	250	23	51	0	1,198
USMC	0	578	0	0	C	0	0	578
Grand Total:	2,205	7,948	540	1,811	314	393	0	13,211
**	(651)	(619)				(15)		

Notes: 1/ FMS
2/ USMC
3/ One each AVLB transferred from FMS to Army account.
* Projected production.
** Loss from Army inventory due to sales or other reasons.

British gun and U.S. engines and transmissions. Japan is currently producing the *Type-74* tank. The tank is completely designed and built in Japan except for the British-designed 105-mm tank gun. The *Type-74* followed the *Type-61*.

Sweden has designed and built several tanks. The two currently in service are the *Stridsvagn 103* or *S-tank* and the *Infanterikanovagn-91*, which is considered by Sweden to be a tank destroyer. The *S-tank* uses a British diesel engine and gun with an American turbine engine. The *IKV-91* is totally designed in Sweden.

Switzerland has designed and produced two tanks. The *Panzer-61* and *Panzer-68*. These tanks were developed to stringent specifications of width and weight and use a West German engine. Switzerland was considering developing a new tank but will purchase new tanks from another country instead. This decision is due to the extremely high costs of developing a new tank that will be produced in limited quantities.

The U.S.A., U.S.S.R., United Kingdom, Federal Republic of Germany, and France all design and produce a variety of tanks. These five countries can design and build any components of a tank with no outside assistance.

As noted above, only 20 countries in the world produce tanks. Of these 20, only the 13 listed in table 1 have demonstrated the capability to design tanks. Many of these countries do not have the capability to design tank main guns, engines, or transmissions. Due to the high cost of tanks, many countries rebuild existing tanks and improve them with new fire control, guns, and engines. For example, an *M-48A3* tank can be converted to an *M-48A5* for $130,000. The *M-48A5* is about equal to the *M-60A1* in combat capabilities.

Often countries building tanks adopt engines and transmissions from other countries because of the very high cost of developing these components. The inability to design these components makes tank-producing countries without this capability dependent on foreign suppliers. Japan, the PRC, and Switzerland do not produce tanks with all domestic parts but could do so if the decision was made. Of those countries capable of designing tanks, only those six indicated in table 1 are capable of designing tank main guns, engines, and transmissions.

For various reasons, some countries have adopted main tank guns designed in other countries. The U.S.A. uses a 105-mm gun designed in the United Kingdom on the *M-60* series tanks and will use a German-designed 120-mm tank gun on *XM-1* tanks. The choice of

	US	USSR	Germany	UK
1940	331	2,794	1,469	1,399
1941	4,052	6,590	3,256	4,844
1942	24,997	24,668	4,098	8,611
1943	28,497	24,000	6,083	7,476
1944	17,565	29,000	8,466	2,476
1945	11,985	25,448	988	
Total	88,400	95,099	24,360	24,803
SP Guns			22,382	
Total (Includes SP Guns)			46,742	

Table 5. World War II Tank Production (Includes Light, Medium, and Heavy Tanks)

Table 7. Estimated Cost of Tanks (U.S. Dollars)

Tank	Cost	Year
T-62	291,000	1976
M-60A1	436,500	1976
Chieftain	514,600	1976
Vickers MBT	460,000	1976
M-60A3	799,583	1979
Leopard 1A1	556,875	1976
AMX 30	629,000	1976
T-64	1,375,000	1980
Leopard 1A4	1,500,000	1979
T-72	1,250,000	1980
Leopard II	1,514,729	1980
XM-1	918,000	1980
PZ-61	577,777	1970
PZ-68	901,960	1970
Type-74	1,350,000	1979

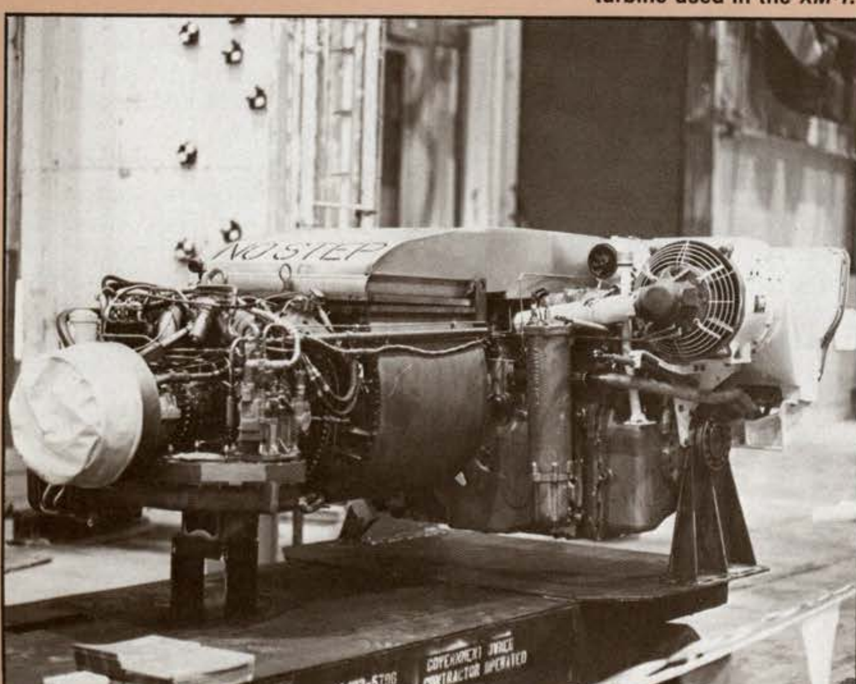
Sources: Various issues, *International Defense Review. Military Technology and Economics,* Issue No. 1, Spring 1977. *T-64* and *T-72* data estimated by author.

se guns was based on a desire to standardize tank main gun ammunition in NATO.

When examining tank production and costs, it should be understood that a typical tank may contain over 100,000 separate parts. Since tanks are so complex, it becomes advantageous to standardize some parts within alliances. For example, most NATO tanks can use tracks from another country, although all track is not interchangeable. Within the Warsaw Pact, all *T-55* tanks use interchangeable parts. The only noticeable difference between Russian and Czech or Polish produced *T-55s* is that Czech or Polish *T-55s* may have external stowage boxes on the turret.

Table 6. Soviet Tank Production[37]

Year	Total
1966	3,500
1967	3,500
1968	4,000
1969	4,000
1970	4,500
1971	4,000
1972	3,000
1973	3,000
1974	2,500
1975	2,000
1976	2,500
1977	2,000
1978	2,000
1979	2,500
TOTAL	43,000



The Avco Lycoming AGT-1500 gas turbine used in the *XM-1*.

Tank production figures are not readily available. Few countries publicize their tank production capacity. The information in table 2 has been compiled from a variety of sources to represent world-wide production of tanks. They represent demonstrated production capacity and do not reflect theoretical peacetime or wartime production capacity. In most cases, annual production was determined by dividing the number of tanks known to be produced by the years the tank was in production. The annual rate was then divided by 12 to determine the monthly production. In some cases, such as U.S. tank production, the monthly figures indicate more tanks can be produced than the annual figure indicated were produced. The reasons for this discrepancy are complex; it is almost impossible to produce at maximum capacity all year long. Weather or supply interruptions can easily slow production as can labor problems.

Frequently, a country simply does not have enough money to produce at full capacity. Table 3 summarizes total U.S. medium tank production between 1941-1959. Table 4 summarizes U.S. *M-60* series tank production by year. Many countries try to maintain a "surge" capability to increase production when war starts. The U.S. formerly maintained the tooling required to activate another *M-60* tank factory at Lima, Ohio. It is planned to produce *XM-1s* at a maximum rate of 90 tanks a

Table 8. Cost of U.S. Medium Tanks

Tank	Fiscal Year	Cost
M-3	1942	33,500
M-4	1943	42,400
M-26	1945	81,324
M-26	1946	109,000
M-46	1951	136,000
M-47	1953	129,000
M-48	1953	110,000
M-48	1955	133,000
*M-48**	1956	134,000
M-60	1959	274,050
M-60	1960	157,314
M-60	1961	151,078
M-60	1962	147,680
M-60A1	1962	147,012
M-60A1	1963	145,336
M-60A1	1964	162,272
M-60A1	1965	180,252
M-60A1	1966	184,564
M-60A2	1967	1/
M-60A1	1968	198,807
M-60A1	1969	249,256
M-60A1 2/	1970	149,627
M-60A1	1971	220,413
M-60A1	1972	315,444
M-60A1	1973	305,488
M-60A1	1974	316,563
M-60A1	1975	424,369
M-60A1 3/	1976	447,400
M-60A1 R/P	197T	472,614
M-60A3 W/O TTS	197T	953,216
M-60A1 R/P	1977	485,007
M-60A3 W/O TTS	1977	700,605

1/ 540 procured FY66 thru FY73; Average Unit Cost $761,120.
2/ Chassis provided as GFE from *M-60A2* Program.
3/ Average unit cost of 462 *M-60A1* and 236 RISE/passive tanks.
*M-48 data not available.

Abbreviations:
R/P = Improved Engine and Passive Sight System
TTS = Tank Thermal Sight
W/O TTS = Without Tank Thermal Sight

Table 9. Cost of *XM-1* Tank Systems Assembly

Integration and assembly	$ 15,842
Hull	56,133
Suspension	48,452
Power package	202,393
Auxiliary automotive	43,883
Turret	102,165
Fire control	130,093
Engineering support to production	17,446
	$616,407

Note: Estimated cost of *XM-1* in FY 1976 for 3,312 tanks.

month. "Surge" capability will be 150 tanks a month. Tank production capability can affect the ability to wage war. Compare the German and allied tank production capability in World War II in table 5. Throughout the last part of World War II, the German tank units were always at 50 percent or less authorized tank strength.

The *T-64* and *T-72* are both in production in the U.S.S.R.[3] The *T-64* is probably produced at the rate of 600 tanks a year and the *T-72* at the rate of over 2,000 tanks per year. Production probably started in 1980 in Poland and Czechoslovakia.[4]

Soviet tank production since 1966 is estimated in table 6. The total figures for 1966-1976 are fairly accurate with the 1976-1979 figures being somewhat less accurate.[5] There is general agreement that the U.S.S.R. has three tank plants.[6] The plants are at Kharkov, Omsk and Nizhniy Tagil. The Kharkov plant is famed for developing the *T-34* before World War II.[7] The Nizhniy Tagil plant is the world's largest tank production facility.

Table 7 has estimated costs for several types of tanks. World-wide tank prices vary with the rate of exchange. Inflation is also rapidly driving tank prices up. Figures for the Soviet Union are probably the least correct estimates as there is no open market cost known. The *T-72* is estimated to cost about five to six times as much as the *T-62*. The *T-64* costs somewhat more due to its unique design features and lower production run.

Table 8 shows the cost of U.S. tanks from 1942 to 1977. These figures show an alarming increase in tank prices. While some of this growth is due to added equipment such as laser rangefinders, computers, and improved engines, the largest cost growth is due to the introduction of thermal imaging optical systems. Table 9 breaks out the cost of various major tank systems.

Inflation is of course the biggest factor in cost growth. For example, the inflation factor for budget planning in the U.S. for fiscal year 1980 was 9 percent. However, deflation of the dollar distorts international costs. In 1976, the estimated cost of a German *Leopard 2* was 2,639,112.5 DM, or $1,096,067.4 (2.4 DM = $1). At an exchange rate of 1.7423:1 (early 1980) *Leopard 2* costs $1,514,729. This compares to an estimated cost of $784,000 for the *Leopard 2* to be produced in the United States in 1977. The *XM-1* will cost $918,000 in 1979 dollars if 7,058 tanks are produced.

Confusing the issue of tank costs is the question of whether the price being quoted is the actual cost of producing the tank or a lower price given for political reasons. Former Assistant Secretary of the Army Pierre has estimated that the *T-72* Costs "considerably" more than $1,000,000. If "considerably" more means $1,250,000, then the *T-72* costs $332,000 more than the *XM-1*. Yet, *Defence Attache* magazine in The January-February 1980 issue indicated that the Russians would charge India about one-third the cost of a comparable Western tank for the *T-72*. Jordan will pay about $1,655,526 for improved *Chieftains*. This indicates the U.S.S.R. will charge about $450,000 for the *T-72* tanks. The U.S.S.R. can charge any sum it wants for tanks because its bookkeeping for costs simply does not have an equivalent in the west. It is safe to say that the *T-72* would cost over $1,000,000 to build in the U.S., and probably at least $500,000 to buy directly from the U.S.S.R.

Another problem in arriving at tank costs is determining what specific cost is being quoted. The figures listed by the U.S. Army to buy tanks include "hardware" costs and the costs of inspecting the tanks and delivering them to their first destination. The costs quoted do not include training or spare parts. Frequently, when one country buys a tank from another, it not only buys the tank but buys spare parts, manuals, and some instructional assistance to aid in assimilating the tank. For these reasons, any estimate for tank costs not released as the unit cost at the factory could vary from 25 to 50 percent over the unit cost. In fact, in 1979, taxes and introduction costs added over $541,453 to the cost of a *Leopard 2* procured for the German

Army. Thirty-two *M-60A1* tanks sold to Saudi Arabia in 1979 cost $1,450,000 each, compared to a factory hardware cost of about $578,000. Normally, U.S. arms cost includes a "support package" of spare parts and technical assistance.

Another factor affecting growth is the cost of limited production. Countries producing a limited number of tanks find costs going up as the production run decreases in size. For example, if the U.S. purchased 3,312 *XM-1s* at the rate of 60 a month, the cost per tank would be $1,315,000. If it purchased 7,058 at a rate of 120 a month, the unit price drops to $1,076,000 (estimates include inflation estimates over life of program). The minimum total number of tanks of one type that appear to be economically feasible to produce is probably 600 to 1,000 tanks. Below a total production of 600 tanks, costs go up at a high rate due to limited production of components.

Another factor affecting cost is the length of time the tank is in production. Generally, after the first 2 years of production, cost per tank drops at least 10 percent.

An important, yet intangible factor in tank production, is the national pride involved in tank production. The ability to produce tanks is a sign that the country has a good industrial production base. The ability to produce tanks also frees the producing country from reliance on outside suppliers. It may also provide a source of export income. In addition, a tank can be produced to exactly meet local requirements, rather than having to buy a tank optimized for another country's particular requirements.

There are indications that other nations, including South Korea, may attempt to produce tanks in the near future. At the same time, there are indications that some countries such as Switzerland are considering dropping tank production due to excessive costs.

Through the 1980's, we can anticipate that tank production will stay at about the same levels as in the past 10 years. More countries will probably attempt to produce tanks and some will find the cost too high.

Footnotes

[1]For data on *Leopard* co-production, see: p.32, *Armies and Weapons,* No. 26, August 1976; p. 13-22, p. 141, Pierangelo Caiti and R A Riccio, *Modern Armor,* Squadron/Signal Publications, Warren, Michigan, 1978; p.8, Christopher Foss, *Jane's Armor and Artillery 1979-80,* London, England, 1979.

For data on *M-60* co-production, see p. 27, 1979-1980, *IISS The Military Balance,* London, 1979,and pp. 8 and 83, Christopher Foss, *Jane's Armor and Artillery 1979-80,* London, England, 1979.

[2]For data on Spanish co-production of AMX-30, see p. 37, Caiti & Riccio, *Modern Armor,* and pp. 106 and 108 of *International Defense Review,* 1/80.

[3]LTC T. Hope, p. 850, *Hearing on Military Posture and DOD Authorization* for FY 1980, Part 3 of 5 parts, Book 1 of 2, Research and Development (HASC No. 96-5). See also pp. 20-22, *ZInternational Defense Review,* 1/80.

[4]See p. 20, *International Defense Review,* 1/80.

[5]1966-1976 figures from p. 27, *Report of Secretary of Defense, Donald H. Rumsfeld to the Congress on the FY 1978 Budget, FY 1979 Authorization Request and FY 1978-82 Defense Programs,* January 19, 1977. 1978-1979 figures extrapolated from p. 43, *Aviation Week and Space Technology,* March 31, 1980. T-72 production for 1977 extracted from article "Nyet Yet as Good", *SAM,* p. 8, January 1980. 1979 figures from p. 311, International Defense Review, 3/80, quoting Dr. Pierre's comments on FY 1981 Budget. Total of 9,900 *T-64/T-72* tanks, with rate of 600 *T-64* and 2,000 *T-72* annually from p. 20, International Defense Review, 1/80 Total of 10,000 *T-64/T-62* also found on p. 239, House Armed Services Committee hearing (HASC 96-5), *Hearings on Military Posture and DOD Authorization for Appropriations for FY 1980,* HASC, 96th Congress, 1st Session, Part 2 of 5 parts.

[6]See p. 20, *International Defense Review,* 1/80.

[7]For information about Kharkov, see p. 20, International Defense Review, 1/80, and p. 4, CPT L. Yeutukhov, *Kraznaya Zvezda,* 20 Feb 77, "Tank Design Bureau Activities Described," where the tie between the original *T-34* and today's tanks is made. See also p. 66, Caiti and Riccio, *Modern Armor,* pp. 44-45; Robert P. Arnoldt, "The Nemesis of the Panzer Armies", ***ARMOR*** Magazine, Sep-Oct 76, and p. 11, COL V. Mikolayev, "T-34 designed by Team Headed by Koshkin", *Technology & Armament,* No. 6, 1975.

[9]See p. 20, *International Defense Review,* 1/80.

[10]See p. 20, *International Defense Review,* 1/80.

[11]See p. 20, *International Defense Review,* 1/80, and p. 239, HASC 96-5.

[12]No figures available.

[13]See p. 51, *Jane's Armor and Artillery* 1979-80.

[14]Extrapolated from 1969 production figures on page 27, Rumsfeld Report to Congress.

[15]See p. 48, *Jane's Armor and Artillery* 1979-1980.

[16]See pp. 70-71, *Jane's Armor and Artillery* 1979-1980.

[17]See p. 63, *Jane's Armor and Artillery* 1979-1980;p. 103, Caiti and Riccio, *Modern Armor;* pp.20,39,and 41, *The Military Balance,* 1979-80, IISS, Facts on File, Inc., New York 1979.

[18]See p 25, *Jane's Armor and Artillery* 1979-1980; a total of 4,561 *Leopard* I MBT built, figure includes 1,573 variants. See also p. 14, *Modern Armor,* pp. 342-343, *International Defense Review,* 3/74. Note: Actual production at lower levels; 100 is capacity of both tank plants, 2 shifts working.

[19]See pp. 168-171, Walter J. Spielberger, *From Half-Track to Leopard 2,* Bernard and Breefs Verlag, Munich, 1979. Monthly and annual production figures are for 1967, the year of greatest production. The total includes variants such as Gepards and AVLBs.

[20]See p. 69, ***ARMOR*** Magazine, Jul-Aug 1979; p. 15 *Jane's Armor and Artillery* 1979-1980; p.24, *Modern Armor;* p. 33, *Defence Attache,* Mar-Apr 79; p. 84, *Military Technology,* Vol. III, No. 11, Sep-Oct 79.

[21]See p. 8, *Jane's Armor and Artillery 1979-1980;* pp. 33-37, *Modern Armor.*

[22]See p. 26, *Jane's Armor and Artillery* 1979-1980, and p. 36, *Armies and Weapons,* No. 40 Dec. 77-Feb. 78.

[23]See p. 7, *Jane's Armor and Artillery,* 1979-1980.

[24]See p. 33, *Jane's Armor and Artillery,* 1979-1980.

[25]See p. 22, *International Defense Review,* 1/80.

[26]*Army Times,* Jan. 8, 1979.

[27]See p. 29, *Jane's Armor and Artillery; pp. 43 & 49, Modern Armor;* p. 67, Military Balance; p. 90, Aviation Week and Space Technology, Feb 11, 1980.

[28]See p. 67, *Military Balance;* pp. 31-32, *Jane's Armor and Artillery,* 1979-1980.

[29]See p. 8, *Jane's Armor and Artillery,* 1979-1980; p. 915, *Defense,* Dec. 79, Vol. 10, No. 2.

[30]See p. 51, *Ground Defense International,* No. 58, Nov. 1979, and pp.109-110, *International Defense Review,* 1/80.

[31]Production order for 200+ tanks for Argentina. Additional exports expected. See pp. 2, 22-23, *Jane's Armor and Artillery,* 1979-1980, p. 36, *Ground Defense International,* No. 58, November 1979.

[32]248 Kurassier built between 1972-1979. 153 in Austria, 50 in Argentina and 45 in Tunisia. See p. 2, *Jane's Armor and Artillery;* p. 31m 45 & 76, *The Military Balance.*

[33]See p. 37, *Modern Armor,* and pp. 106 and 108, *International Defense Review,* 1/80.

[34] See p. 35, *Jane's Armor and Artillery,* 1979-1980, and pp. 52-55, *Modern Armor.*

[35]See pp. 40-41, *Jane's Armor and Artillery;* p. 58, *Modern Armor;* and p. 59, *Military Balance.*

[36]See p. 34, *Military Balance;* p. 55, *Modern Armor;* and p. 39, *Jane's Armor and Artillery.*

[37]Data to Contract Table extracted from following sources:

1966-1976: p. 27, *Report of Secretary of Defense Donald H. Rumsfeld to the Congress of FY 1978 Budget, FY 1979 Authorization Request and FY 1978-82 Defense Programs,* January 17, 1977, GPO.

1977: p. 8, "Nyet Yet Is Good," DOD newspaper *SAM,* January 1980.

1978: Data derived by using year data from 1974 to 1977 from above sources and 1979 data below to compile total production of 11,600 less 1978. Data from table 4 provided U.S. total of 5,433. U.S.S.R.-U.S. ratio of 2.5:1 tank production was extracted from p. 43, *Aviation Week & Space Technology,* March 31, 1980. When 5,433 is multiplied by 2.5, the total is 13,582.5. Subtracting 11,600 from that figure is 1,982.5. Rounded off, the total is 2,000 for 1978.

1979: The 1979 estimate of 2,500 is from a quote of Dr. Pierre's FY 1981 Budget on p. 311, *International Defense Review,* 3/80.

CAPTAIN GERALD A. HALBERT received a Bachelor's Degree from California State University-Fullerton in 1974. He served in artillery positions with the 101st Airborne, 9th Infantry and 82d Airborne; and in intelligence positions with the 8th Infantry, I Corps (ROK/US) Group and XVIII Airborne Corps, 66th MI Group and HQ, USAREUR. He has been with the Studies Division, Directorate of Combat Developments, USAARMS, Fort Knox, since August 1979.

PROFESSIONAL THOUGHTS

The Inspectors Need Inspecting

For a variety of reasons, as our Army has become more complicated over the last couple of decades, roving bands of inspectors and staff officers have prowled the landscape in increasing numbers. They can be found anywhere. Often, they have checklists. Usually, they report in writing. Frequently, they post numbers on charts.

These inspectors and staff officers are probably necessary. Commanders never have the time to look into all the details and learn all of the new questions—much less the answers. Technical complexities alone demand that we permit technical experts to review our operations and dig below superficiality. Staff officers also need to assist the commander by providing feedback on a variety of operations and programs.

In some of our units, inspectors and staff officers have wrested control from unit commanders. They have slowly but surely moved into the driver's seat. The commander sometimes becomes nothing more than a conduit between itinerant inspectors and the members of his unit: his priorities frequently rearranged, his schedules often upset, as the unit abruptly responds to the latest dictates of some itinerant inspector.

Our Army needs to put inspectors in perspective. First, they will always be with us and are probably needed. Second, they will never be blessed with broad insight, because that's not their nature. Third, they have no direct and lingering responsibilities whatsoever for the health, welfare, morale, or combat readiness of any particular unit in the same way that the commander has such responsibilities. Understanding all these things, we need to inspect the inspectors and redress the balance of terror. To do this, the first thing we need is a chain of command with the courage to tell the commander senior to them the degree of damage the inspectors are inflicting. Then, the senior commander can decide if it's worth the price. Additionally, we need some convenient way of pushing feedback so that the inspector realizes that he has bounds within which he must work—in the same way that the unit commander does.

One solution to this is some sort of "Inspect the Inspector Program." The form you see on this page is one attempt. (Probably a mandatory submission is the best approach.) It seems to be working fairly well and has contributed in a small way toward the reestablishment of the primacy of command authority. (Also, this form is useful in identifying the vast majority of inspectors who are inspecting fairly and comprehensively and coaching the unit at the same time. Worthwhile suggestions and laudatory comments are frequently found in the unit commander's "Inspect the Inspector" inputs).

W. F. ULMER, JR.
Major General, USA
Commanding General, 3d AD

3AD "INSPECT THE INSPECTOR" PROGRAM

UNIT COMMANDER'S COMMENTS ON INSPECTION/ASSISTANCE VISIT

UNIT INSPECTED/ASSISTED: ____________ DATE: ________

INSPECTION/ASSISTANCE TEAM: ____________

OIC/NCOIC OF TEAM: ____________

UNIT COMMANDER COMPLETING REPORT: ____________

UNANNOUNCED? ☐ YES ☐ NO   REQUESTED BY UNIT? ☐ YES ☐ NO

1. Findings and recommendations:
   a. Findings or key recommendations generated by the inspection/visit which unit commander considers significant.

   b. Findings or recommendations generated by the inspection/visit which unit commander considers trivial or inappropriate.

2. Unit commander's comments on conduct of the visit:
   a. Appropriately comprehensive? YES ______ NO ______
REMARKS:

   b. Major attention on important items? YES ______ NO ______
REMARKS:

   c. Fair, objective, impartial evaluation? YES ______ NO ______
REMARKS:

   d. Evaluation consistent with your understanding of Division standards? YES ______ NO ______ REMARKS:

   e. Evaluations consistent with previous Division Headquarters visits addressing the same subjects? YES ______ NO ______ REMARKS:

   f. Feedback, coaching provided to unit? YES ______ NO ______
REMARKS:

   g. Remarks reference a through f above, if any: (Continue on back if needed.)

HQ AETF FORM 698
15 Mar 80

INSTRUCTIONS:

1. Complete one of these forms on all inspections/assistance team visit from Division or higher HQ.

2. Only one copy is required. Pencil, pen, or typed is O.K. but make it legible.

3. The company/battery/troop commander is to complete this report, show it (or a copy) to the Bn/Sqdn Cdr, and forward it to CG 3AD through normal distribution. Complete it the same day as the inspection while memory and emotions are sharp.

4. Call it as you see it. Let the inspectors know they are being evaluated. Showing them your comments is optional.

I Am Bothered

I don't quite know how to begin this, but I have to say what is on my mind. My father, rest his soul, was a World War I veteran. He always taught me to call a spade a spade. He once said, "Son, there ain't no such thing as a "spaderrake"; it either is or is not; there is no in-between." I have been in the Army for almost 23 years. A lot of changes have been made, some good, most bad. At present, I am a command sergeant major of a tank battalion.

What is bothering me? Let me begin; read what I have to say. A lot of noncommissioned officers (NCOs) are very concerned. I am bothered because if you can run 2 miles a day, you can do anything. You may not be able to do a right face in marching, stand at attention when you talk to an officer, clean an *M-16* rifle, fire a tank, etc.; but you can run 2 miles a day!

I am bothered. We must improve the soldier's life style. Have we forgotten that all NCOs were soldiers first, and still are! Improving the life style of soldiers is great. I love it. Soldiers are the only people in the world who are given basic and advanced training and can expect to be shipped anywhere at any time, maybe getting their brains blown out for their country for $500 a month. Hell, they should get the best. If any of you readers can tell me of any other profession that requires that, you know what I will do.

But, when you make the decision to improve the soldier's life style, don't hire civilian psychologists from Harvard who have never been soldiers. Don't base it on the standards of society. Our society does not have any standards. "Tuff" but *true!* When I, as a command sergeant major, walk into a troop billet and see wall-to-wall carpeting, bath/showers, three nice wall lockers, and enough stains on the carpet to kill a roach, I wonder how we expect them not to stain the carpet. I still do that at home.

I am bothered. I read a lot and hear a lot about the quality of soldiers. Some congressmen (oops) congresspersons say we are taking in too many Category (Cat) IVs. I don't know what that means. I am probably a Cat V, but I am an American. I serve in the forces that guard my country and protect my way of life. I am prepared to give my life in their defense. Sound familiar? I hope it does.

I am bothered. Been doing a lot of research lately. Got the pamphlet just published by DA on the Duties, Responsibilities, and Authority of NCOs. Part of that was published in 1778. Hasn't changed. Why are we republishing? What was not covered in 1778 was covered later by AR 600-20, UCMJ, AR 670-1, etc. Hasn't changed. Are we teaching the NCO Corps or the Officer Corps?

I am bothered. I read a lot about the duties of a command sergeant major. What is the question? We are here to support the commander. If the mission is police call (and I hear a lot about that), it is our duty to have the battalion, brigade, regiment, division, corps, or army in the correct uniform and disciplined with the esprit de corps, morale, and proficiency to accomplish that mission. Is that hard to understand? That goes down to the fire team leader, by the way. *I am bothered* that we need a published list for the duties of the NCO Corps. AR 611-201 does very nicely. Read it.

I am bothered by the people that deal in "people" problems before the NCO has been involved. When I see that, I feel you have one of two situations. You either have the "best" or "worst" unit in the U.S. Army. There is no "in-between." *I am bothered* by people having meetings at 1630-1900. When do the first sergeants on down get the word? Who tells the troops, the ones who must do the work? *I am bothered* about the prejudices, racism, etc. We have an army. Either we are soldiers, or we are not. If we are, reward us; if we are not, kick us back to the society from which we came. *I am bothered* by high-rise BOQs for single officers with 2 years in the Army and a dungeon for E-5/E-6 on up to command sergeant major with many more years in the Army. *I am bothered* by the quarters assignments. *I am bothered* by the weight allowance. *I am bothered* about the "fixed standards" for DWI vs. drugs. *I am bothered* about the admin actions against the EM but not others.

I am bothered about a lot of other things that I will not go into print about. I have said enough. Is it any wonder why we are losing our NCOs?

SHELDON McINTOSH
Command Sergeant Major

A Philosophy of Leadership

Fresh from an assignment as a tank platoon leader, I wrote an essay entitled "Letter to a Company Commander" (*Armor*, '77). In that essay, I attempted to analyze in detail the leadership techniques employed by my former company commander. In some areas I praised his efforts, and in others I was somewhat critical. Since that time I have served in three other units, under three different commanders. As an Infantry

Officer Advance Course (IOAC) student, I am now looking ahead to an USAREUR assignment, and hopefully a company command of my own.

In this essay, I want to reiterate some thoughts expressed in my previous effort, add additional ideas gained from subsequent experiences, and outline my own philosophy of leadership. I do not pretend to have all the answers, or even most of them. I am still searching, and this effort to describe my philosophy is part of that search. When I cease work on the development of my leadership techniques, I will no longer be of use to the Army. So I will continue the search, through IOAC and beyond.

I begin by examining what it is that I should expect from myself as an officer and commander. The most important element I must bring to the task is dedication to the mission of the Army, to the mission of my unit, and to the soldiers in my command who will work toward the accomplishment of that mission. Dedication to the mission of the Army and my unit is demonstrated by my willingness to subordinate my personal interests, and those of my family, to the demands of my job. This is neither easy nor pleasant, but is absolutely necessary. Dedication to the soldiers in my command is evidenced by my sincere interest and a concern for every aspect of their lives, both on and off duty. It does not imply pampering or babysitting them. It does require that I provide challenging and meaningful training, that I show concern for their safety and welfare, and that I ensure their professional development.

A second element of leadership I must bring to the task is technical competence. In a general sense, this means that I must be proficient at many tasks common to my grade. I must be able to communicate orally and in writing, to manage personnel and equipment resources, to successfully balance conflicting requirements, to make intelligent decisions, and so on. But as an armor company commander, I must do a lot more. I must demonstrate a thorough knowledge of my unit's equipment, from the smallest monitoring device in the CBR room to the *M-88* recovery vehicle in the motor pool. I must expand my knowledge of tactics to the degree that I will be able to instruct my platoon leaders. I must be able to lead a combined arms team in the field, properly employing attached infantry and engineer elements, and using all available means of fire support. In addition to all this, I must improve my own skill as a tank commander and qualify with my crew.

As I have already stated, an important duty of any commander is the development of subordinates. In my opinion, this is one area where there is much room in our Army for improvement, particularly at the company level. I want to establish, in my command, an environment in which each soldier is being counselled frequently on his manner of performance, whether it be good or bad. To this end, I will periodically counsel my immediate subordinates—the executive officer, first sergeant, and platoon leaders. They will understand their duties, our mutual goals, and my guidance on how the unit should function. I will inform them of my perception of their efforts, and at the same time, solicit their recommendations. I will require that each of them develop a counselling plan of his own, and keep such records as are appropriate. In this way, the good soldiers can be recognized with opportunities for promotions and schools. The bad soldiers can be transformed into good ones, or failing that, be eliminated from the service.

I will require my platoon leaders to become knowledgeable about the technical aspects of their platoon equipment. They will be able to perform the duties of driver, gunner, and loader on their tank. They will be the commander of their own crew as well as the leader of their platoon. This will entail the performance of many of the mundane, but important, maintenance tasks on their own tank. Not only will this assist them in their platoon maintenance effort, but also it will give them the mechanical expertise they will need as an armor company executive officer. Finally, I think that on occasion an officer should get down in the trenches with his men and work beside them, rather than over them. The men will come to respect him as one who is not afraid of work, or is too good to get his hands dirty. Leaders at every level need to know from first-hand experience what is involved in accomplishing the tasks they assign to their men.

I want to move on now and discuss some of the leadership qualities I would like to see in my battalion commander. Logically, I will endeavor to display these same qualities to my subordinates. I first expect my commander to be ethical. In his interpersonal relationships, I want him to be straightforward and open. He should demand that he always be told the truth, and should not tolerate those who tell him only what they think he wants to hear. My commander must always speak the truth himself, whether it be in closed-door sessions or in records and reports. Soldiers have little respect for a leader who knowingly distorts his unit's training, personnel, or equipment readiness posture in reports to higher headquarters. Likewise, many officers have been hindered in their career development because of the general trend toward inflation which permeates the officer evaluation reporting system. Too often, raters and indorsers have failed to distinguish between the good and the outstanding officers in their commands.

I expect my commander to allow me to make mistakes. He should give me sufficient guidance to ensure I understand what he wants of me, but enough latitude to fail on occasion. When I trip over my own feet, he should help me to get up again, rather than walk over the top of me. As he develops me as a commander, I will make fewer mistakes. He should not demand that I attain perfection, just as I won't expect it of him.

I desire that my commander be realistic in his anticipation of what the unit can accomplish. By this I mean that he should neither take on, nor pass down, missions for which neither of us have adequate resources. At present, with existing Army-wide personnel shortages and fiscal restraints, this would seem an unreasonable request. How does a commander, at any level, refuse to accept a mission without implying his own incompetence? The junior commander is at the mercy of the senior commander. Our Chief of Staff, General Edward C. Meyer, has stated, "We have passed the point where heightened effort alone can achieve the results desired." Only when senior Army leaders in the field accept this tenet and restructure their priorities to reflect it, will we junior leaders be freed from the present dilemma of having to do too much with too little.

Lastly, I want my commander to review periodically with me his evaluation of my performance. This has seldom occurred in my 8 plus years of active service. Too often I have become aware of my rater's or indorser's dissatisfaction with my performance only when it is too late to do anything about it in that reporting period. Just as I have a responsibility to develop my subordinates and to prepare them for positions of greater responsibility, my commander should also work with me. The new officer evaluation reporting system will help in this regard if we all are earnest in our efforts to use it properly.

Many challenges lie ahead for those of us who will command in the 1980's. Several new and complicated weapon systems will come into the inventory. Energy shortages will continue to erode training resources. Escalating ammunition costs will further reduce already inadequate training ammunition allocations. Our personnel situation is likely to get worse before it gets better. The key ingredient, and principal factor, in maintaining a viable fighting force in the decade ahead is the quality of leadership which we commanders are able to sustain in the face of these challenges. My leadership philosophy for the months and years ahead is built around a solid ethical base, will be supported by superior technical skills, and will be carried out with dedication to the Army and with genuine concern for soldiers. As new challenges arise and as the nature of our soldier changes, I must be able to respond with effective new techniques to ensure continued mission accomplishment.

JAMES F. GEBHARDT
Captain, Armor

Abrams Tank Type Classified "Standard"

The Department of the Army type classified the *M-1* Abrams Tank as "standard" on 17 February.

Planned production through FY1983 is: FY1980—309; FY1981—569; FY1982—720; and FY1983—802. Production will increase to 30 per month in the summer of 1981 and production is currently scheduled to increase to 60 per month in CY 1982 and 90 per month in CY 1985.

The first production models of the *M-1* armed with the 120-mm gun are now scheduled for the fall of 1984.

Recognition Quiz Answers

1. **Soviet SA-6 Gainful.** A two-stage, solid-fuel, low-altitude, surface-to-air missile and mounted on a modified *PT-76* chassis which provides excellent mobility but is not amphibious.
2. **Soviet BM-21.** A track-mounted, 40-round, 122-mm rocket launcher. The 40 rounds can be fired in 20 seconds, but not as accurately as artillery rounds. HE and chemical rounds can be fired from the launcher.
3. **Czech and Polish OT-62/TOPAS.** A basic infantry carrier with no fixed armor. Resembles the Soviet *BTR-50 (PU)* command vehicles.
4. **Soviet BTR-70.** One of the newest Soviet armored personnel carriers and amphibious. It is longer and more squared on both ends than the *BTR-60 (PB)*. It's armed with 14.5-mm and 7.62-mm MGs.
5. **Soviet BTR-40.** The second armored personnel carrier developed by the Soviets. Has a limited troop carrying capability. Used more as a command and reconnaissance vehicle. No longer in production, but is still found in many armies throughout the world. Armed with one 7.62-mm MG.
6. **Soviet ZSU 57-2.** An antiaircraft gun with a twin-mounted 57-mm automatic gun system mounted on a modified *T-54* chassis. Used at division level. Now being replaced by the *SA-9* and *ZSU 23-4*.

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 51)


1


2


3


4


5


6

FORGING THE THUNDERBOLT

This marks the first time since the January-February 1979 issue that a "Forging The Thunderbolt" article has appeared in **ARMOR** Magazine. It will be a continuing feature as part of a renewed effort to keep the field informed about developments at the "Home of Armor." This article, as well as the articles in the next six issues, will contain a listing of class titles and hours of the courses outlined by the commandant in his "Commander's Hatch" series on the Armor training and professional development courses conducted at the Armor School. The intent is to provide some detail on what subjects are being taught in a particular course and the amount of time allocated to each subject. Additional specifics on training objectives and standards are contained in the approved Programs of Instruction for each course and can be provided to units in the field upon request.

On pages 3-4 of this issue, the commandant addresses the Armor Officer Basic Course in his "Commander's Hatch" article. Listed below are the current class titles and hours for the Armor Officer Basic Course, Tank and Armored Cavalry:

CLASSES PRESENTED TO BOTH THE TANK AND ARMORED CAVALRY COURSES

CLASS TITLE	HOURS
Introduction to Gunnery Training	1
Tank Machineguns	6
Tank Ammunition	2
Xenon Searchlights, AN/VSS-2, AN/VSS-3A	2
Armament Controls and Equipment	12
Prepare to Fire	16
Conduct of Fire	24
Auxiliary Fire Control Instruments and Range Cards	6
Turret Mechanical Training	8
Tank Crew Gunnery Skills Test	8
Gunnery Skills Subject Review	4
Tank Crew Gunnery Skills Retest	2
Conduct of Tank Ranges	2
Tables I, II, III, IVA/C, IVB/C	12
Table VA/C	12
Table VIA/B	24
Table VIIA/C, VIIB/C	24
Table VIIA	12
Platoon Fire Control	4
Table VP	8
Table IXB	12
Tank Gun Capabilities (SECRET)	4
Introduction to Maintenance Department	1
The Army Maintenance Management System	12
Repair Parts Supply	7
Basic Issue Items (M-60 Series)	3
Tank Maintenance, Inspection, and Readiness Reports	14
Crew Duties for Scheduled Organizational Maintenance	4
Turret Preventive Maintenance Checks and Services	8
Maintenance Examination and Retest	3
Escape and Evacuation from a Vehicle	1
Operating Fundamentals	3
Track Vehicle Driving (M-60 Series)	8
Vehicle Recovery (M-60 Series)	8
Map Reading Diagnostic Test	1
Map Reading Review	6
Map Reading Diagnostic Retest	2
Terrain Association	4
Conduct of Map Reconnaissance	4
Mounted Land Navigation	4
Night Navigation	5
Company/Troop Communications	2
Radio/Telephone Procedures	2
CEOI Extracts, Codes, and Ciphers	4
Tactical Radios and Accessories	8
Combat Communications and Troubleshooting	3
Radio Net Exercises	4
Communications Security Equipment	2
M-18A1 Claymore Mine, M-119A1 .45 Caliber Pistol, M-3A1 Submachinegun	4
Mortar Training Methods, Aids, and Devices	4
Forward Observer Procedures	4
Fire Direction Procedures I	4
Mechanical Training 4.2-inch Mortar	4
Mortar Firing Exercise	8
Qualification .45 Caliber Pistol	4
Fundamentals of Leadership	2
Decision Making	2
Motivation Techniques	2
Personnel Management System (Officer and Enlisted)	2
Counseling	3
Disruptive Influences	2
Effective Communications	2
Leadership Skills and Ethics	2
Platoon Leader Seminar	2
Organizational Effectiveness	4
Introduction to Training Management	1
The Battalion Training Management System	2
Assessment (Training)	2
Platoon Planning (Training)	3
Mission/Task Analysis	2
Training/Evaluation Planning	1
Performance Oriented Training	1
Training Management Examination, Critique and Retest	3
Supply Management	8
Military Justice	4
The Law of War	2
Survival, Evasion, Resistance, and Escape	2
Control of Civil Disturbances	1
History and Role of Armor	2
The United States Marine Corps	1
The Threat	4
Air Defense	1
Field Artillery	4
USAF Tactical Air Support	2
Nuclear, Biological, Chemical Defense, and Decontamination	9
Electronic Warfare (SECRET)	2
Signal Security (CONFIDENTIAL)	2
Field Living and Standard Operating Procedures	2
Command and Control	3
Physical Training and Testing	40
Physical Fitness Test	4

TANK COURSE SPECIFIC CLASSES

CLASS TITLE	HOURS
Introduction to Tank Organizations and Tactics	2
Pioneering for Tankers	12
Road Marches and Assembly Areas	2
Fundamentals of Tank Platoon Operations	24
Terrain Analysis	4
Antitank Weapons	6
Mounted Tactical Training Exercise—Tank Platoon	218
Tank Platoon Tactics Examination and Retest	12

ARMORED CAVALRY COURSE SPECIFIC SUBJECTS

CLASS TITLE	HOURS
Introduction to Cavalry Organizations and Tactics	·2
Air Cavalry	2
Tactical Vehicle Movement and Scouting Techniques	36
Fundamentals of Armored Cavalry Platoon Operations	16
Pioneering for Armored Cavalry	16
Fire Direction Center Procedures II	4
M-60 Machinegun, M-16 Rifle, and M-203 Mechanical Training	4
Night Vision Devices and Mechanical Training	4
Small Arms Firing	8
Antitank Weapons	10
Antiarmor Combat Course	4
Starting and Stopping, M-113 Series Vehicle	1
Track Vehicle Driving, M-113 Series Vehicle	2
Maintenance and Inspection Procedures, M-113 Series Vehicle	3
Mounted Tactical Training Exercise—Armored Cavalry Platoon	240
Armored Cavalry Platoon Tactics Examination and Retest	16

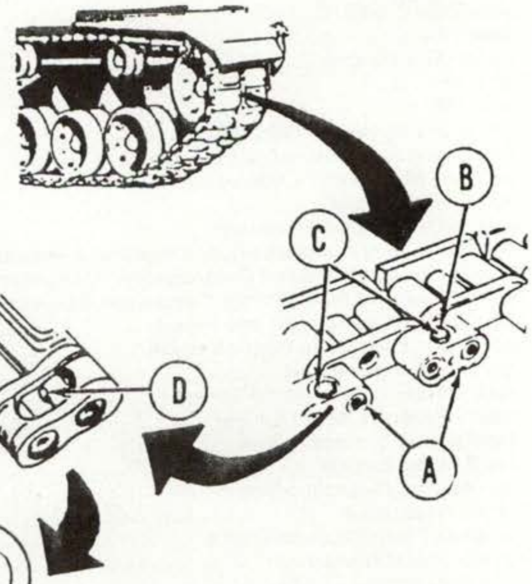
NOTE: Not reflected in the class and hour listings are the hours of integrated training during the Mounted Tactical Training Exercise when many subjects previously taught are reinforced; i.e., leadership, tactics, maintenance, gunnery, logistics, field training, NBC operations, pioneering, and recovery. Also not clearly indicated are hours devoted to writing and speaking requirements. At first glance, the total number of hours listed exceeds the 15- and 16-week official course length. This is because extensive night training extends the training day beyond 8 hours and some training is conducted on weekends.

FORGE THE THUNDERBOLT

New Track Maintenance Procedures

Notes:
1. **Items are to be inspected daily during and after operation if the vehicle is operated.**
2. **Track maintenance should be performed on a hard level surface.**
3. **The following procedures will be published as a change to the technical manuals listed below.**
   TM 9-2350-10, M-60A3 Tank
   TM 9-2350-257-10-1, M60A1 (RISE)/(RISE Passive Tank)
   TM 9-2350-215-10-1, M-60A1/M-60A1 (AOS) Tank
   TM 9-2350-260-10-1, M-60 Tank

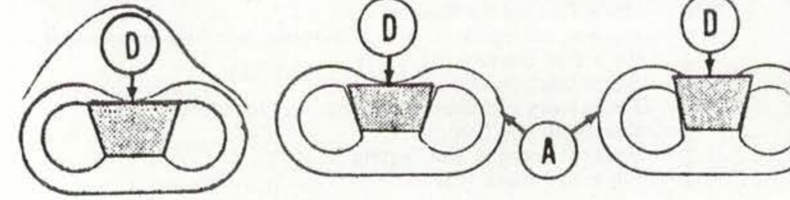
VEHICLE IS NOT READY OR AVAILABLE IF:
- **ONE OR MORE END CONNECTORS ARE BROKEN OR MISSING.**
- **ONE OR MORE WEDGES ARE BROKEN OR MISSING.**



END CONNECTORS

- **Check for broken, missing, or loose end connectors (A).**
- **Look for shiny metal (B) where bolt (C) touches end connector (A) (shiny metal indicates loose wedge and bolt).**
- **Look for missing wedges (D) and bolts (C).**
- **Look for improperly seated wedges (D).**

WEDGE IN NORMAL POSITION — **WEDGE NOT SEATED** — **WEDGE NOTICEABLY HIGHER THAN OTHERS**



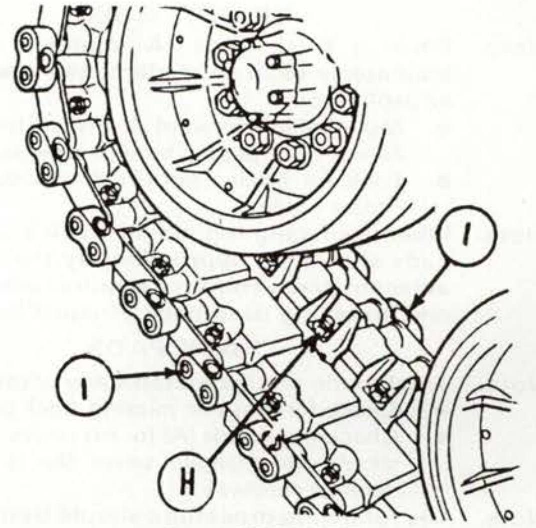
Note. **End connector may need to be repositioned in or out on pins to get properly seated wedge.**

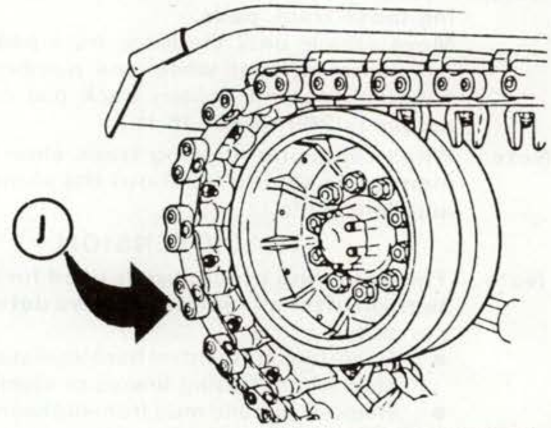
Notes. **A four-man crew is required for making the checks listed above, using the following procedure.**

- The driver starts and warms up the engine.
- Two crewmembers stand in front of the vehicle (one on each side) to observe each track as it passes over the compensating idler.
- The fourth member serves as ground guide while the checks are being made.
- The ground guide instructs the driver to drive the tank in reverse at a slow (creeping) speed. The crewmembers in front look for missing or improperly seated wedges and loose or worn end connectors as they pass over the compensating idler wheels. As faults are found, crewmembers observing the tracks signal the driver to stop the tank and mark the outboard end connector for later repair reference. After complete track has been visually inspected, faults are repaired after the visual inspection of the entire track is completed.

Note. **The following procedure must be followed before tightening any loose end connectors.**

- Loosen track tension.
- Loosen center guide nut (H) on the same link that has loose end connector (I).
- Move vehicle forward or backward until loose end connectors (J) are midway over compensating idler wheel. Stop vehicle and tighten both inboard and outboard end connectors. **(Proper torque is 180 to 200 lb ft.)**
- Move vehicle until loosened center guide is between compensating idler wheel and number 1 road wheel. Stop vehicle and tighten center guide nut. **(Proper torque is 350 to 380 lb ft.)**
- Adjust track tension in accordance with -10 weekly preventive maintenance checks and services (PMCS) after all faults have been corrected.





CENTER GUIDES

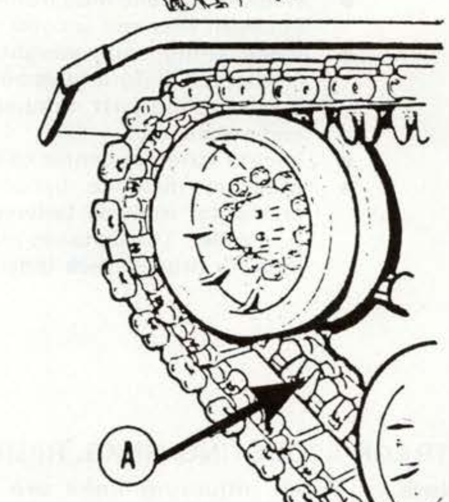
- Check for missing, bent, cracked, or loose center guides (A). (Shiny metal indicates a loose center guide nut.)

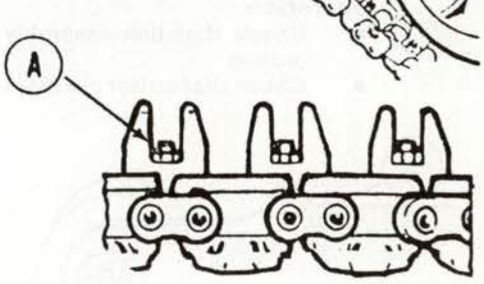
Note. **While tank is stopped, have two crewmembers (one on each side) check center guides between the compensating idler wheel and number 1 road wheel, visually and manually. Move tank forward or backward until the next center guides are positioned between the compensating idler and road wheel. Stop the tank and inspect guides. Repeat the procedure until all guides have been inspected.**

CAUTION. The tank must be completely stopped before the manual inspection is made.

Note. **The following procedure must be used for repairing or replacing center guides.**

- Loosen track tension.
- Move vehicle forward or backward until defective center guide is between compensating idler wheel and number 1 road wheel. Stop the vehicle.
- Repair or replace center guides as required, and tighten center guide nut. **(Proper torque is 350 to 380 lb ft.)**
- Adjust track tension in accordance with new -10 weekly PMCS after all faults have been corrected.



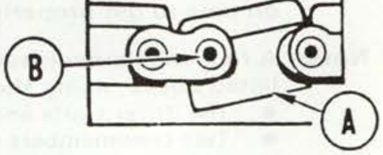


VEHICLE IS NOT READY OR AVAILABLE IF ONE OR MORE CENTER GUIDES ARE BROKEN OR MISSING.

TRACK SHOES

Note. When a track shoe (A) appears out of line, it indicates a dead shoe, damaged track pin bushing, or broken pin.

- Move vehicle forward slowly and look for dead shoes as the track passes between the support rollers.
- Look for broken pin (B) at end connectors and at center guide.

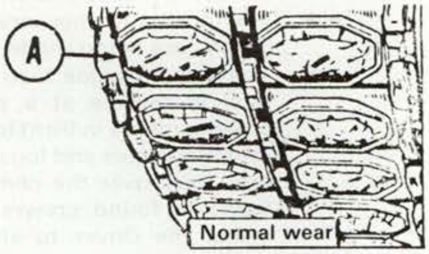


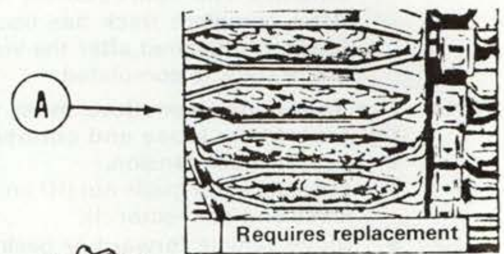
Note. When replacing individual track shoes, the rubber pads should be approximately the same height as adjacent pads. This may require removing new pads and installing used pads of equal height.

TRACK PADS

Note. Track pads are inspected daily after operation.

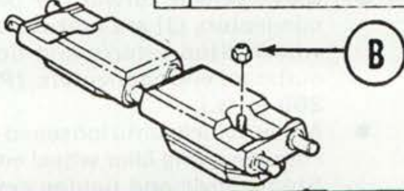
- Check for loose or missing track pads (A).
- Check track pads (A) for excessive wear. Track pads should be changed when the grouser begins to damage roadway.





Note. The following procedure should be used for tightening loose track pads.

Move vehicle until the loose track pad is between the compensating idler wheel and number 1 road wheel. Stop vehicle and tighten track pad nut (B). (Proper torque is 260 to 280 lb ft.)



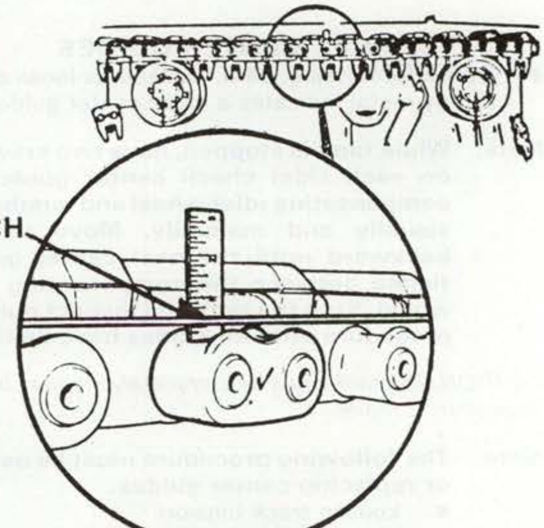
Note. When replacing missing track shoe pads, replacement pads should be about the same height as the adjacent pads.

VEHICLE IS NOT READY OR AVAILABLE IF AN ADJUSTING LINK IS BROKEN OR MISSING.

TRACK TENSION

Note. The following procedure is used for adjusting track tension after all faults that were detected have been corrected.

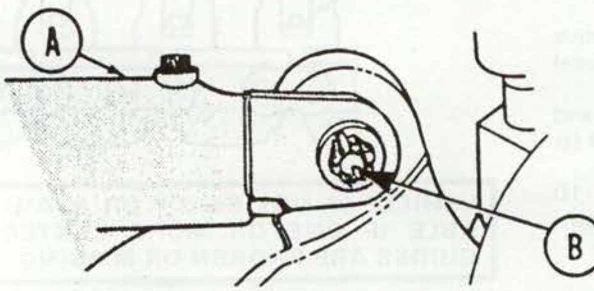
- Move tank forward on hard level surface and coast to stop without using brakes or steering.
- Remove dirt and mud from outboard end connectors between first and second support rollers.
- Place string, with weights on end, over first end connector before number 1 support roller and extend string past number 2 support roller to next end connector.
- Locate string in center of end connectors.
- Measure distance between string and the end connector midway between first and second support roller. The distance must be 3/8 to 9/16 of an inch for proper track tension.



TRACK ADJUSTING LINKS, RIGHT AND LEFT SIDES

Note. Track adjusting links are inspected daily after operation.

- Check that link assembly (A) is not missing or broken.
- Check that cotter pin (B) is not missing or broken.



VEHICLE IS NOT READY OR AVAILABLE IF THERE ARE THREE OR MORE DEAD SHOES OR ANY PIN IS BROKEN.

news notes

Reunions

The 35th annual reunion of the 12th Armored Division Association, July 16-19, 1981, Holiday Inn-Genessee Plaza, 120 Main St. East, Rochester, NY 14604.

The 39th anniversary reunion of the 11th Armored Division, August 13-16, 1981, the Marriott Inn, 505 Marriott Drive, Clarksville, IN 47130.

The 12th annual reunion of the 11th Armored Cavalry Regiment (Blackhorse), May 14-15, 1981, Fort Knox, KY. (Contact Bill Squires, Box C, Fort Knox, KY 40121.)

The 35th annual reunion of the 7th Armored Division Association, September 2-6, 1981, The Opryland Hotel, Nashville, TN.

The 3d Armored Division Association (Spearhead) reunion, July 23-26, 1981, Arlington Hotel, Hot Springs National Park, AR. (Contact Harley Swenson, Box 3153A, Fairfield Bay, AR 72088.)

The 34th annual reunion of the 6th Armored Division Association, July 22-25, 1981, the Hyatt Regency Hotel, Loyola Avenue and Poydras, New Orleans, LA (next to the Superdome).

The 16th Armored Division Association reunion, August 13-16, 1981, Little America Hotel, 500 S. Main Street, Salt Lake City, UT 84101. (Contact Edward "Doc" Blanchard, 801-250-2129.)

Armor Officer Is French Army Chief of Staff

General Jean Yves Delaunay, former Commander of Saumur, the French Army's Armor and Cavalry School, has been appointed as Chief of Staff of the French Army. An Armor officer, General Delaunay's career encompasses attendance at various French service academies, including the Staff College and War Academy. He served in several staff positions in Morocco and Algeria and was an instructor at the Army Tactical Studies Center. After attending the Center for Higher Military Studies and the National Defense Institute, General Delaunay was posted as Chief of Staff, 5th Military Region (Lyon), and subsequently as Commander, 10th Mechanized Brigade (Reims). While serving as Commandant of the French Armor and Cavalry School, General Delaunay visited the U. S. Army Armor School, Fort Knox.

USMA Preparatory School

The United States Military Academy Preparatory School (USMAPS) at Fort Monmouth, NJ, is now accepting applications for the class of 1981-82, which begins in August 1981. The application deadline for this class is May 1981.

USMAPS is an Army School which assists selected enlisted members to prepare and qualify academically, physically, and militarily for admission to the United States Military Academy at West Point. The 10-month academic year emphasizes English and mathematics. All students automatically receive a nomination to the Military Academy.

Applicants are urged to apply early in the academic year, as admission to USMAPS is highly competitive. Last year, over 1,200 Regular Army soldiers applied for the 170 vacancies available at USMAPS.

The basic eligibility requirements are simple. An applicant must be:

- A citizen of the U.S. prior to entering the Military Academy.
- At least 17 and not yet 21 years of age on 1 July of the year he or she enters the school.
- Unmarried and have no legal obligation to support a child or children.
- In good health, have no disqualifying physical defects, and have vision correctable to 20/20.
- A high school graduate, or the equivalent, with a solid academic background. Ideally, applicants should have 4 years of English and 3 years of college preparatory mathematics. An individual with obvious leadership potential but a weaker academic background should not be discouraged from applying since many factors are considered.
- Applicants should be highly recommended by their commanders. A Commander's Counseling Guide is included as the Appendix to AR 351-12. All recommendations from the chain-of-command are closely reviewed in an effort to ascertain the applicant's maturity, motivation, and desire.

Inclosures to the basic application are described in paragraph 9, AR 351-12, dated 1 October 1980. School transcripts and SAT/ACT test results may be forwarded separately; however, MILPOs and commanders should insure that the following items are included with the basic application:

- Medical forms (SF 88 and 93) not more than 1 year old.
- GT score.
- ETS date.
- MOS.
- Most recent BPFT/APFT results, less than one year old (baseline PT scores cannot be accepted).
- Current photograph.
- Commander's evaluation.
- Personal handwritten essay, subject: Why I Want to Attend the Prep School and My Goals in Life.

Further information may be obtained by calling the USMAPS Admissions Office at AUTOVON 992-1807 or commercial (201) 532-1807, or by writing to the Commandant, US Military Academy Preparatory School, ATTN: MAPS-AD-A, Fort Monmouth, NJ 07703

Pages from the Past

A MORE EFFECTIVE TANK ORGANIZATION

Specifically, those elements or services which are needed to make up a properly balanced and more effective tank organization are smoke, antitank gun destroyers (self-propelled artillery), pioneers, antiaircraft protection, reliable and fast communication, and suitable and sufficient reconnaissance, command, maintenance and supply vehicles. Just how to fit these services into the scheme of organization to give tank units proper balance must be determined by practical and extensive field tests.

The Cavalry Journal
January 1930

SMOKE FOR TANKS

It is inconceivable in modern war that tanks should not make use of smoke as fully as is practicable. Aside from the smoke produced on general areas by supporting artillery or aircraft, tanks should have smoke immediately available to them for neutralizing hostile antitank guns and OPs covering their withdrawal and maneuver against hostile armored vehicles, and for many other purposes. This requirement for smoke within the tank organization immediately brings up the question as to how it should be produced. Obviously, the simplest way would be to provide smoke shells for the tank cannon. However, the small caliber of the cannon and the limited amount of available ammunition precludes the possibility of developing an adequate volume of smoke by this means. Another method, which has received considerable attention experimentally, is to provide the tank with a smoke-producing apparatus which can be turned on and off at will.

The Cavalry Journal
January 1930

A WELL-BALANCED TEAM

The progressive tank officer has a vision of a powerful, well-balanced team; a team sufficient within itself to meet the normal events of a good tank fight, and a unit which is able to give intelligent and powerful support to the rifle units it is supporting. Such a dream will only become a reality by a reorganization which will exploit fully the powers of the tank and provide those elements which are normal and necessary to every tank fight. Again, the objective of such a reorganization should be to increase the battle mobility of the tank unit; thus making it a much more flexible and powerful aid to the supported rifle troops.

The Cavalry Journal
January 1930

OBJECTIVES OF THE MECHANIZED FORCE

The objectives of the mechanized force in attack will be well in rear of the enemy's frontlines. Such objectives may be: enemy reserve divisions, army artillery, command posts and lines of communication, areas of tactical importance to its own army, critical areas essential to the enemy in his withdrawal; or may be the opposing mechanized force. The last named may well be the first objective for, like Cavalry and Aviation, a mechanized force cannot take full advantage of its characteristics until it obtains mastery over the corresponding arm in the ranks of the enemy.

The Cavalry Journal
July 1930

BOOKS

ARMOUR IN CONFLICT: THE DESIGN AND TACTICS OF ARMORED FIGHTING by Ian V. Hogg. Jane's Publishing Company, London, 1980. 202 pages. $16.95

Ian V. Hogg's new book on tanks might better be subtitled, "A History of Tank Tactics and Design from 1914 to 1945." Of the 202 pages of text, 173 pages cover the period 1914 to 1945. What is truly disappointing is that Ian Hogg is one of the finest military writers active today. His books on U.S., British, and German artillery are classics in the field.

Unfortunately, *Armour in Conflict* does not adequately address modern armor. For example, on page 201, a photograph caption of the *Leopard II AV* implies that the *Leopard II* is only an improved *Leopard I,* rather than a new generation of tanks. No mention is made of the Soviet *T-64* or *T-72* tanks. A misstatement of fact also occurs on page 201, where Hogg states that "no major main battle tank of today carries a plain high explosive shell . . . ." In fact, all Soviet tanks carry up to half the basic load of High Explosive (not HEAT) shell. The development of Antitank Guided Missiles (ATGM) and the implications ATGM have in the design of tanks is so poor that the value of the book is questionable. Finally, no mention of the development of Chobham armor by the United Kingdom is made. A glaring fault is the failure to discuss modern small unit tactics at the platoon level, to compare three, four, and five tank platoons, or to discuss the use of light and main battle tanks in reconnaissance units.

Strong points of Hogg's book include a masterly discussion on the false lessons learned about the tank employment during the Spanish Civil War, and the evolution of tanks between World War I and World War II.

Summing up, *Armour in Conflict* can serve as a useful introduction to armor, but falls seriously short of being a valuable discussion on modern tank design. The book falls short of the standards set by most other books published by Jane's for the specialist. It can be recommended only for beginners.

GERALD A. HALBERT
Captain, MI

COUNTER COUP: THE STRUGGLE FOR THE CONTROL OF IRAN by Kermit Roosevelt. New York: McGraw-Hill, 1979. $12.95

In 1953, Mohammed Mossadegh was prime minister of Iran. He allowed himself to appear, or become, a threat to British oil interests, to the political position of the Shah, and to the strategic posture of the United States as interpreted by the Dulles brothers.

By covert action, Mossadegh was removed from office and imprisoned. "Kim" Roosevelt writes of his part in the overthrow in *Counter Coup* and it is an exciting tale of a real episode in the early days of what was called the Cold War.

Be warned that this is an account by one participant and there must have been many details and identities that he did not feel proper to include over 25 years later. The essence of the events was that the Shah was persuaded to dismiss and arrest his prime minister, replacing him with one whose orientation was pro-Western.

The author, grandson of Theodore Roosevelt and a graduate of Harvard in the early thirties, had a wartime career with the Office of Special Services (OSS) and then served with the CIA. He tells his tale in an entertaining manner although he confused me by shifting in time abruptly and frequently.

Roosevelt states (p. 107) that the coup, when first proposed in late 1952, had "no chance to win approval from the outgoing administration of Truman and Acheson." The Dulles brothers, in contrast, seem to have supported the coup readily.

The ending of Roosevelt's account throws him in a favorable light as he reported to John Foster Dulles, who seemed to relish covert actions of this sort. The author warned him that careful, accurate intelligence work had shown that the plan would almost certainly succeed—as it did—but such action should be undertaken only when the prospects were clearly favorable. Roosevelt's warning to John Foster Dulles was disregarded in the preparation for the Bay of Pigs.

This is a must for those interested in international politics.

B. MCCLUER GILLIAM
Colonel
Virginia Military Institute

THE BATTLE FOR GAUL by Julius Caesar. Translated by Anne & Peter Wiseman. David R. Godine, Boston, April 1980. 216 pages. $15.95

For more than two millennia now, Julius Caesar's *Commentaries* on his conquest of Gaul (58-50 BC) have been one of the great military and literary classics of Western civilization. Peter Wiseman, professor of classics at Exeter University, and his wife, Anne, now offer us a new translation of this work, along with illustrations selected by Barry Cunliffe, professor of European archaeology at Oxford University. This new edition may become almost as much a classic in our own time as Caesar's work did in his.

The Wisemans and Professor Cunliffe have added an introduction on Caesar himself and the political world of Rome during the late Republic, along with some extremely useful comments on the Gaul of Caesar's day: comments which draw as much on archaeology as on the classical writings. The only criticism I can make of these additions to Caesar's text is that they are too short. They add so much depth and interpretation to what Caesar wrote that they greatly enhance the value of the *Commentaries* and enable the reader to catch nuances in the text that he might otherwise miss. The illustrations consist of photos of archaeological relics contemporary with Caesar's conquest, plus some useful maps and diagrams and several beautiful color plates. Again, the only criticism I can make is to regret that there are not more of them. They are excellent examples of the way maps, diagrams, and photos can broaden and enhance the value of a text.

I cannot evaluate the Wisemans' translation of the *Commentaries*. I last tangled with the *Commentaries* in Latin as a sophomore in high school; Caesar won that one too. But their translation reads well and preserves much of the terse, spare flavor of the original text. The translators note that they have taken two liberties with the original manuscript: They have substituted current names for some of those of Caesar's day, and they have dropped Caesar's stylistic device of always referring to himself in the third person. The result is a smoother text. Of course, the substitution of current names assumes that we know the exact locations to which Caesar refers; I presume the Wisemans and Professor Cunliffe are competent to make that judgment. But I have some reservations about making Caesar speak in the first person. Caesar the politician chose to use the third person, possibly to give himself airs of modesty, to cloak himself in the majesty of greater distances from the reader, or for other unknown reasons. It may well be that modern audiences could not grasp the effect that Caesar intended—still, as a historian, I dislike tampering with documents. I would rather leave it to the readers to make of this stylistic quirk whatever they will. Granted, this is a minor point.

But what of the text itself? For those who have not yet read the story of Caesar's conquest and "pacification" of the greater part of western Europe in eight years, this edition represents a marvelous opportunity. Caesar's taut and unadorned style lays bare—granted, from his own point of view alone—the cold and calculating policy, the technical and, above all, administrative superiority, and finally, the utter ruthlessness which brought the whole of the western world under the dominion of Rome. The reader watches Caesar first research, then exploit, the political and tactical weaknesses of his Celtic, Germanic, and British foes. The reader notes Caesar's respect for his foes as individuals, but also his contempt for their "barbarous" societies and his unquestioning assumption of Rome's fitness and destiny to rule. Above all, the reader gets a splendid chance to watch a real leader and commander planning his campaigns, always to do what the enemy does not expect; balancing the conflicting requirements of strategy, tactics, and logistics; *caring* for his men as individuals and never forgetting that he owes everything to their efforts, and finally, in the decisive moments of battle, getting out in front and *leading* them to victory.

This book has been one of the great classics of soldiering for 2,000 years. The soldier who has not yet read it is missing something of great value. Take advantage of this magnificent new edition and find out what the word "soldier" really means.

JEFF GUNSBURG
Major
Virginia Military Institute

MECHANIZED INFANTRY by Richard E. Simpkin. Published by Brassey's Publishers Limited and Pergamon Press, Inc., Elmsford, New York, June 1980. $26

This book is aggressive. It is a good extension of Brigadier Simpkin's recent book, *Tank Warfare*. In fact, you need to have that book handy while reading this one, because he has not wasted any pages or the reader's time by duplicating what he has already presented once quite well.

This reviewer read through the book four times. The first reading was confusing because so much is packed into so little text. The second reading was used to note errors that have obviously occurred because the author has not received proper information. For example, page 84 speculates on the genesis of recent efforts on automatic 75-mm cannon firing armor-piercing discarding sabot, fin-stabilized (APDSFS) ammunition.

With respect to that, this reviewer remembers the meetings and discussions in 1972 as well as the proposals for 60- to 76-mm cannon and the analysis in November 1972 that supported 75-mm by showing that a single hit would perforate and kill heavy armor. Furthermore, there was an upstart's suggestion on a few occasions that an 88- or 90-mm cannon would provide for multipurpose usage and growth.

The reason for burst fire was not for multiple strikes (even though the damage that a *Vulcan, ZSU-23-4,* or *Gepard* can do is quite impressive), but rather to provide for shorter time-to-kill by using the closed-loop fire control to gain a higher engagement hit probability at extended ranges before the enemy could effectively hit in return. Another error, which is forgivable, is the premature writing-off of recoilless guns for firing APDSFS projectiles. Most recently, Finland has displayed a new family of recoilless weapons that apparently do this quite well.

The third and fourth readings were rather fast and were in contrast and then agreement with many of the author's points. This reviewer's polarization can be summarized in the following: The role of infantry (no matter how transported) is to deal with human beings; the role of war machines is to deal with equal and lesser war machines (this is preferable, though at times the opponent may be better, in which case sacrificial superiority in numbers becomes important).

Furthermore, this reviewer would not enslave men to protect or destroy war machines that are more durable than they are (i.e., cover a tank's blind spots or form sacrificial hunter-killer teams). Other answers should be found like better tanks and/or more of them. In agreement with the author, one should look into means of driving/enticing enemy tanks and infantry combat vehicles into situations where mechanized infantry with firepower from the vehicle and dug-in personnel can be used to help defeat the enemy (hammer and anvil).

The polarization and interest of this reviewer was achieved. Seeing as how it takes 7 to 15 years or so to get new equipment into the field, the obvious intent of this book is to reopen the debate on roles, organization, and equipment for the next generation of mechanized infantry (land or air transported). In order to do this, many sides of the problem(s) are discussed simultaneously. Many readers will be polarized by the discussions; some others may be turned off by minor errors. This book will accomplish its purpose if it is read *and discussed*. Those truly concerned with land warfare and the future generation to be engaged in it will find *Mechanized Infantry* stimulating and essential.

JOSEPH E. BACKOFEN, JR.
Battelle's Columbus Laboratories

THE ARMOR DESK

This issue marks ARMOR's 93d Anniversary, the U.S. Army's oldest professional journal, and the end of my tour as ARMOR's 33d Editor and Executive Director of the U.S. Armor Association. The ever changing needs of the Army at Fort Knox beckon.

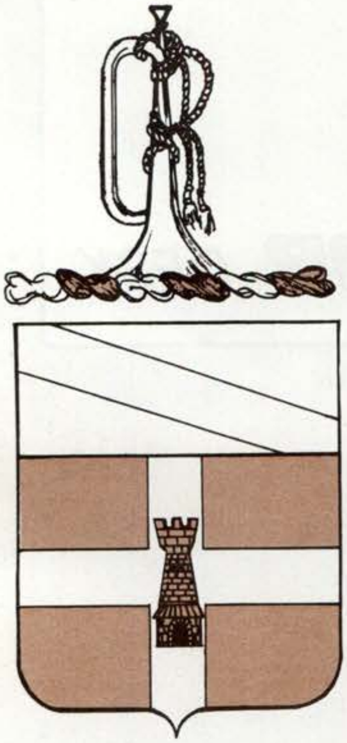
Upon becoming ARMOR's Editor, I pledged to you to build upon the quality and prestige of ARMOR and the Armor Association that my predecessors had established. Only you can be the judge of my success.

I wish to express my gratitude to the ARMOR and Armor Association staffs for their support and to all of you who supported ARMOR and myself with your articles, letters, and praise as well as constructive criticism. Continue to do so for my successor. ARMOR cannot maintain its highly respected international position without your contributions.

The nearly two years that I have served you have been most rewarding. I have witnessed our coming ever closer to receiving our much needed new steeds of battle, a renewed sense of professionalism in our junior armor officers, a better-trained armor force, and a steady improvement in Armor Association membership. Hopefully, ARMOR in some small way has been contributing to the Armor Community's achievements.

Challenges still abound. But I am confident that the Armor Community can meet them. "There is no substitute for victory." You, the "Combat Arm of Decision," must be prepared to defend the freedom of our nation and other nations that call for our help.

FWS



3d Armored Cavalry

The regiment's original green facings on the uniform and its gold trumpet insignia are shown by the color of the shield and by the crest. The unit's first engagement was the capture of Vera Cruz, and it continued with especially distinguished service throughout the campaign of 1847 to the capture of Mexico City. Upon entering the city, it hoisted the Stars and Stripes over the national palace and displayed the regimental standard from the palace balcony, which drew from General Scott the statement, "Brave Rifles! Veterans! You have been baptized in fire and blood and have come out steel." The campaign is shown by the cross for Vera Cruz and the tower in green (the Mexican color) for fortified Mexico City, the first and last engagements thereof. The chief, taken from the arms of Lorraine, commemorates the regiment's World War I service.

3D ARMORED CAVALRY

(Brave Rifles)

Constituted 19 May 1846 in the Regular Army as the Regiment of Mounted Riflemen. Organized 12 October 1846 at Jefferson Barracks, Missouri. Redesignated 3 August 1861 as 3d Cavalry.

Inactivated 15 July 1942 at Fort Benning, Georgia; personnel and equipment transferred to 3d Armored Regiment (see ANNEX). Redesignated 18 January 1943 as 3d Cavalry, Mechanized. Activated 15 March 1943 at Camp Gordon, Georgia.

Regiment broken up 3 November 1943 and its elements reorganized and redesignated as Headquarters and Headquarters Troop, 3d Cavalry Group, Mechanized, and 3d and 43d Cavalry Reconnaissance Squadrons, Mechanized.

Headquarters and Headquarters Troop, 3d Cavalry Group, Mechanized, inactivated 22 December 1945 at Camp Kilmer, New Jersey. Activated 26 February 1946 at Fort George G. Meade, Maryland. Redesignated 5 November 1948 as Headquarters and Headquarters Company, 3d Armored Cavalry; organization of the remainder of 3d Armored Cavalry completed 3 November 1948 by redesignation of elements of the 3d and 43d Cavalry Reconnaissance Squadrons, Mechanized (both active), and by reconstitution, redesignation, and activation of certain other elements of the 3d Cavalry which had been inactivated or demobilized during 1921—1928.

3d, 777th, and 21st Tank Battalions (see ANNEX) consolidated 8 January 1951 with 3d Armored Cavalry. (Battalions and companies redesignated 1 June 1960 as squadrons and troops.)

Annex

3d Armored Regiment constituted 11 July 1942 in the Army of the United States and assigned to 10th Armored Division. Activated 15 July 1942 at Fort Benning, Georgia, with personnel and equipment from 3d Cavalry.

Regiment broken up 20 September 1943 and its elements reorganized and redesignated as follows: 3d Armored Regiment (less 1st and 3d Battalions, Band, and Maintenance, Service, and Reconnaissance Companies) as 3d Tank Battalion; 1st Battalion as 777th Tank Battalion and relieved from assignment to 10th Armored Division; 3d Battalion as 21st Tank Battalion; Reconnaissance Company as Troop D, 90th Cavalry Reconnaissance Squadron, Mechanized (separate lineage); Band and Maintenance and Service Companies disbanded.

Above battalions inactivated as follows: 3d Tank Battalion 13 October 1945 at Camp Patrick Henry, Virginia. 777th Tank Battalion 24 October 1945 at Camp San Luis Obispo, California. 21st Tank Battalion 19 October 1945 at Camp Myles Standish, Massachusetts.

3d, 777th, and 21st Tank Battalions consolidated 8 January 1951 with 3d Armored Cavalry; concurrently, 3d and 21st Tank Battalions relieved from assignment to 10th Armored Division.

Campaign Participation Credit

Mexican War
- Vera Cruz
- Cerro Gordo
- Contreras
- Churubusco
- Chapultepec
- Vera Cruz 1847

Civil War
- Chattanooga
- New Mexico 1861
- New Mexico 1862
- Alabama 1863
- Tennessee 1863
- Arkansas 1864

Indian Wars
- Comanches
- Little Big Horn
- Cheyennes
- Utes
- Texas 1856
- New Mexico 1857
- New Mexico 1858
- New Mexico 1860
- New Mexico 1861
- New Mexico 1867
- New Mexico 1869
- Oklahoma 1868
- Arizona 1870
- Arizona 1871
- Arizona 1882

War With Spain
- Santiago

Philippine Insurrection
- San Isidro
- Luzon 1899
- Luzon 1900

World War I
- Without inscription

World War II
- Northern France
- Rhineland
- Ardennes-Alsace
- Central Europe

Troops additionally entitled to Campaign Participation Credit as follows:

Troop A:
Indian Wars
- Texas 1855
- New Mexico 1859

Philippine Insurrection
- Luzon 1901

Troop B:
Indian Wars
- Nebraska 1872

Troop C:
Indian Wars
- South Dakota 1877

Troop F:
Indian Wars
- Texas 1869

Troop I:
Mexican War
- Molino del Ray

Decorations

Presidential Unit Citation (Army), Streamer embroidered BASTOGNE (3d Tank Battalion [less Company C] and Company C, 21st Tank Battalion, cited; WD GO 17, 1945)

Belgian Croix de Guerre 1940 with Palm, Streamer embroidered BASTOGNE; Cited in the Order of the Day of the Belgian Army for action at BASTOGNE (3d Tank Battalion [less Company C] and Company C, 21st Tank Battalion, cited; DA GO 43, 1950 and DA GO 27, 1959)

Troop G additionally entitled to: French Croix de Guerre with Silver-Gilt Star, World War II, Streamer embroidered MOSELLE (Troop B£ ½⅜D Cavalry Reconnaissance Squadron, cited; DA GO 43, 1950)

Troop Lj additionally entitled to: French Croix de Guerre with Palm, World War II, Streamer embroidered LORRAINE (Troop C, 3d Cavalry Reconnaissance Squadron, cited DA GO 43, 1950)

may-june 1981

ARMOR

US ARMY ARMOR SCHOOL

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Assistant Commandant
BG JOHN L. BALLANTYNE

Chief of Staff
COL WILLIAM F. COAD

Command Sergeant Major
CSM JOHN W. GILLIS

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"To disseminate knowledge of the military arts and sciences, with special attention to mobility in ground warfare; to promote professional improvement of the Armor Community; and to preserve and foster the spirit, the traditions, and the solidarity of Armor in the Army of the United States."

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ARMOR the Magazine of Mobile Warfare

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COVER

While countless cavalry regiments were wasting time in France during World War I awaiting tactical opportunities that never came, other regiments were playing a major role in a mobile campaign on another continent. Cavalry, whose era of dominance was coming to a close, was to enjoy one last, glorious moment before retiring from the field of battle. Beginning on page 30, Lieutenant Jonathan Harbuck recounts and analyzes Sir Edmund Allenby's campaign in Palestine.

LETTERS

On-the-Spot Maintenance

Dear Sir:

As a former maintenance battalion commander in an armored division, I read CPT Boulter's article, "GS Maintenance Forward," in your Nov-Dec 1980 issue with considerable interest. There is, of course, nothing new about the concept of repairing deadlined equipment as far forward as feasible. One of the first steps that I took when I assumed command was to send contact teams on a "permanent" basis to each maneuver battalion. While this presented certain control difficulties for me and my company commanders, the principal benefit was to try to convince these supported commanders that we really were serious about on-the-spot maintenance.

The maintenance task is far more complicated than inferred in CPT Boulter's article; moreover, his article is incomplete in that it presents only a piece of the total picture. Additionally, I believe that his conclusions are too euphoric about the "success" of this new RGS approach. Much more needs to be written about it, and certainly more testing is needed.

I think that the battleground will be so chaotic that for all practical purposes we can forget resupply, evacuation and return of disabled equipment. If we cannot fix it quickly on the spot, or in close proximity, we can forget it. This means, of course, that we must develop more maintenance skills than ever before in both using units and support elements—and, most important, we must change our ingrained *attitudes* about this need. Commanders must learn to appreciate these conditions and insist that maintenance personnel really learn their jobs, *get proper support internally* and externally, and see that they *do perform*. The worst maintenance problem I had was with the cavalry squadron because that CO did not give a damn about maintenance, and thus nobody else in that unit did either. Although I made a major effort to help him, it was never productive and never sustained, as he thought maintenance was entirely my job and a bore to boot. He did not seem to realize that, ultimately, the only charging he was going to do would be on foot.

Of course it also would help if we stopped making our equipment so infernally complicated. This, really, is where the maintenance problem begins. If the operator does not understand the equipment, he certainly will abuse it, and the same applies to the mechanic. At a time when we should be trying to encourage more individual resourcefulness, we are creating a tunnel vision soldier who is taught only to plug in, plug out. When the supply of "plug ins" runs out, he is helpless, and finally, the unit is too.

DR. GEORGE G. EDDY
Austin, TX

The M-48A6 and M-60A4

Dear Sir:

During the last several years, the firepower, fire control, powerplant and drivetrain performance has been increased on the *M-48/M-60* series tanks. The most important factor, as I see it, has been overlooked—survivability. The chance of these tanks surviving on the modern battlefield depends largely on the crew's ability to avoid being hit. Since they will engage the enemy in direct fire, they will be hit sometime and most likely destroyed, because of the thin armor and poor interior layout. The active Army will not have to worry about this, as they will have the *XM-1* in a few years. The National Guard and Reserve, who make up a large part of our forces, will be using the *M-48/M-60* tanks into the 1990's. Something must be done to increase the survivability of these tanks since they will be fighting alongside the *XM-1*. I do not relish facing *T-80s* with a *M-60A3*, let alone a *M-60A1*.

Because of our tactics, most of the hits will be on the turret. This was shown in the Yom Kippur War. One possible solution is an applique armor kit for the turret. This increases the armor, but does nothing for interior protection. The second solution, and the best in my opinion, is to replace the current *M-48/M-60* turret with one like that of the *XM-1*. I need say nothing of the *XM-1* turret armor. Given there is a penetration, the Halon fire suppression system and ammunition compartmentalization will increase the chance of survival.

There are a few other advantages. All of our tanks—Active, National Guard and Reserve—would have the same turret components, test sets, and special tools. Also, all of the turret mechanics would be trained the same. Only the hull would be different, and the Army is planning on supporting two entirely different tanks anyway. This modification could possibly be made into a kit for division maintenance to install. The gun tube and communication system could be transferred from the old turrets along with any other common items.

The National Guard and Reserve *need* a better tank. The *M-48A6* and *M-60A4* can be that vehicle. In no way could this modified tank replace the *XM-1*. What they could do is better operate with the *XM-1* than the current *M-48A5* and *M-60A1/M-60A3* can. This proposal is a less expensive alternative to buying new tanks to increase the effectiveness of the second half of our combat forces through the 1990's.

CHRISTOPHER F. SCHNEIDER
Staff Sergeant
Troop A, 1/238th Cavalry ARNG

Appreciates Division '86

Dear Sir:

Your article in **ARMOR** (Nov-Dec 80) on Division 86 was a most welcome sight, as my boss recently asked me to prepare a one-hour briefing for the division staff on this issue. I am Assistant G-3 for Operations and Exercises to the 5th Armored Division, French Army in Germany, as an exchange officer.

I note the disappointment in the failure of the Division 86 Study to adopt the Combined Arms Battalion. You probably know through the USAARMS' French LNO, COL Loubens, that this is exactly how the infantry battalions/regiments of the French armored division are organized. *(See* **ARMOR**, *September-October 1980. Ed.)* I have visited the two mechanized regiments of my division, and they do in fact enjoy the advantages you mention in the **ARMOR** article. Next week, the division goes to a major training area inside France, and I'll have the opportunity for several weeks to see how the train-together theme works out in the field. True to the principle, the armored regiments of the armored division have a 4-platoon mechanized company, mounted in the *AMX-10P* IFV. This permits a theoretical allocation of one mechanized platoon per tank company, depending on the mission.

WILLIAM K. BERGMAN
Major, Armor, U.S. Army
5th French Armored Division

This letter was addressed to LTC Ralph G. Rosenberg, author of "Increased Combat Power," which appeared in the Nov-Dec issue of **ARMOR**. *Ed.*

"Panzer Ace"

Dear Sir:

After three years of research and two trips to Europe, I'm ready to start writing my book on SS-Hauptsturmfuhrer Michael Wittmann. While in command of a *Tiger I* tank, Wittmann and his crew destroyed a grand total of 138 tanks and 132 antitank and field pieces, making him Germany's top ranking "Panzer Ace" of all time.

We are in contact with his widow, family, and veterans who served with him. We are also trying to locate any others who may have served with him in France, Poland, Greece, Russia, or in Normandy, 1944. I have over a hundred photos for the book (many never before seen by the public) but am seeking photos of Wittmann serving in infantry, in armoured cars (France, 1940), and in Sturmgeschutz III (Greece and Russia, 1942-43). Any and all information, photos, etc., provided for this publication will be credited and returned after its use. Please contact me at the address given below.

GARY L. SIMPSON
2051 Division Street
Boise, ID 83706
U.S.A.
Tel: (208) 342-3820

Search for Liberators

Dear Sir:

I have been told you are the only person who can help me in my 7-months try to find out what armored division liberated us POWs who had marched from Krems, Austria on April 1, 1945, and stopped on May 2, 1945, because we had reached a point just short of the American lines. We were all interned in *Stalag* 17. We were liberated in the Passau area. I can still remember the tank that broke through the area and came upon us, but for the life of me, I can't recall what division it was. I'm certain it was part of the Third Army.

I was a tail gunner in a *B-24* on our way to bomb a place called Zwiekau, Germany. We didn't get very far, as we were shot down over the Brussels area on April 12, 1944. The odd thing about this mission—which I found out about 30 years later—was that it was called back just as the 445th Bomber Group crossed over the German border.

MICHAEL R. CIANO
53 Brighton Ave.
Belleville, NJ 07109

Upgrading the MBT Fleet

Dear Sir:

I read with considerable interest the article on Teledyne's "Super" *M-60* battle tank in the March-April issue of **ARMOR**.

It seems a shame that *M-60A1s* scheduled for rebuilding into *M-60A3s* at the Anniston, Alabama, tank plant should not come out "Super" *M-60s.* All of these systems are proven and are needed to make the *M-60* viable through the 1980's. The Federal Republic of Germany has already done basically this with *Leopard I* in the *Leopard IA3.* The British have decided on the challenger/improved *Chieftain* and the Soviets are fielding the *T-72* with cavity armor. The U.S. appears to be the only major power dragging behind on upgrading its MBT fleet.

Additional neutron radiation attentuation might also be provided to the "Super" *M-60* by filling the armor cavities with a boronated polymer. In any case, the Teledyne concept appears to be viable and very cost effective, as well as timely.

It is rewarding to see that private U.S. companies are still interested in defense enough to expend their own efforts to improve U.S. equipment, despite DOD's poor record in rewarding private initiative. Of course, I am sure other countries will probably take the opportunity to upgrade their *M-60s* even if the United States doesn't.

BRADLEY H. PETERSEN, JR
Lieutenant Colonel, Armor

M-1 and Leopard II

Dear Sir;

I do not read **ARMOR** very frequently, but despite this fact, I must emphasize that its articles about new technology and historical background are very attractive and instructive.

Furthermore, it is significant that the editors do not follow a uniform *"pro domo"* line, but leave space for critical remarks; e.g., the letter from R. Stone in the September-October issue about the quality of *XM-1* and *Leopard II. (The XM-1 has been classified type standard as the M-1. Ed.)*

As for myself, I am not so concerned with the disadvantages and advantages of each tank. They are negligible. The major disadvantage is in having another main battle tank (MBT) in Europe for which you have to build up facilities for repair and maintenance, warehousing of spares, etc, etc. If you consider that NATO is operating about nine types of MBTs, you can imagine how this will cost the already frustrated taxpayers millions of dollars extra. Additionally, the functioning of supply lines in wartime will be more than doubtful.

We Germans suffered the worst sort of experience in World War II with the mix of many types of vehicles. I do not understand why we are not in the position to learn from such lessons.

In the *M-1,* I see mainly a further lost chance to standardize our equipment in NATO (with the exception of the 120-mm gun) as the Russians have done. Even if *Leopard II* had been considered the second best solution—something which I don't believe personally—it would have been better to agree to that solution which was available for both of us and could have saved considerable money and effort. But it seems that it is the ambition of national armies and industries to create their own tank—a very costly hobby in peacetime and a very dangerous practice in wartime when we risk the lives of many soldiers of our allied forces.

M. G. HAARMANN
Dusseldorf
West Germany

Effective Firepower

Dear Sir:

I enjoyed Sergeant Scott's letter in the January-February 1981 issue of **ARMOR** and appreciate the feedback. Unfortunately, he missed the point in my articles in that I believe that rocket-assisted rifle grenades might be the close-in antiarmor weapon he is searching for. The simple reason for this is that the warhead must be larger than 40-mm if it is to defeat future threats, i.e., those in the field when the grenade finally finishes development. Looking at the historically accepted sizes and weights (not withstanding Captain Mitchell's excellent article in the same issue), someone should try to package a new warhead and propulsion system into those constraints to meet Sergeant Scott's desires. In this way each rifleman could carry and fire two or more of these new grenades that would not expose his position, have a relatively flat trajectory to maybe 200 meters, and kill an armored target. It would also be useful if the grenades could be thrown or dropped out of buildings onto the tops of armored vehicles or among troops in the open.

With respect to crew-served weapons, I am really recommending that they be used as multipurpose, heavy firepower weapons. One of the roles would be to kill tanks with unguided, shaped-charge ammunition for use to maybe 1,200 meters. Another role might be to launch a fire-and-forget, self-guiding round that could engage armored vehicles to 3,000 meters. These latter rounds might only be issued where there was a chance targets might actually be engaged at ranges over 1,200 meters. If the shaped-charge warhead of the unguided round is loaded with more explosive than may be necessary to kill an armored vehicle, it might enable the round to also have enough explosive effect to be useful against bunkers and buildings in an urban environment. If this design feat cannot be achieved while maintaining a reasonably fast and flat trajectory to 1,200 meters, then I would suggest that the crew-served weapon be used with high-explosive plastic rounds against these other important targets. By now you may note that the gist of my thinking is to provide man-portable, accurate, heavy, effective firepower.

I appreciate your comments and ideas. I am sorry that I have not been too clear on all the points contained in my articles. Please continue to pursue your goal of coming up with more effective firepower. I hope that this explanation helps you toward this goal.

JOSEPH E. BACKOFEN, JR
Ordnance Technology Section
Battelle Columbus Laboratories
Columbus, OH

Comments on T-72

Dear Sir:

We reviewed with interest the photograph of the Soviet tanks (Jan-Feb 80), apparently of the *T-72* type, equipped with hull skirts and a small but possibly significant turret alteration.

On first glance, it is interesting to note that the tank in the photo is equipped with full-length hull skirts. In light of the discussions concerning the Western developments in the armor field, particularly as evidenced in the affixing of Chobham-style armor to U.S. as well as possibly West German and British tanks, and rumors of Soviet efforts to develop new armor, it would seem quite simple to leap to the conclusion that the skirts may be a Soviet form of such armor. However, upon closer scrutiny, we notice that the skirt is divided into four sections, bolted to the pannier. Based upon our limited knowledge of Chobham armor, it would seem questionable that such armor, at least of the Western style, which is reported to weigh virtually as much as common steel armor, could be bolted to the light sheet steel panniers without simply dismounting the entire assembly due to the weight involved. Moreover, all of the photos showing Western Chobham, and we would presume any other Chobham style, have graphically indicated the presence of such armor as a result of the employment of thick flat plates, unlike the apparently rounded top of the skirts in this photograph.

Further, as we look to the left of the photo, near the rear of the foremost vehicle, we note that the skirt sections are not properly aligned, giving the impression that they are in fact only light sheet steel. While it is possible that the Soviets are planning to equip their vehicles with simple skirts such as these, and may have been testing the concept in the field for any potential problems related to such skirts in mud and snow, we are left with the question of why the skirts were not displayed for the visiting French delegation at the same time as the "Gill armor" in 1977? Perhaps more so now than before, since such armor has been highly disputed in effectiveness. It is of virtually no worth in stopping kinetic rounds and apparently would have a tendency to enhance the effect of large HEAT type rounds mounted, as they are so close to the vehicle.

Is it possible the full skirts shown in the photograph were a test that ran concurrently with the test of Gill armor, which ultimately saw the latter selected as the better defensive armor, thus making the photograph a sample of a rather early armor test? Or is it instead a very recent photograph, as the modification of the turret would lead us to believe, which shows a simple test rig for upcoming Chobham skirts? The turret would seem to lead us to the latter solution.

As has been reported through various sources, the Soviets have continued to progress in their efforts to provide new and more efficient sights for their tanks. In the photo, it is interesting to note that the angular protrusion on the top of the turret, forward of the commander's cupola, has been deleted. Housing what we believe to have been the commander's sighting system in the first models of the *T-72*, it would seem that some significant change in or improvement of the commander's sights has now been effected, at least to the stage of field testing. A possible replacement system, which is quite small and apparently very simple in exterior design, is affixed adjacent and much closer to the commander's cupola than with the previous sights.

Although it would seem remotely possible that what we observe is one-half of a simple stereoscopic sighting system as was mounted on their earlier *SU-130* tank destroyers, the mounting for such a system, particularly over the commander's station rather than the gunner's station, would tend to refute such a system. Also similar in both size and shape to current passive light intensifiers, it may be that the new system is intended to utilize a Soviet development in this area in an attempt to restore Soviet ascendency in the field of night combat. Although we are not certain that such an equipment addition would justify or even require the deletion of the previous sighting station. So we wonder if the current discussions in Soviet armor circles concerning the utilization of the longer-ranged, more hard-hitting 125-mm gun of the *T-64* and *T-72* for specific antiarmor fire from halted or dug-in vehicles has generated the demand for a much more highly effective sighting system based on laser optics? Or has the availability of laser optics, a system now being field-tested, perhaps created the discussions concerning its tactical employment?

As always, we find **ARMOR** magazine both interesting and thought provoking. We hope to see more such photographs and data on current Soviet armor in the future as it is released.

JOSEPH R. BURNIECE
PAUL A. HOVEN
Summit Simulations, Inc.
Edina, MN

Comments on Ratios

Dear Sir:

In response to Captain McCaig's letter in your January-February issue titled "Power to Weight Ratios": I could not agree more that increasing sprocket or wheel horsepower-per-ton yields increasing rates of burst acceleration. However, the ability of the tracks or drive wheels to transmit that power can quickly become the limiting factor. Increasing sprocket or drive wheel torque beyond the traction coefficient will result in smoke and dirt thrown in the air, but remarkably little improvement in forward progress.

On the point of torque converters lacking response or holding back the engine after a step increase in throttle opening: I recommend for Captain McCaig's consideration that when full throttle is requested, any engine must first accelerate itself to high rotational speed before it can provide maximum horsepower for vehicle acceleration. Torque converters permit the engine to accelerate its own speed, while simultaneously multiplying engine output torque to accelerate the vehicle. This characteristic is controlled by design in such a manner so as to maximize vehicle acceleration over a distance. Different engine types also have different response characteristics, independent of this type of control.

It should be noted that other methods have, and are still being tried to exert transmission control over engine speed for hoped-for improvements in acceleration as well as fuel consumption. Independent Army testing reported in TACOM Technical Report No. 11675, Aberdeen Proving Ground Report No, APG-MT-4848, Amex III: Mobility Evaluation of XM723 MICV (DT-II Phase), and TACOM Letter Report—Contract DAAE07-74-C-0019 consistently document a 7 percent sacrifice in acceleration and a 12 to 21 percent penalty in fuel consumption, due to internal inefficiencies associated with the alternate methods tried thus far.

Lastly, I suggest that Captain McCaig also consider that acceleration response comparisons between vehicles must take into account differences in sprocket or wheel horsepower available per ton. An *M-60* tank with approximately 8.5 sprocket horsepower per ton cannot respond to throttle changes in the same way as a passenger car at approximately 70 wheel horsepower per ton, or even a truck at some interim value.

J. R. LUCAS
Detroit Diesel Allison
Division of General Motors
Indianapolis, IN

We Owe Captain Smith An Apology

ARMOR sincerely regrets the misattribution of the article, "A New Option for the M-551" (ARMOR, January-February), to Captain Robert A. Snedden.

The author was, in fact, Captain Donald B. Smith who also wrote "TOW in the 80's" (ARMOR, March-April 1981).

Captain Smith has been awarded a certificate of appreciation by the commandant of the U.S. Army Armor Center for his contribution to the increased knowledge of the military arts and sciences.

COMMANDER'S HATCH

MG Louis C. Wagner, Jr.
Commandant
U.S. Army Armor School

The Armor Officer Advanced Course

This is the second in a series of "Commander's Hatch" and "Forging the Thunderbolt" articles outlining various training and professional development courses conducted at the Armor Center. In this issue, the Armor Officer Advanced Course is highlighted.

The Armor Officer Advanced Course has always been the Armor Center's foremost professional development course. This course prepares combat arms officers to command armor companies and troops or other combined arms company-sized units and to serve in staff positions at the battalion and brigade level. The primary emphasis is on developing and refining the skills necessary for company and troop command. Staff instruction spans the spectrum of staff positions found in a battalion/squadron and is intended to provide base knowledge and skills. While much of the course is oriented to developing and refining the skills needed in a wartime environment, a major portion of the curriculum is directed towards training, leading, and managing armor units during peacetime. A balance is maintained.

As is the case with most of the courses conducted at the Armor Center, the Armor Officer Advanced Course is considerably different from the one attended by most Armor officers now in the grade of major and above. The foregoing description of the course purpose and focus and the course content—outlined in the accompanying "Forging the Thunderbolt" article—shows the shift of primary instructional emphasis from the battalion and brigade level to the company and battalion level. The course length has been shortened from 36 weeks in 1976, to the present 26 weeks. The number of classes per year has been increased from two to four (some years five) with approximately 500-600 students attending annually. The Armor Center also conducts two Reserve Component Armor Officer Advanced Courses a year. Each course runs 12 weeks and has an enrollment of 60 students.

The experience level of the students has also changed. At one time, most officers attending the course were senior captains who had commanded companies or troops and had served as battalion/squadron staff officers. Now, most of the students are senior first lieutenants or junior captains with only about 20 percent having command experience. Most come to the course from their initial unit of assignment and depart en route to company/troop command or battalion/squadron staff assignments. Many of the 20 percent who have commanded are subsequently sent to nominative assignments (e.g., ROTC, Recruiting Command, Readiness Region, USMA) in accordance with Department of the Army requirements. In the true combined arms tradition, the course is attended by officers from Armor, Infantry, Field Artillery, Air Defense Artillery, and Engineer branches of the active and reserve components. Officers from many foreign nations and Armor officers from the U.S. Marine Corps also attend.

All instructional departments and several other Armor Center offices and organizations provide the 1,040 hours of instruction that comprise the course.

• The Command, Staff and Doctrine Department presents 702 hours of instruction covering a broad range of subjects which include tactics, leadership, logistics, personnel management, administration, military justice, military history, training management, and orientations on other U.S. and Allied Armed Forces. This Department's primary effort revolves around a heavy load of company/troop and battalion/squadron tactical instruction that emphasizes the detailed "how to" of command, tactical techniques, staff functions, and the integration of combat and combat service support. Combined arms operations are stressed. Unlike the Armor Officer Basic Course, the Advanced Course is not oriented toward a specific unit or item of equipment. All students follow a common program of instruction, although for ease of managing resources, the classes (usually numbering 100 to 140 students) are divided into two platoons and enter the instructional sequence at different points. Major emphasis is placed on learning fundamentals prior to entering the tactics phase of the course. The idea is to provide a solid base of fundamentals in key subjects such as gunnery, maintenance, combat and combat service support, and then to continually integrate these subjects during tactical instruction. Each tactical class, whether at the company/troop or battalion/squadron level, reinforces fundamentals previously taught.

• The Weapons Department presents 85 hours of instruction on tank gunnery and antitank subjects. The officer is taught the skills necessary to employ, maintain, and conduct training for the weapon systems organic to, or supporting, tank and armored cavalry units.

• The Maintenance Department's 77 hours is oriented towards company level maintenance management and operations. Instruction is provided on organizational maintenance records, materiel readiness reporting and repair parts supply procedures, management of resources, and company level recovery techniques. Preventive maintenance is stressed.

• The Committee Group presents 48 hours of map reading, communications-electronics equipment, forward observer, and mortar subjects instruction.

• The Directorate of Plans and Training provides 17 hours of orientation and guest speakers. The guest speaker program is a key portion of the course, providing high level views of the contemporary military scene.

• The 1st Battalion, Lightning Brigade, provides command, control, administrative support and conducts 120 hours of physical training, 16 hours of PT testing, and 24 hours of in/out processing. Emphasis is placed on weight control and physical readiness.

• The Deputy Assistant Commandant for Educational Technology presents 58 hours of instruction, 54 of which are a German self-paced language course taken by selected students as a special project. Students whose subsequent assignments are in Germany are required to enroll. The other 4 hours concern reading and listening programs and provide an orientation to the Armor School Library and Learning Center. Foreign officers may receive as much as 131 hours of additional instruction depending on results of diagnostic tests and requirements of specific countries. Most of this instruction pertains to conversational English and military terminology. Eight hours are devoted to political and governmental systems of the United States.

The techniques used to teach the Advanced Course rely heavily on practical exercises in the classroom, practical exercises using equipment, tactical exercises without troops (TEWT) in a field environment, and computerized battle simulations. Every effort is made to place the student into a realistic as possible mode; the student performs the tasks he will be expected to perform in a unit. The detailed "how to" and "why" are keyed. Heavy demands are placed on the students' nonclassroom time in the form of required, graded homework exercises, special projects, and graded writing requirements. The standards have been considerably toughened in all areas of academic performance, weight control, and physical conditioning. Students must meet the standards or they are required to appear before a board of senior officers who determine whether the officer will continue the course, be recycled to a subsequent class, or not graduate. To recognize outstanding academic achievement, an incentive program has been reinstituted. One officer from each class is selected as the Distinguished Graduate and the top 20 percent are selected for the Commandant's List. The intent is clear. Every effort is made to insure that the field will receive an Advanced Course graduate who has demonstrated the knowledge and skills necessary to command at the company level and to serve as a battalion and brigade staff officer. However, there is one note of caution. While these officers have been provided the base knowledge for duty in all staff positions, the technical nature of positions such as the S-1, S-2, and S-4 requires more training or experience than can be provided in this course. Officers designated for these positions should be provided with additional schooling specifically designed to prepare them in detail or be given additional on-the-job training. Nonetheless, these officers should be able to do the job—they are just not seasoned.

As for the future, initiatives are underway assessing the course to determine the nature and extent of improvements dictated by our own and higher headquarters' studies. The fielding of new items of equipment and the impending conversion to Division 86 structures will cause significant changes in the course content. These changes will be made prior to the fielding of new items of equipment and Division 86 conversions in order to provide officers to the field who are schooled in the new equipment, organizations, and tactics. Also, efforts are ongoing to add more hands-on, field-oriented training. The next 2 to 3 years will be exciting ones for this course. The Armor Officer Advanced Course will remain, as it has always been, the centerpiece of the Armor Center's efforts to prepare company grade officers for the challenges that await them in command or staff. The course is compact, vigorous, and demanding—demanding of both the student and this institution. The Armor Force deserves and will receive no less than the best efforts from the students and the staff and faculty. We welcome your comments on whether the course is providing what is needed.

DRIVER'S SEAT

CSM John W. Gillis
Command Sergeant Major
U.S. Army Armor Center and Fort Knox

SQT . . . What the hell is it?

Most would answer the question by stating that SQT is the Skill Qualification Test. They would go on to discuss something they are proud of . . . . the skill qualification test scores of their soldiers. The NCO trainers, first sergeants, command sergeants major, and company, battalion, and brigade commanders each point to the scores of their soldiers with a feeling of accomplishment and success. After all, passing test results indicate that a soldier is trained and that the trainer and commander have accomplished this high priority and highly visible mission. Right? . . . . Wrong! Successful test results have absolutely *nothing* to do with any of this. They only indicate the one success we have had to date, the only thing we can "brag" about—we are experts at getting soldiers to pass the test!

For those who find this difficult to believe, let me suggest a few ways you can prove it for yourself in your unit. The next time you talk to a company commander, first sergeant, or senior NCO concerning SQTs and they talk of success based on test scores, tell him, "Those scores are great, but I am more concerned with how the soldier achieved that score. How did you do it?" Some will tell you they set up practice test sites and trained hard right up to the day before the test . . . and. . . *it was all done by NCOs.*

When you ask, "How soon before the test date did you start the training," still smiling confidently, they will answer, "60 to 90 days before the test." But ask them, "What did you do in skill qualification training of your soldiers the other 9 to 10 months of the year?" Although the answer is obvious, none want to state it. The answer is "nothing."

In early 1977, as the command sergeant major of the 8th Infantry Division Support Command, I embraced the concept of skill qualification training. It was a better training system than the old written MOS test. It placed the noncommissioned officer in the forefront as the trainer. Soldiers would be better trained than ever before! In February 1977, I expounded on this great vision to all the sergeants major of the DISCOM, and sent them on their way, secure in the knowledge of unbounded success. Success??? Quoting from a DF I published four months later and sent to every sergeant major and first sergeant:

"Our efforts in skill qualification training of our soldiers are nonexistent. I find soldiers that do not know what SQT means. Others don't know what a Soldier's Manual is. Still others have the Soldier's Manual, but haven't taken it out of their wall locker since it was issued. Section sergeants, 'the trainers,' do not know if their soldiers have been issued Soldier's Manuals. Those that do, have *not* utilized the manual in training.

"I see the problem with our poor progress as a lack of knowledge of the *methods* to implement skill qualification training and the lack of awareness of what we are already doing in this area. We are trying to make difficult what is very, very simple. A few simple facts about skill qualification training are:

- It does *not* interfere with mission.
- It is *not* always on the unit training schedule.
- It is *not* formal type training requiring lesson plans and formal training records.
- It does *not* (usually) add any additional hours to the duty day.
- It is *not* centralized at battalion level.
- It *is* (usually) part of the normal everyday mission.
- In most subjects, it *is* conducted during the normal duty day at the soldier's place of duty.
- It *is* a normal, organized, *everyday* training program.
- It *is* the responsibility of the first-line NCO. He *will be* evaluated on the performance of his soldiers. He is the trainer.

Despite instructing NCOs through the DF to give this training daily, after three more months, we were still doing nothing except giving "lip service" to this mission. That September, I held a briefing for all sergeants major and first sergeants and pointed out the importance of skill qualification training to the Army. I listed the responsibilities of each NCO (from CSM to first-line NCO) and briefed them on how to organize a skill qualification training program at company level.

The success of this endeavor was again unspectacular. I finally wrote a draft in early December 1977, "Year-Round Skill Qualification Training Program at Company Level." It went out to each battalion and separate company commander in the DISCOM, and to platoon sergeants and above, with a cover letter from the DISCOM commander. Quoting from that letter:

"Each company in the DISCOM will formulate a written skill qualification program. The draft copy attached may be used as a starting point for the company's program, as the final product for the company's program, or for anything in between these two points. It is intended to be the basic document to start from. The only requirement for the company is that their written program be simple, workable, efficient, and realistic.

"A copy of each company skill qualification training program will be submitted to me NLT COB 27 Dec 77."

Success was achieved! Units developed and implemented their training programs. Training of individual soldiers took place. Some commanders approached the DISCOM commander with excuses why they "couldn't do it," but left (after a short conversation) with the absolute understanding that they would! External evaluations from division to USAREUR & 7th Army verified this success. As success was recognized by the units, it became its own motivator. Proud leadership took over in each unit and their effectiveness in training individual soldier skills was what made each program the success it was.

The difficult road to success I have described was not caused by an ineffective chain of command in the DISCOM, nor by a lack of interest at the senior NCO level. Skill qualification training was new and not generally accepted at the "grass roots" level of command. The *Army Times*, at that time, published an article entitled, "Army's SQT System a Shambles." "Comic Book Field Manuals," Soldier's Manuals described as the soldiers' "own comic book with cartoons," and the solution to this "shambles"—to "close Fort Monroe"—were all comments made in this pathetic article.

Now four years later, "this new system" is no longer new. What have we learned and how much have we accomplished with individual training of our soldiers? I believe a year-round skill qualification training program still does not exist in most units.

We have centralized, departmentalized, and prioritized, so this 12-month program consists of only three months—all it takes to pass the test. A passing test score has replaced individual soldier training.

Does this describe a system that was a "shambles?" No, it simply describes a system with all the normal problems expected when an entire organization, from top to bottom, is involved in making a dramatic institutional change. With all the changes going on, commanders still had the responsibility to have a year-round skill qualification training program. It was next to impossible. Some succeeded, but most training programs evolved into the "beat the system" program of train-up periods only. This evolution was not by the choice of most commanders but was, they felt, the only way they could accomplish this training/testing mission.

We can implement an organized training program that will produce all it was intended to. We must first identify these responsibilities by level of command. Brigade and higher are basically responsible for *testing*, battalion for *evaluation*, and company for *training*. Brigade (and higher) involvement in training is almost exclusively one of providing resources, including trainers of SL4 noncommissioned officers who are not available at battalion level. Battalion involvement in training is almost exclusively to evaluate the company's year-round program and to manage and direct the train-up period prior to the test. Company involvement is to manage and direct its own year-round training program. All must interact, but these levels of command responsibilities must be clearly understood and accepted by the entire chain of command to be successful.

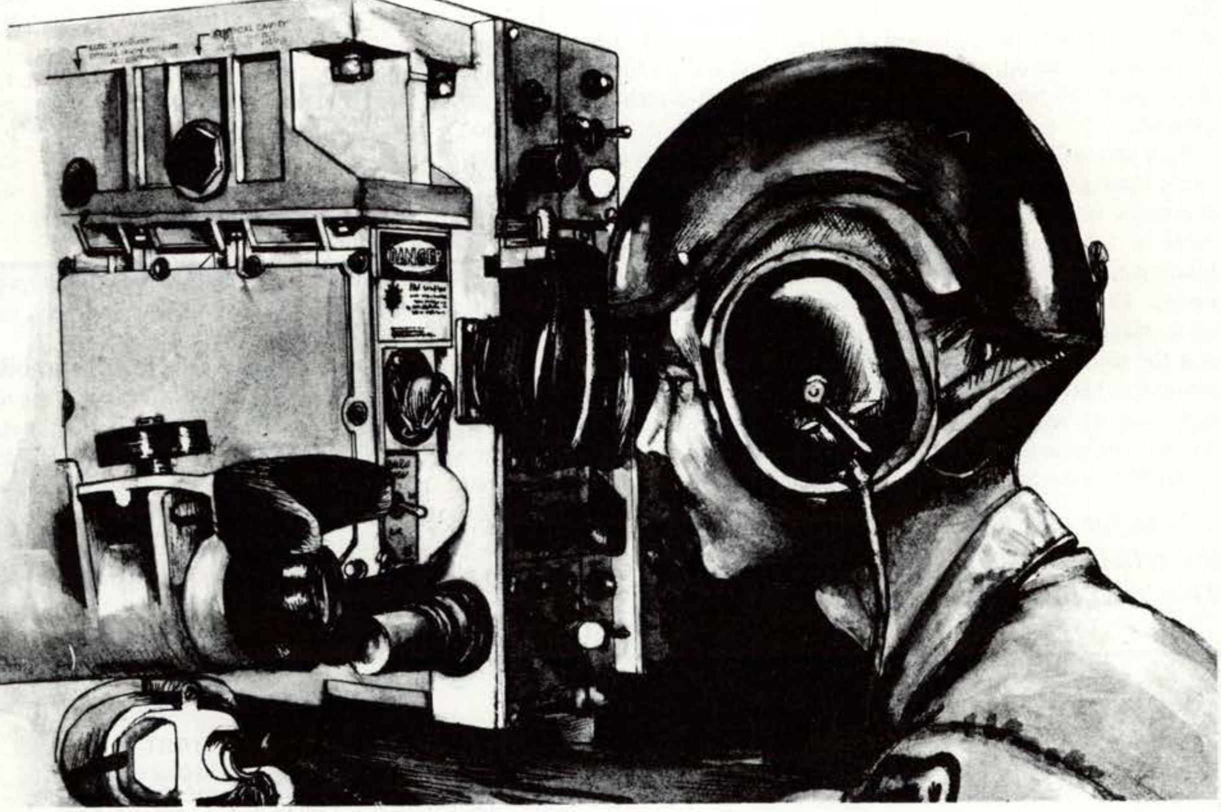
A short, direct, *written* year-round skill qualification training program is necessary at battalion and company level. The program should deal with evaluation of training and with the actual training of soldiers, instead of the useless "standard" type of three-ring binder program that explains all about SQT, defines the terms, lists those responsible for administrative functions, and emphasizes its importance. I'm talking about one where all echelons, from soldier to commander, can be issued the part that applies to them, and can train or manage from it. I'm talking about a program that does all this in *specifics*, using the Soldier's Manual, the Job Book, the Individual Training Profile, a planning guide, and an absolute minimum of any other record keeping.

The success or failure of this program can only be measured by evaluating the training of each soldier by each NCO trainer. But in a successful program, evaluating the trainer is as important as evaluating the training. The NCO trainer is succeeding if he is following a year-round program, training to his best ability as well as to the best ability of each of his soldiers. The commander who states, "30 tasks will be trained and/or tested within this training quarter," puts them all on the training schedule, and then determines success or failure on that number and those tasks, will guarantee his own *failure*. He has failed to consider the individual ability of each NCO to train, the individual ability of each soldier to learn, the availability of soldiers and resources for training, and many other factors.

What the hell is SQT? It is first . . . year-round skill qualification *training*, and second . . . skill qualification *testing*. Skill qualification training directly relates to our ability to survive and win on the battlefield. Skill qualification testing is important to the peacetime Army as relates to promotions, reenlistment, training evaluation, etc. These relationships must be kept in mind. The soldier with the passing skill qualification test score MAY NOT be the soldier you and I want in the foxhole with us during the next war. The soldier who was trained appropriately to attain that passing score IS!

John W Gillis

MASTER GUNNER'S CORNER



It Was Okay (the last time I checked it)

"I know it can't be my fire control. They checked it on the Brigade Maintenance Inspection (eight weeks ago) and I didn't get any gigs."

Staff Sergeant
Tank Commander

Tank fire control, like many other mechanical systems, works only as well as the man who sets it up and uses it. The smartest computer is useless if it isn't programmed; the best gun won't hit targets if it isn't zeroed. Advanced fire control systems are a two-edged sword which not only provide performance when they work but are a potential source of degraded performance when they do not. For example, a tank without a wind sensor cannot have a wind-induced error greater than that associated with the wind that is present. While a tank with a wind sensor will have virtually no error when the sensor works, it may have a very large artificially induced error when the sensor is faulty or when it is improperly set up. Although advanced systems offer the possibility of self-test routines and built-in test equpment, such capabilities are themselves subject to failure and are seldom comprehensive in nature. The actions of a well-trained, alert, and intelligent operator are still the best assurance of maximum performance from the tank systems.

The prefire inspection outlined in section 4-2, FM 17-12 is a good guide. Whenever this document is available on the tank, it and the operator's manual should be used. Several cards and checklists available from the U.S. Army Armor Center or from local sources are also useful. However, these documents may not be available to every crew when and where they are needed. (The pocket-sized checklists are particularly difficult to read after they come back from the laundry with your fatigues.) The following suggestions are intended to supplement, but not replace, the fire control checks found in more authoritative documents.

"We only use that (rangefinder) during our annual gunnery period, so I didn't check it this morning."

Sergeant
Tank Commander

Computer Input Shaft Alignment. The coincidence rangefinder communicates with the *M-13* computer through a rotary output shaft. This output shaft is connected to the computer input shaft (figure 1) by a flange with four machine screw connectors. When your turret mechanic installs the computer, he sets the rangefinder and the computer at 1,200 meters, connects the flange with the screws, and installs safety wires to hold them in place.

You can ensure that this is done correctly the same way he did. First, index 1,200 meters in the rangefinder. Then, flip up the rubber dust skirt to expose the index marks on the computer input shaft and on the top of the computer case. If these marks do not line up, call your turret mechanic and get him to do it again, this time per paragraph 2-79 of the -20-2 technical manual.

How serious is this error, anyway? The most common error in connecting the flange is made when the range dial is used to determine when 1,200 meters is set in the computer. The two faces of the flange are then (erroneously) matched up by rotating each until one of the four machine screws can be connected. This results in errors of up to ¼ turn. An error of the same magnitude can be induced if the safety wiring is broken and the machine screws vibrate out enough to allow relative movement between the two faces of the flange. Table 1 shows the range of possible errors that would result from a one-fourth-turn mismatch. Although the errors are not great, they contribute to the aggregation of many small errors from other sources whose end effect is to lower your hit probability. Elimination of this error source is cheap and easy, so why not check it once in awhile?

"As far as I know, all you have to do is lay the reticle on the target and push the button. That's all there is to it."

Armor Colonel

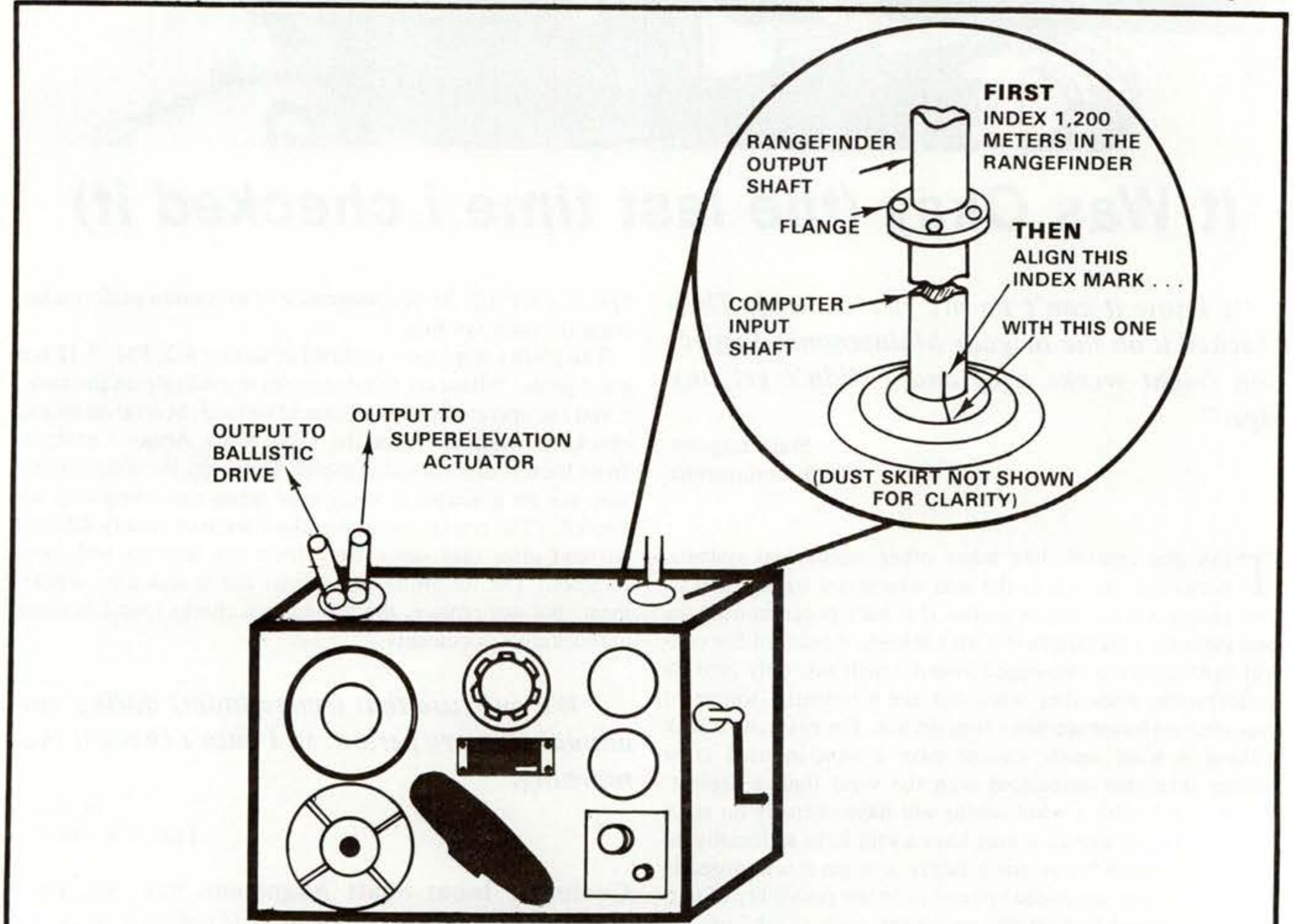
Table 1

RANGEFINDER OUTPUT	COMPUTER INPUT ¼ Turn Clockwise Error	COMPUTER INPUT ¼ Turn Counter-clockwise Error
1,000	960	1,030
1,200	1,160	1,240
1,600	1,550	1,650
2,000	1,940	2,050
2,400	2,320	2,460
2,800	2,710	2,870
3,000	2,910	3,080

All data is in meters.

Boresight Knob Linearity and Repeatability. The zero you obtain for the main gun is expressed as the horizontal and vertical angle with respect to boresight, which best predicts the strike of the rounds. The boresight knobs are calibrated in mils to help you measure these angles. When you find, for example, that your *M-32* periscope deflection setting is 4.6, you have determined that the rounds are striking six-tenths of a mil to the right of the boresight point. (Center of scale is slipped to 4.0, so 4.0 + .6 = 4.6.)

If the boresight knob does not move the reticle the required



M-13 SERIES COMPUTER

amount (linearity) or if the reticle does not move the same amount each time (repeatability), your established zero is meaningless. You are, in effect, measuring a distance with a broken ruler. You can quickly and easily check your sights with the following procedure.

To begin this check, lay the *M-32* reticle on any readily definable aiming point. Note the scale reading. Being careful not to slip the scale, turn the elevation knob until 1 mil of travel is indicated on the scale. Look into the sight to ensure that 1 mil of reticle travel has been introduced into the reticle. Repeat for travel in the other direction. Repeat this several times for different amounts of knob movement. Repeat the whole test for the deflection knob of the *M-32* and for both axes of the day and night reticles of the rangefinder. A similar test for the telescope is possible, but more difficult, since the elevation lines in the telescope are in meters instead of mils. If any sight fails in either linearity or repeatability, have it written up by organizational maintenance.

Superelevation Output. Thus far, the suggested checks have not used test equipment or any reference material at all. This check uses the secondary sight as reference for the primary system. Checks for computer solution and superelevation output can be performed whenever lack of time or nonavailability of firing tables precludes making the tests shown in paragraph 4-2b(4) and (5), FM 17-12. This test has the advantages of taking little time and requiring no external reference material.

The supplementary check is performed as follows:

- Put the fire control system into operation. Place the range correction knob at zero. The test can be performed after boresighting and either before or after the established zero is indexed.
- Turn off the computer and crank off superelevation. Using the periscope, lay on a well-defined aiming point close to the boresighting range. (This aim point will be used for all subsequent observations.) Check to ensure that the telescope boresight cross and all other reticles are on the target.
- Turn the computer back on and index high-explosive plastic (HEP) and 800 meters into the fire control system. Using the periscope, lay on the aiming point. Inspection of the telescope HEP reticle should reveal the 800-meter range line to be on the aiming point. Repeat the test by relaying the periscope with 1,200, 1,600, 2,000, and 2,400 successively indexed into the rangefinder. In each case, the range line of the telescope reticle should correspond to the setting on the rangefinder.
- Repeat the test for high-explosive antitank (HEAT) and armor-piercing, discarding sabot. (APDS). If you have time to check only one channel, use HEP because errors will show up more readily on it than on channels that produce smaller superelevation angles.
- If errors are detected, turn off turret power (leave the computer on) and rerun the test. By turning turret power off, you are shutting off the superelevation actuator. If the errors were caused by a faulty actuator, the errors will disappear when you rerun the test. If they remain, the problem is a faulty ballistic drive. (This conclusion is true *only* if you have eliminated the possibility of synchronization errors and computer mil output errors by regular performance of the checks in FM 17-12.)

This test can be partially performed after every engagement (live- or dry-fire) by having the gunner relay on the target and read the telescope range line. There are two limitations to this method. System parallax will cause apparent error if the target is very far from the boresighting range (this will, however, be a recognizable, consistent, and predictable error), and drift correction in the HEP ballistic reticle is not accounted for in the periscope or rangefinder.

Summary. Make the following three checks to see whether the

Reference marks on the computer input shaft are aligned when 1,200 meters is indexed on the rangefinder.

A mil of boresight knob travel produces a mil of reticle travel.

Primary sight agrees with the secondary sight as to where the rounds are expected to hit.

These checks can be used as a quick and easy supplement to your regular fire control checks. They are conducted in a logical sequence that does not require memorization of complicated procedures. They do not depend on printed reference materials, which may not be available when needed. In fact, the only requirement is a crew who wants to be able to say, "It was okay—I just checked it!"

Author's Note: The suggestions in this article are tailored to M-60A1 tanks. The methodology may be extrapolated by the reader to suit the tanks with which he is equipped.

MAJOR JAMES D. BROWN
HHC, 7th ATC

Revised Tank Gunnery Safety Procedures

Chapter 12, AR 385-63, Tank Gunnery was revised by Change 1 to AR 385-63, 1 December 1980. The revision is based on recommendations from the Army and Marine Corps armor community, range operations, and safety and test activity personnel. The scarcity of available training land, coupled with emerging weapon systems and the urgent need for realistic training in peacetime, resulted in reevaluation of tank surface danger zones to determine efficient and safe use of range firing areas. Since World War II, tank firing surface danger zones have been constructed using a quadrant elevation of 15 degrees in spite of the fact that most tank firing was at elevations of 5 degrees or less.

In the revision, Distance X will be computed based on a quadrant elevation of 10 degrees for direct fire at fixed or moving ground targets from stationary or moving tanks (with stabilized guns) with a quadrant elevation of 5 degrees or less. This provides a buffer zone of 5 degrees uprange.

The revision provides more specific instructions on how to construct surface danger zone diagrams, to include modification to permit cross-range firings. To facilitate training, noncommissioned officers in the grade of E-7 or above may be used as Officers-in-Charge (OIC) of firing.

Also, the requirement for firing tanks to display flags/lights during battle runs has been eliminated.

Commander, TRADOC, ATEN-S, is proponent for AR 385-63. Inquiries pertaining to construction of Tank Gunnery surface danger zone diagrams should be directed to Mr. Warren F. Leary, AUTOVON 680-3357/3930.

A. B. GARDNER
TRADOC Safety Director

Where Have All The Sergeants Gone?

As you stand on any range at any Army post and watch the battalion's tanks fire Table VIII, you will note that almost one of each two tanks is commanded by a sergeant or soldier of lesser rank. Approximately $1 million worth of equipment is in the charge of a crewman with 5 years of service or less. Where is the trained trainer—where have all the sergeants gone?

In MOS 19E/F, the armor community is currently short over 1,000 tankers in grades E-5 to E-8 or, more simply stated, in these grades, we are forced to operate at 83.5 percent of authorized strength. The most critical shortage is grade E-6 which is at 79 percent strength.

There are two basic causes for this problem. One is the authorized grade structure in armor units and the other, which is related to the structure problem, is the attrition of not only first-termers but careerists as well.

Let us first look at the grade structure in armor units. Figure 1 portrays a pyramid containing optimal grade distribution. Now examine figure 2 and compare it against figure 1. This comparison will show that we have too many E-6 and E-5 authorizations and too few at grade E-4 and below. Again, looking at the optimal grade structure, we can see that it is symmetrical with a broad base and a steady decrease in strength at each grade level. The armor structure lacks this broad base and steady decrease at each grade, and that is the primary reason we cannot "grow our own" sergeants.

How did we get into this mess? The staffing and grade structure in armor units evolved from experiences in World War II. The evolution of armor vehicles since that period had little effect until the fielding of the *M-48* tank in the late 1950's. Up to that point, all tanks had a 5-man crew and our structure was quite sound. When the *M-48* arrived on the scene with its 4-man crew, the force developers simply lopped off the fifth crewman without consideration of the impact on grade feasibility. In essence, the broad base of our pyramid was destroyed at that time and has never been replaced.

Armor soldiers do reap some benefits from the shortages existing in MOS 19E/F. Analysis of the semi-centralized promotion system reveals that soldiers in the primary zone for promotion to E-6 in MOS 19E seldom were on the list more than 2 months beyond the 90-day mandatory waiting period after command certification. The promotion rate for the secondary zone has also been significantly higher in MOS 19E/F than for the rest of the Army.

Promotion history attests to the Army's attempt to promote as many soldiers as possible in the MOS. Yet the shortages remain.

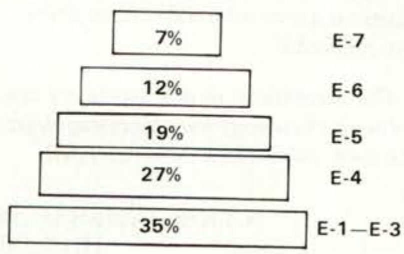


Figure 1. Optimal pyramid MOS authorizations E-1 through E-7 based on program budget guidance.

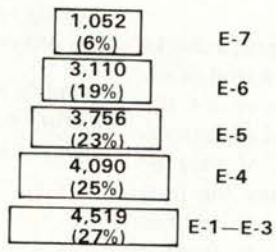


Figure 2. MOS 19E/F current authorizations totaling 16,527.

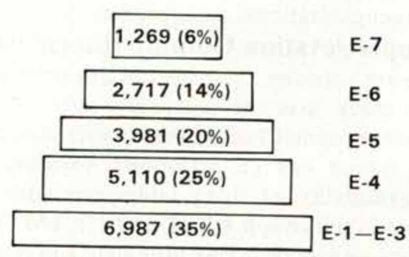


Figure 3. MOS 19E/F with security sections added to each unit, resulting in a 3,437 new authorization.

Briefly looking at attrition, we know that E-7 and E-8 armor sergeants are voluntarily retiring in ever greater numbers, particularly when levied to return to Europe. Even more devastating is the number of careerists in grades E-5 to E-7 not eligible for retirement who simply resign rather than face a return to Europe. Why is this happening now? Looking at grade E-6, for example, which is operating at only 79 percent of authorized strength, we see that Europe has about 42 percent of the authorized positions for this grade. Due to the shortage of faces vs. the spaces, Europe actually has closer to 50 percent of the faces at any given time. This is what ties attrition to the structure of MOS 19E/F.

One of the primary causes of attrition is the turnaround time for armor sergeants; that is, the time spent in CONUS between overseas tours. For 19E grade E-6 personnel, this time is 18-24 months, which points out that the armor sergeant can expect to spend more time in Europe than in CONUS. The shortage of government quarters frequently causes family separations and the total impact of this problem causes many armor sergeants to become angry, disgruntled, or disgusted; and as a result, turn into an attrition statistic.

Another form of attrition is the migration into other MOSs at the time of reenlistment. First-termers do this at an annual rate of 23 percent and careerists at a 10 percent rate. This high attrition relates to the grade structure in another way. It creates the need for an even broader base (E-4 and below) than is called for in the optimum pyramid in figure 1.

Taken as a whole, these problems impact on armor units. The FORSCOM unit suffers more since the priority of fill remains overseas. Yet FORSCOM units must train for a multitude of contingencies. The short turnaround time in CONUS creates an almost intolerable degree of turbulence in these units. The most significant impact on the European-based unit is the morale problem created by frequent family separations due to short turnaround time and field duty.

Now that we know the problem, what can be done to solve it? Four measures appear to be appropriate for examination: change the armor structure to more closely align it with the optimal structure, reinstitute the NCO Candidate Course, involuntarily reclassify E-5 and E-6 soldiers who occupy overstrength MOS, and/or reduce attrition.

Let us examine the structure again in figure 2. This total structure covers both TOE and TDA authorizations and, as we discovered earlier, is not self-sustaining. One available course of action would be to reduce the authorized grade for some of our tank commanders to E-5 and some of the E-5 spaces to E-4. However, this is an emotion-filled issue. Bypassing the emotion, the very heart of the matter is experience, and the question becomes, does the armor E-5 have the experience to fight that weapon system to the maximum potential of the tank and thus contribute his full share of the 36 percent of the firepower that the tank provides on the battlefield?

There are some changes that seem reasonable. The tank battalion and company commanders' tanks each have a 5-man crew, counting the officer. Since the officer will, by doctrine, command that tank during unit employment, we could reduce the grade of the tank commander to E-5. Further improvement could be realized by upgrading the battalion and company headquarters tank section leader to E-7. In the company, this E-7 position could be designated for the master gunner. Table 1 shows current TOE authorizations for tank battalions and cavalry squadrons. Table 2 shows the same authorizations with the above mentioned fixes applied. Some improvements are apparent; however, the structure is still not self-sustaining.

The NCO Candidate Course, which we need to keep in mind, may become necessary, even with an increase in end strength. We must remember, however, that the most intensive training cannot replace experience, and we would simply be increasing the lack of experience in our tank commanders' ranks by this step.

Involuntary reclassification of E-5 and E-6 into armor does not appear to be a viable course of action. Too many of us have undergone the agony of having to train a totally novice retread tank commander while he was supposed to be training his own crew. The crew suffered as did the entire unit, even if the outcome was successful. Too often, it was not.

Attrition can be attacked from two directions. First, solving the structure problems will alleviate the short turnaround time and frequent family separations caused thereby. Second, developing incentives will make it more attractive to remain in an armor MOS. Infantry and artillery have the same problems, so these incentives could be attached to a combat arms MOS; or perhaps, to service in a maneuver battalion. They could take the form of tax-free base pay for CONUS, some form of proficiency pay, or anything else that would recognize that the life of most combat arms soldiers is more difficult than that of the average combat support or combat service support soldier. It would also consider the fact that service in the combat arms does not develop a readily saleable civilian skill.

The ultimate solution appears to be an increase in the authorized end strength. An addition of 3,437 spaces to MOS 19E/F could be distributed as 9-man security sections in each tank company and combat support company and an 18-man section in the headquarters company of the tank battalion. Distribution to cavalry units using the same principle would account for the aggregate increase. This would create the structure shown in figure 3. Comparison with the optimal structure in figure 1 shows only minor differences, and analysis of this structure by MILPERCEN shows it to be completely self-sustaining.

Many readers have ideas on this subject, and we actively solicit them. Keep in mind that the end strength and most incentives that would be attractive require congressional approval and cost money.

Please send your ideas to: Commander, USAARMC ATTN: ATZK-CG-AM (P), Fort Knox KY 40121, or call Autovon 464-5155/2710 and ask for Bob Cisco.

Table 1. Present TOE 19E/F Authorizations

	1 Tk Bn	50 Tk Bns	1 Regt Cav Sqdn	9 Regt Cav Sqdn	1 Div Cav Sqdn	10 Div Cav Sqdn	Total
E-7	11	550 (5%)	3	27 (1%)			577 (4%)
E-6	36	1,800 (16%)	39	351 (18%)	27	270 (20%)	2,421 (16%)
E-5	54	2,700 (23%)	53	477 (25%)	36	360 (27%)	3,537 (24%)
E-4	60	3,000 (26%)	54	486 (26%)	36	360 (27%)	3,846 (26%)
E-1—E-3	70	3,500 (30%)	63	567 (30%)	36	360 (27%)	4,427 (30%)
		11,550		1,908		1,350	14,808

Table 2.

	Adj	1Tk Bn	50 Tk Bns	Adj	1 Regt Cav Sqdn	9 Regt Cav Sqdn	Adj	1 Div Cav Sqdn	10 Div Cav Sqdn	Total
E-7	+4	15	750 (7%)	+1	4	36 (2%)	0			786 (5%)
E-6	-8	28	1,400 (12%)	-1	38	342 (18%)	0	27	270 (20%)	2,012 (14%)
E-5	+4	58	2,900 (25%)		53	477 (25%)		36	360 (27%)	3,737 (25%)
E-4		60	3,000 (26%)		54	486 (26%)		36	360 (27%)	3,846 (26%)
E-1—E-3		70	3,500 (30%)		63	567 (30%)		36	360 (27%)	4,427 (30%)
			11,550			1,908				14.808

This article was prepared by LTC (Ret) Bob Cisco, now employed as a military personnel management specialist by the Office of Armor Force Management and Standardization; and by LTC Michael A. Molino, Executive Officer, Enlisted Personnel Management Division, Military Personnel Center.

CALIBRATED ZERO SYSTEM

By Captain William L. Braddy and Staff Sergeant Glenn E. Graham

A gunnery training cycle to a company commander and his master gunner is usually remembered as "challenging." It is also often confusing, busy, and redundant. After home station or preliminary training, the first opportunity to lay the basis for combat readiness as well as good gunnery performance is the zero range. The zero procedures described in FM 17-12 are adequate but slow. Commanders attempt to closely control the quality of each tank's zero, further slowing the process. Discussion is frequently heard on eliminating the warm-up round to save time and money. A TPDS round now costs $129. Typically, a full firing day (12 hours) and 85 rounds (5 per tank) is allocated to zero a tank company. In theory, the tank must be zeroed once in its life. In actuality, the tank is rezeroed or a thorough confirmation exercise conducted at each Level I gunnery period. Major fire control components change, crew members leave or get promoted to a new crew position; crew confidence wanes if a good zero is not confirmed annually.

At company level the zero objectives are to:

•Hit a 50-centimeter circle (19.7 inches) at 1,200 meters and thereby instill crew confidence in their equipment.

•Record the zero in a system that can be reapplied to the sights.

•Reduce the need to rezero thru a quality first effort.

•Save ammunition for training by minimizing ammo used to zero.

•Reduce range time needed for zeroing.

With these objectives in mind, Company A, 2d Battalion, 37th Armor set out to improve its zero technique. The results are shared in this article and establish the following fundamentals:

•Use the operator's manual TM 9-2350-257-10 and good preventive maintenance checks and services.

•Use the *M-105D* telescope as the primary sight for zero and 1,200 meters as the zero range.

•Use the *Pye-Watson* system for a very accurate boresight.

•Obtain a two-round shot group, then refer the sights.

•Fire no more than three rounds to obtain a shot group, or move off the firing line (further explanation follows).

•Fire the zero exercise over the number 2 support roller.

•The gunner may need a warm-up round. The gun bore needs to be clean and dry.

•Use a zero fire command.

•Use a precise system for checking sight referral, e.g., the "calibrated zero."

Definitions. The following terms will be used frequently to explain fundamentals and the use of the calibrated zero.

Boresight—Alignment of all fire control system sights with the axis of the bore of the main gun at a known range, preferably 1,200 meters. We use the *Pye-Watson* system.

Zero—The procedure to move the strike of the round to the aiming point at a given range.

Relay—To move the gun and sights, by use of the manual or power controls, back to the original aiming point.

Refer—To move only the sight reticle, using the deflection and elevation knobs, to a given point, *after* relaying the gun.

Shot group—A specified number of rounds impacting close enough together so as to establish a center point for sight referral. We use two rounds to establish a shot group.

Confirmation round—The last round fired in a zero exercise to insure that the round strikes within a specified distance of the aiming point. Our confirmation round must strike the 50-cm circle.

Zero panel—We use a modified zero panel (figure 1). It is a black or olive drab panel with white circles. The panel ideally is 300 cm x 300 cm. The standard panel has a 50-cm circle and a 100-cm circle, one inside the other. We added a 200-cm circle, 1-inch wide, outside the other two. The tendency is to locate the strike of a round to the closest edge or circle. The outer dimension of the zero panel may vary according to availability of plywood sheets or other target material. The 200-cm circle insures that all rounds that strike the panel can be located in relation to a precise reference. Reverse painting assists in precise gun lay and in accurate sensing.

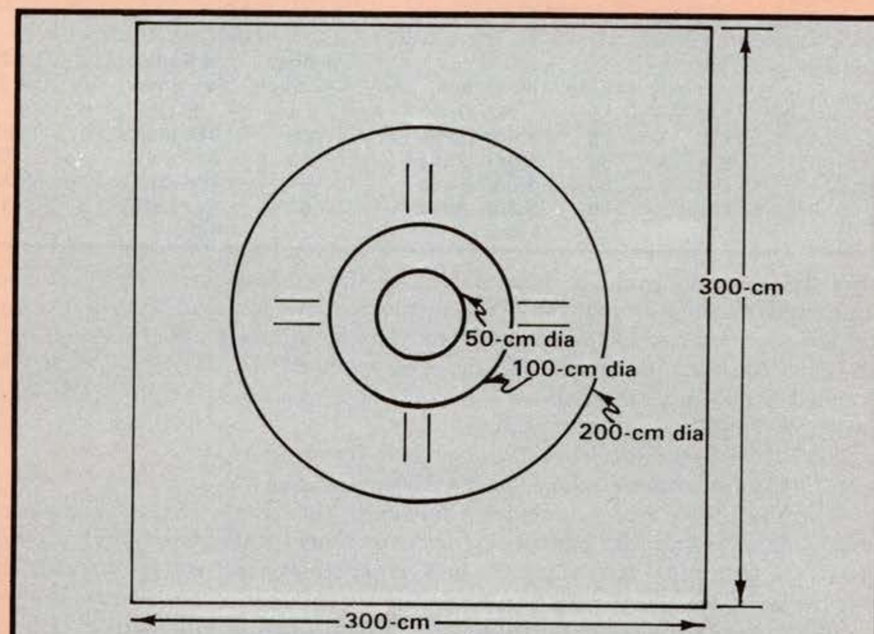


Figure 1

Pre-Gunnery Maintenance.

The maintenance aspect of a sound gunnery program must be stressed. Thorough turret technical inspections should be continuous and must be completed well in advance of departing for the range. Identify and isolate problems early so repairs can be scheduled. Range time is valuable and cannot be wasted on problems that could have been avoided. Turret mechanics and master gunners are indispensable during this critical period.

The final preventive maintenance check to be performed before moving to the ranges is a check of synchronization; normally during thorough quarterly services. We used the 40-foot indoor method with great success. (Refer to **ARMOR** Magazine, Sep-Oct 1978.) All tanks can be brought in tolerance without leaving the motor pool. This is a fuel efficient practice. Training Aids Service Centers can manufacture the board.

Using the M-105D Telescope.

A deviation from the standard boresight procedure is the use of the *M-105D* telescope, which we also use as the primary sight for zero. Especially at 1,200 meters, there are distinct advantages to using the *M-105D* instead of the *M-32*. The 1,200-meter aiming point on the *M-105D* is a circle with a dot in the center. This becomes extremely important in zeroing as it is more precise to lay the dot on target than the *M-32* crosshair. The *M-32* crosshair actually obscures the target. The dot on the *M-105D* reticle can be precisely laid in the center of the inner circle of the zero panel.

Another advantage in using the *M-105D* is its independence from the primary direct fire control system (PDFC). Most common fire control malfunctions have no effect on the telescope. When using the *M-32*, all components of the PDFC must be in good operating condition. Because of the *M-105D's* independence, it is the most dependable sight on the tank. Provided the gunner is familiar with the reticle in the *M-105D*, there is less chance of a procedural error in boresight and zero, i.e., forgetting to crank off superelevation, indexing the wrong range, or leaving the computer shut off. Finally, the *M-105D* is unaffected by synchronization as it is coaxially mounted to the main gun.

There are some disadvantages in the *M-105D* telescope. At a range other than 1,200 meters, it may be difficult to determine the aiming point on the APDS reticle precisely enough for zero purposes. The majority of zero ranges have 1,200 meter panels so this should not be a significant problem. Lack of familiarity with the reticle can cause problems, but this is easily corrected with training and by cross-checks of the gunner by the tank commander.

The scales on the *M-105D* have a tendency to slip when turning the boresight knobs. It is extremely important that this does not happen when referring the sights during zero. Once the scales have been slipped to (3) and (3) in the boresight procedure, tape the scales to the knobs with clear plastic tape. Finally, the headrest is critical. The gunner must insure the headrest is both secure and comfortably adjusted. He must look through the sight the same way every time. There is no internal parallax adjustment as on the *M-32*, so this becomes increasingly important.

Boresight—The Pye-Watson System. Boresight procedures are extremely important and there are *no* shortcuts. An accurate boresight is a necessity in obtaining a good zero. Procedures used in A/2-37th Armor differ somewhat from TM 9-2350-257-10. No steps are omitted; however, some are changed. We use the 105-mm *Pye-Watson* device in lieu of the conventional string and tape method. It is more accurate to lay the dot in the *Pye-Watson* device on the target corner than it is to lay the cross from the string.

Parallax is an important consideration when using the *Pye-Watson* device. Either remove it through calibration or standardize the use of the *Pye-Watson*, i.e., the same man should sight through it for each tank. The device should be inserted into the muzzle in exactly the same position each time.

An efficient procedure for the man on the *Pye-Watson* device is to talk the gunner onto the upper left corner of the panel. One must be careful that the exact aiming point is very clearly defined to

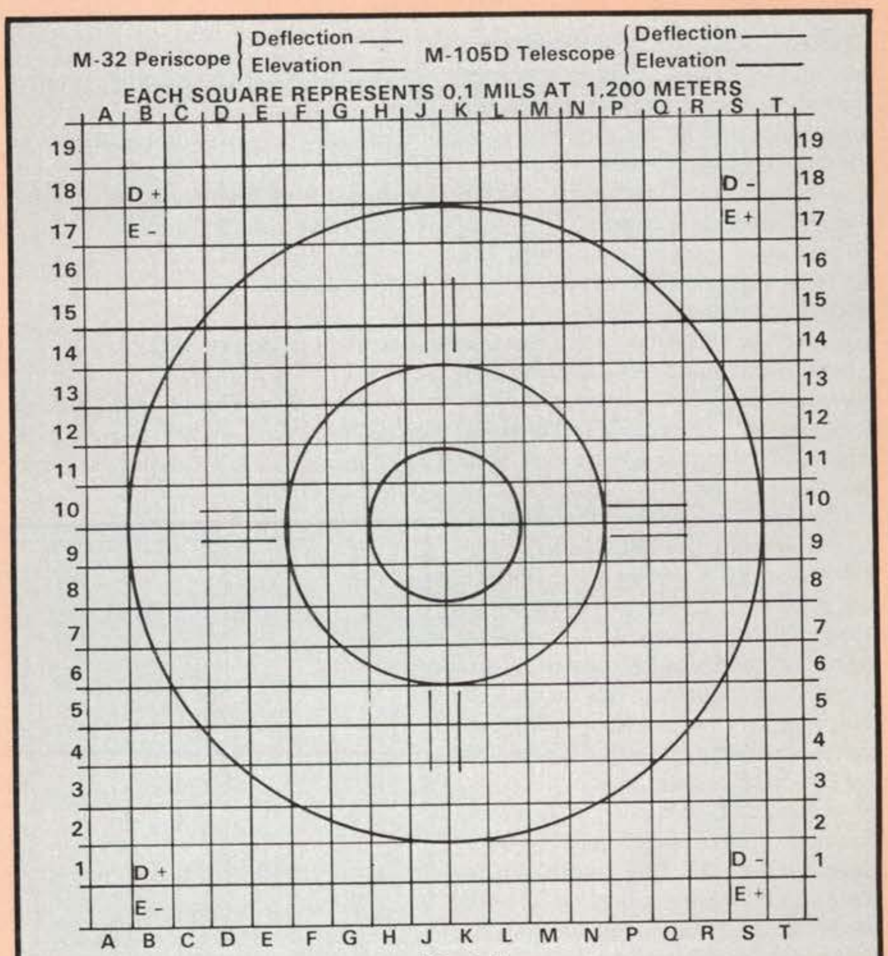


Figure 2

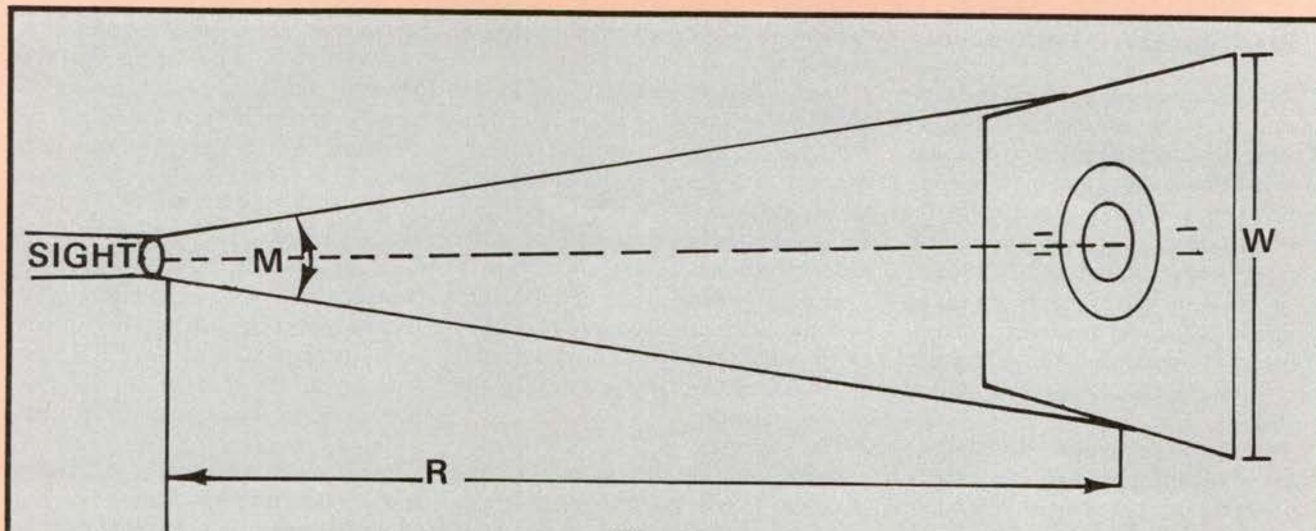


Figure 3

both the gunner and the *Pye-Watson* man. We recommend using the outer white edge of the boresight panel so there will be a contrast of a black dot on the white edge. Once the *Pye-Watson* man is certain the center of the muzzle is aligned on this clearly defined point, the gunner will refer his boresight cross to the same point and slip the scales to the settings of (3) and (3).

Once the scales are slipped during the boresight procedure, they must not be allowed to slip again. After the tank commander checks his gunner's sight picture, the gunner should lay completely off the panel and then lay back to the clearly defined aiming point. The *Pye-Watson* man then sights through the device to insure the accuracy of the referral and relay.

Before the first rounds are fired, a system of accurate sensings and the subsequent recording of those sensings must be developed. The 8-power magnification of the telescope or even the 10-power optics of the rangefinder are frequently not sufficient to allow the tank crew to see the TPDS hole.

A tow sight, a battery commander's scope, or spotting scope will allow the tower officer in charge (OIC) to assist the tank crew in locating the shot group. To easily communicate this location to the firing tank, a grid reference system can be superimposed over a drawing of the zero panel (figure 2).

A comment by a former 1st Armored Division Commander, then Major General Glenn K. Otis, caused us to design a grid reference that would have mathematical meaning on the target, rather than an arbitrary assignment of line spacing to form the grid. The "calibrated zero" system was the final result.

The WORM formula is the basis for calibration. A quick review is in order. WORM means width over range times mils is a constant proportion (figure 3).

W = width of the target in meters

R = range to the target in 1,000's of meters

M = the mil angle including the target

The smallest correction that can be applied to the gunner's sights is 0.1 mil. Reduce the WORM formula to W = R x M. At 1,200 meters:

$$W = 1.2 \times 0.1$$

$$W = 0.12 \text{ meters or } 12 \text{ cm}$$

A sight setting change of 0.1 mil will move the impact of the round 12 cm (4.72 inches) at 1,200 meters. The grid system can now be drawn to approximate 0.1 mil or 12 cm between lines (figure 2).

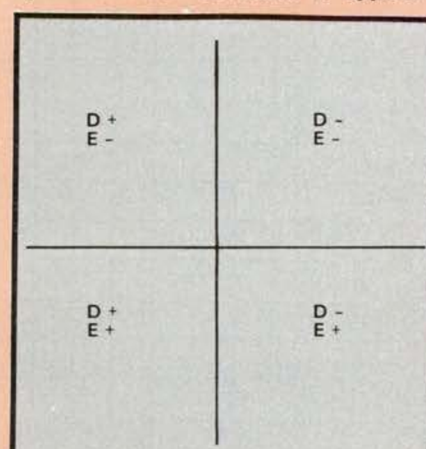


Figure 4

Four blocks equal 48 cm or 0.4 mil. Round off 48 cm to 50 cm and the inner 40-cm circle is now equal to 0.4 mil at 1,200 meters. This rounding induces a 2 cm error in locating the shot group.

Deliberately Induced Error.

0.1 mil = 12 cm

0.4 mil = 48 cm

2 cm is .787 inches of error on the inner circle and 1.57 inches on the 100-cm circle. This is insignificant when the TPDS round-to-round dispersion is considered.

Each square shown in figure 2 represents 0.1 mil of correction in sight setting in either deflection or elevation. From experience, when the *M-105D* telescope is referred *up* to a shot group, the elevation scale reading gets smaller. The correction applied was actually *subtracted.* Conversely, when referred *down,* the elevation reading gets larger. The correction was *added.* When the telescope is referred to the *right,* the deflection scale reading gets smaller. Conversely, it gets larger if referred *left.* The correction factor is easily remembered by "right or up, like a map—subtract." The corrections for the telescope are shown in figure 4.

Once the shot group is located on the target and assigned on the grid location, the correct referred sight setting is now predictable. This is especially useful if the tank crew is unable to see the group due to less than ideal weather. The referred settings can be quickly determined and the knobs turned to those settings.

The sights are referred mathematically rather than visually through the telescope. Simply stated, plot the shot group. Count the blocks from the center of the target to the shot group, first in deflection, then in elevation. Each block is worth 0.1 mil. The distance in deflection from the center of the target to the shot group is 6 blocks, then 0.6 mil error exists. The sight would be referred to the right (to the group), therefore the sign is negative and the correct deflection reading is (3) - 0.6 = *2.4.*

The OIC in the tower can use an enlarged grid system made from *M-10,* 1:25,000-scale plotting paper. The correction for both deflection and elevation is written in each square. Once the center of the group is determined, the numerical corrections can be read directly from the enlarged grid instead of counting the grid squares. The corrections can also be applied against settings for an established zero. Calculations would be made from other than boresight settings of (3) and (3).

Corrections for the *M-32* can also be included on this grid, but use a different color of ink. The signs (+ and -) differ from the *M-105D,* and the *M-32* corrections are, of course, calculated against (4) and (4) as boresight settings.

Application. Two rounds have been fired and a good shot group established (figure 5). To determine the correct sight setting

- Count the blocks from the center of the target to the center of the shot group, first in deflection—6 blocks = 0.4 mils.
- Add or subtract from the boresight settings, depending on the quadrant. To the right is minus—(3) -0.6 = 2.4. Up is minus—(3) - 0.4 = 2.6.
- The correct readings are *deflection 2.4* and *elevation 2.6.*

Accept 0.1 mil of difference between the calculated setting and the actual setting based on where the center of the shot group was estimated and where the gunner referred the sight. If more than 0.1 mil difference exists, then an error was made in sight referral. Without moving the gun, turn the sights back to the center of the target, or (3) and (3), and refer again.

The gunner can visually refer his sight and then read the setting to the control tower for confirmation against the calculated value. Again, the two figures (actual and calculated) should be within 0.1 mil.

If the gunner is unable to see the shot group, then the tower can dictate the settings to be placed on the sight before the confirmation round is fired.

The cross-check of actual and calculated values *saves* ammunition and time by detecting errors in referral. The dictation of settings allows zeroing to continue rapidly and efficiently during less than ideal weather conditions as long as the gunner can see the zero panel.

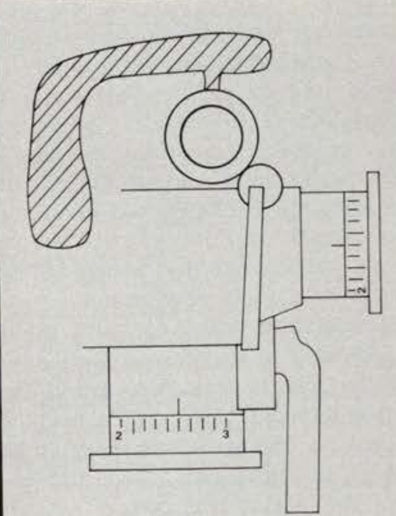


Figure 6

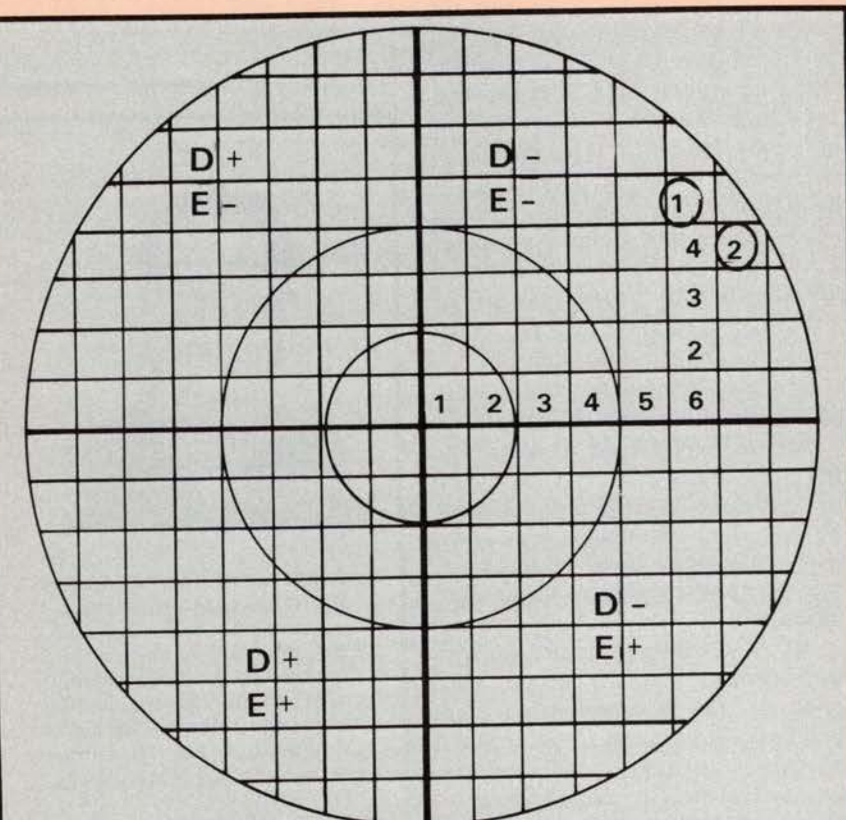


Figure 5

Once the zero is complete, we recommend carefully recording the scale readings in the logbook. Experience has shown this record is best in the form of a drawing. A reasonable facsimile of the telescope and its boresight knobs is mimeographed and given to each tank commander. When the zero is complete, he sketches in the sight readings as they actually appear, including 0.1 mil tick marks (figure 6).

In order to complete the zero exercise for the main gun, the remaining sight reticles must be referred to the *M-105D.* The *M-32* and *M-17A1* are boresighted. Proceed as follows:

- Lay the 1,200 meter aiming dot of the *M-105D* on a clearly defined right angle at 1,200 meters. The top left edge of the zero panel may be used, but be precise.
- With the computer on and 1,200 meters set on the rangefinder, the *M-32* crosshair should be very close to the aiming point. Using the boresight knobs on the *M-32,* move the crosshair to exactly the same aiming point as the

M-105D aiming dot.

•Verify 1,200 meters on the rangefinder, (insure that the rangefinder is in proper operation according to the -10 TM) and then refer its cross to the aiming point of the *M-105D*.

The procedure to complete the tank zero is in accordance with the -10 TM, except that the *M-105D* furnishes the datum line rather than the *M-32*. Wherever possible, use of the -10 manual will eliminate omissions and errors. The unit commander may decide to record referred site readings on DA Form 2408-10, Equipment Component Register, which is a part of the tank's logbook, or he may use a facsimile of the *M-32* and *M-17A1* as was shown for the *M-105D*.

We feel strongly that understanding the tank and the relationship of the super-elevation system to each sight is fundamental to a good zero. Tank commanders can be trained to expect the correct responses at any given step in the procedure. This zero exercise should be precise, efficient, and, therefore, enjoyable to a good tank crew.

Other Saving Measures. *Checklist for zero exercise.* The calibrated cross-check for sight referral allows decentralization of zeroing with improved quality assurance. Use of a good checklist by the tank commander and his verification of precise gunner actions will reduce tower involvement to the minimum necessary for sensing and safe control of the firing line. The tank commander *can* zero his tank and do it well.

The first round may be useable. Rather than debate the necessity of the warm-up round, ammunition can be saved by firing the first round for record. If a two-round shot group results after the second round, then refer the sights. If a third round is necessary to establish a two-round shot group, then no additional ammo was spent, but so far none saved. In other words, begin with the very first round fired and attempt to establish a two-round shot group for referral. If the first round fired is in the group, then ammunition is saved, as a group was established with two rounds. At most, three rounds are required for warm-up and a group. If after the third round no shot group is apparent, move the tank off the firing line. Assuming all rounds are from the same lot, mechanical difficulty may exist. More likely, nervousness is causing the dispersion. Once the systems are checked or the crew is relaxed, begin the procedure again. Three rounds to group, or go!

Fire over the number 2 support roller. Strong empirical evidence emerged from a study by the Ballistic Research Laboratory that indicates that first round hit probability increases when the gun is fired over the side of the tank. Over the number 2 support roller, a tank has a 25 percent better chance of a first round hit at 1,600 meters. The advisability of applying this finding in combat is questionable, but for zeroing, it is very useful. With the tank parked to allow the zero exercise to be fired over the number 2 support roller, our company achieved an average group size of 8 inches.

Use a zero fire command. Predictability is axiomatic to tank crew response. Each main gun engagement is initiated by a standardized fire command. Such a fire command (GUNNER—SABOT—TARGET 7) seems to settle nerves even on the zero range and generates sound automatic crew responses.

Summary

The nine fundamentals expressed here helped to significantly reduce required range time to zero and to increase the quality of the zero exercise. Eighteen tanks completed the full zero exercise in 6 hours. Each tank fired a confirmation round into the 50-cm circle. Five of those tanks zeroed in three rounds or less from the boresight setting. Ten of the 18 used the first round fired to form the two-round shot group. An average of 3.8 rounds per tank were used for the exercise with 2.5 rounds needed to establish a two-round shot group. Six- to seven-inch groups were common. A locally procured 45-power spotting scope was used to increase the accuracy of sensings from the tower. Any good optical device such as a BC scope or TOW sight will help. This system is *not* a substitute for well-trained tank commanders and crews. It will enhance crew confidence and morale with its inherent efficiency.

Note: The authors wish to express their gratitude to many people who helped in the development of the Calibrated Zero System. LTG Glenn K. Otis made obvious the need for improvement. Several ideas on zeroing were provided by SFC Robert Francis of the Seventh Army Training Command. Encourangement to put it on paper came from LTC John C. Heldstab, Commander, 2d Battalion, 37th Armor. The noncommissioned officers of Company A provided ideas and excellent training. Special thanks go to the men of Company A who patiently tested this system and subsequently provided the empirical data.

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T-72 vs M-1

A Conversation with the Comrade

by MAJOR PHILLIP C. GUTZMAN

It was Friday, the final day of the basic officer course and the class about to be graduated was gathered in the main lecture hall to hear a presentation by the nation's foremost military theoritician, Comrade Oleg Popov, Order of Lenin, Hero of the Soviet Union. As was customary, the Comrade would give a brief speech extolling the tank troops and recount for the class the immense importance of their new positions at this time of tension with the NATO alliance.

The lecture hall was a low buzz of whispered conversation as the bored men shifted on the hard seats of the small desks arranged in front of the stage. The stage supported a small podium and was backed by an immense flag of the Homeland.

Lieutenant Yuri Boschevsky turned to his friend Pavel Racovich and commented, "I wish we could get this over with; who wants to listen to some old *apparatchik* babble about the 'Great War,' and then tell us all about how we are the cutting edge of the Party and how we are equipped with the newest and best the nation has to offer."

Pavel nodded his assent and Yuri continued, "Did you see that bootleg copy of *Soldat und Technik* being passed around in the barracks? The one with the article about the new American tank, the *M-1?* Now *there* is a combat vehicle. What I wouldn't give to crew one of those babies!"

He noticed Pavel was looking past him and that his eyes were wide and his mouth was hanging open. "Comrade, what's . . .?" his voice trailed off as he glanced over his shoulder into a pair of hard blue eyes deep-set under bushy brows in a face that looked more like it was carved from a block of granite than made of flesh and bone. His stomach knotted and the blood drained from his face.

"Go on, please." The apparition spoke in a voice that sounded like gravel rattling in the bottom of a garbage can. "What is it you find so appealing about the American tank?"

Yuri glanced wildly around, hoping against hope for some sign of assistance, something that would take him off the spot, but the eyes of the entire class were now riveted on him and the burly figure before him. He gulped and tried to make his voice work, but all he could squeeze out was "I-I-I-I."

Suddenly, the man said "Quiet!" and stalked onto the stage where he stepped behind the podium. All that could be heard in the hall was the collective hiss of the assembled men's breathing.

Looking out across the strained faces of the class, Comrade Popov began, "So! You think there may be a better tank in the world than that which you will shortly command." His eyes rested on Yuri's sweating face. "You have read some of the articles in the capitalist press and you now have some doubts as to the ability of our own forces." He gestured to his aide, who came to the podium, and the Comrade whispered something to him, after which the aide left the auditorium.

"I have sent my aide to my office for a film we recently procured from the United States. It shows the new American tank during some of its testing. As soon as he returns, we will view the film and then I will tell you some things about the equipment we have in our own forces. Until he returns, please take a short rest in place."

In a few moments the aide returned and the Comrade called the class back to order. "Now, watch the film closely; you are among the few in the Soviet Union who have been privileged to view it."

On the screen the American tank was roaring through mud, accelerating down trails at great enough speeds that it was actually leaving the ground as it moved across rough terrain, and firing on the move with devastating effect at targets set in a desert at great ranges. In other parts of the film, the tank was shot at and driven over mines, and yet kept moving. It was very impressive and the young officers were totally enthralled by the presentation.

The film came to an end and the lights brightened. "Now," said the Comrade, "we must look at the tanks of the Motherland and see how they compare; but to do this, we must know something of their evolution.

Following the October Revolution, we experimented with a number of armored vehicle designs before we settled on the BT series in the early 1930s. Because of the success of the series, we adopted the basic premise that the so-called Christie suspension system was the best available, and for 30 years we continued to use it. During the "Great Patriotic War" against the Fascist Powers, the famous *T-34* was the scourge of the Western Front. With it, and the derivatives of it, we drove the invaders from the soil of our Homeland and crushed their formations wherever we encountered them. Five years later, in their valiant attempt to liberate and unify their homeland, our comrades in North Korea used the same tank, which had been up-gunned in 1943 to the *T-34/85*, with great effect against the Imperialist Powers.

From this basic design we derived the *T-54/55* series, a tank which has seen combat in the hands of progressive peoples all over the world; in the Middle East, in Pakistan, in Asia, and in Central Europe, where we crushed the decadent reform movements in East Germany, Hungary, and Czechoslovakia.

As a result of the studies concerning the performance of our armor in some of these wars against the American *M-48* and *M-60* and the British *Centurion*, it was determined that a more powerful vehicle was needed. Our designers responded with the very powerful *T-62*, which was the first attempt anywhere to arm a main battle tank with a smooth-bore gun, our 115-mm. Again based on the performance of the vehicle in combat, this time against the Israeli armored formations in the Middle East, it was determined that, though the gun design held promise, the *T-62* lacked somewhat in mobility and also could not realize its full potential because of inadequate fire-control systems at extended ranges. Our designers experimented with the fire-control and mobility of the vehicle, and it became apparent that it was going to be necessary to do two things: first, abandon the Christie suspension system for greater road wheel travel that would help stabilize the gun for firing on the move; and second, adopt some type of optical or electro-optical ranging system so the range potential of the gun could be realized and accuracy improved.

We devised a research vehicle and christened it the *T-70*, which is called the *M-1970* by NATO. It maintained the 115-mm gun and 580-hp diesel engine of the *T-62*, but

had a British Vickers-type suspension system with six road wheels and three small return/support rollers per side. In addition, we used a "live" track to assist mobility and cut down vibration in the tank. The tank silhouette was lowered by placing the driver at the hull centerline just forward of the turret ring and moving the turret rearward to the middle of the chassis; concurrently, an optical ranging system was incorporated in the turret. Using these test vehicles, we experimented with a number of guns, ranging all the way up to 125-mm; a number of fire-control systems; and some different engine combinations. This vehicle was never put into series production.

Our experiments with the *T-70* were incorporated in part into our very fine *T-64,* which entered series production in 1975. The *T-64,* as you know, has the Vickers-type suspension, with four return rollers and six stamped steel road wheels per side and slide-piston-type shock absorbers to increase the accuracy while firing on the move. In conjunction with this, we also used a double-pin live track.

Armament for the *T-64* was improved with the adoption of a 125-mm smoothbore gun and an automatic loader. This innovation results in the ability to reduce the crew from four to three while retaining a favorable weight and lowering the silhouette even further. The coaxial armament is the familiar *Kalashnikov PKT* 7.62-mm machinegun and the commander's weapon is a 12.7-mm machinegun, which is pivot-mounted in front of his hatch and can be remotely fired from inside the tank.

Fire control has not been overlooked in the *T-64.* We have installed a very sophisticated electro-optical ranging and sighting system, giving our crews the ability to range and track with an automatic system built into a small computer that directs the gun. Of course, the commander has the option of assuming control of the firing of the main or secondary armament by overriding the gunner's controls. He also has a stereoscopic rangefinder that enables him to passively range on a target if the enemy has infrared or laser energy detectors.

Since its adoption, the Ministry of Armaments has produced more than 2,000 *T-64s,* which is a significant number. Of course, there is continuous progress in tank design, and we now come to the current main battle tank our industry is turning out, the *T-72.*

We officially presented the *T-72* to the world in 1977 at the celebration and parade marking the 60th Anniversary of the October Revolution. It is a continued refinement of the series that began with *T-70,* paralleled the development of the *T-64,* and resulted in the finest main battle tank in full production and fielded in the world today.

The *T-72* is an extremely mobile vehicle, equipped with a Vickers-type suspension system having a live, single-pin track that is somewhat wider than the one we used on the *T-64,* six rubber-clad cast steel road wheels, and three support rollers on a side. The suspension is completed by using hydraulic shock absorbers to assist in damping out oscillations and to stabilize the torsion bar suspension to the point that it is now possible to fire very accurately on the move. In adopting this type of suspension system, we also saved a significant amount of weight over that on the *T-64,* and have achieved unsurpassed mobility in muddy or snow-covered terrain due to a low ground pressure of about 0.85kg/cm^2.

The overall ability of the *T-72* to move about the battlefield has also been enhanced by the adoption of a different engine than that used in our older tanks. We have completed the development of a new 700-hp diesel that is transversely mounted and gives the *T-72* a road speed of 70 km/hr, the ability to negotiate 60 percent slopes, and a cruising range in the neighborhood of 500 km. In combat, you can expect to move cross-country in normal terrain at speeds in the 25-30 km/hr range and maintain the ability to fire.

Of course, the ability to kill the enemy while you survive is a matter of the greatest importance. The American general, Patton, was correct when he said, 'Your job is not to die for your country; it is to see to it that the other man dies for his.' With this in mind, our designers have provided you the very latest developments in armament and fire-control.

Armament and fire-control are, of course, located in the turret. Some of you will find the turret of the *T-72* a bit cramped because we have designed it to retain as small an armored envelope as we can, minimizing the vehicle silhouette while retaining the efficiencies of the improved gun systems. Because of the automatic loader that only we have, there are just two men located in the turret—the commander, who sits on the right side of the automatic loader, and the gunner, who sits on the left.

In the past, the commander and the gunner of our tanks had some difficulty in viewing the battlefield while they were "buttoned up." In the *T-72,* we have alleviated this problem somewhat by providing the commander a ring of armored glass vision blocks which will allow him to see 360 degrees with the hatch closed. The gunner has been given one vision block to view the area immediately ahead of the vehicle and another on his left to see into the dead space that would otherwise exist there due to the elimination of the loader. Naturally, additional vision capability is provided by the sighting and fire-control devices mounted in the turret.

Unlike all our other tanks, the *T-64* and *T-72* do not have a 'through the armor' sight slaved to the gun and protruding parallel to it through the gun mantlet. Instead, the gunner's sight is contained in a periscope mounted in the left front of his hatch. The periscope contains a panoramic stabilized sight and an image intensification system for fighting at night or in periods of limited visibility.

The commander is provided with a stereoscopic rangefinder with a 1.4-meter base width for optical ranging and firing the main and secondary armament from his position. Incorporated into the left end-box of the rangefinder is a laser ranging system that provides extremely accurate range information during periods of good visibility and when faced with enemy equipment that does not have detectors for laser energy.

The fire-control system is connected to a main armament of 125-mm, which is fully stabilized to take advantage of the improved suspension system and allows accurate engagements on the move. The gun is a

smoothbore, approximately 5.3 meters long, with about 4.5 meters extending outside the turret. To insure it retains its accuracy, we have enclosed it in a thermal shroud; actually five small sections of light alloy shrouding—four cylindrical ones along the tube and a conical one against the mantlet. A fume extractor is located at the midpoint of the tube to insure no gun gases build up in the turret.

Loading is accomplished by an electrically-driven automatic system that allows the gunner to select which of the three types of ammunition we have developed for the gun he wishes to fire. All three types utilize a combustible propellant case with a steel base cap. This means the residue following firing is limited to a small piece of spent brass rather than the entire shell casing. This, in turn, solves the disposal problem.

The elevation and traverse mechanisms are redundant in that they work either electro-hydraulically or manually.

Another small innovation we have incorporated is a travel lock, which allows the tank to move with the turret forward and ready for combat. The lock consists of a locking link inside the turret that retains the gun in a semi-elevated position while traveling, but can be rapidly removed from inside the turret to prepare for combat. Our method is opposed to the American system of tying the gun to the back deck of the tank and then having to travel with the gun to the rear or getting out of the vehicle to unlatch it.

The secondary armament of the *T-72* is the well proven 7.62-mm PKT machinegun installed coaxially on the right side of the main armament and loaded by the commander. This weapon is extremely effective out to 1,000 meters. The commander's weapon marks a departure from our previous design in that it is skate-mounted on a ring around the commander's hatch and cannot be fired remotely from inside the turret once the hatch is closed. It is also a gun of a new design, incorporating two hydraulically-assisted hand cranks for elevation and traverse, but retaining the same caliber—1.27-mm. It is a very efficient weapon out to ranges in excess of 2,000 meters when fired using the incorporated reflex sight. It also has a built-in folding sight, should the reflex system be inoperative.

No discussion of the armament and fire-control system would be complete without a comment on night-fighting capabilities. As you are aware, the Soviet Union has always been a leader in the design and production of night-fighting equipment for armored vehicles. The *T-72* with its three infrared searchlights is a case in point. The main light is slaved to the main gun with a link and elevates and depresses in concert with the gun. A second light is slaved to the gunner's primary sight and allows him to observe with his own light source. The third is attached to the front edge of the commander's cupola and is for his use. Using this equipment, the *T-72* is capable of extemely accurate firing at night out to ranges of 800 meters.

I spoke earlier of the three types of ammunition we have developed for the new 125-mm gun on the *T-72*; an armor-piercing, fin-stabilized, discarding-sabot (APFSDS) round will be the primary armor-defeating round for the tank. It is of the so-called "long-rod penetrator" type and the sabot has a length to diameter ratio of about 12.4:1. With this penetrator and the muzzle velocity of the round, 1,800 meters per second, we have achieved an extremely flat trajectory and a very high probability of hits and kills to 1,800 meters and beyond.

The second round we have designed is a high-explosive, antitank (HEAT) round, which contains a hollow charge cone with a wave-shaper and a detonator located at the tip of a very narrow ogive. Location of the detonator on the tip of the ogive and the addition of the wave-shaper act to stabilize the explosive jet and increase the penetration so the round can punch through 500-mm of armor at any range. The HEAT round is somewhat slower than the APFSDS because the muzzle velocity is only 1,100 meters per second, but it still has a very flat trajectory. The design of the fins, four of which are folded forward along the round until it clears the muzzle, stabilizes it and insures that it is accurate to at least 1,500 meters.

The other round we are producing is a high-explosive (HE) round for use against all types of unarmored or lightly armored targets. It, too, is fin-stabilized by fins that are folded backward along the round until it clears the muzzle. The round has the capability of being fuzed for different types of burst and is essentially a very straight-forward shell filled with TNT.

This then is a look at the primary main battle tank of the Homeland.

How does it compare with the current American main battle tanks," Comrade Popov asked as he looked around the room at the young officers assembled there.

"The chart on the screen will give you our current evaluation." A large chart (table 1) appeared on the projection screen to the left of the podium.

Comrade Popov looked out at the students in the class as they digested the material presented in the chart.

Comparison	USA Superior	USSR Superior	About Equal	Comments on Capabilities
U.S. M-60 vs. T-64/T-72				
Gun/Ammunition		X		Larger, higher-velocity Soviet gun, improved ammunition with long-rod penetrator
Fire Control	X			Auto-ranging and tracking on Soviet armor
Armor		X		Soviet laminated and spaced/composites
Engine/Automotive			X	Improved Soviet engine/transmission but probably no better than the U.S.
Suspension			X	Improved Soviet suspension removes U.S. advantage in this area
U.S. M-1 vs. T-64/T-72				
Gun/Ammunition			X	
Fire Control	X			Laser rangefinder and improved computer will improve U.S. capabilities
Armor	X			U.S. special armor is highly effective
Engine	X			U.S. turbine is highly advanced, but will use more fuel
Suspension	X			Not a high technology, but improved when compared to Soviet design

Table 1

"Are there any questions?" he rumbled.

Yuri could not resist and raised his hand. "Comrade," he began, "it would appear that the American vehicle is in several ways superior to the *T-72*. Are we doing anything about that?"

Popov's eyebrows shot up and he stared at the young man. "Of course we are—dolt!" he roared. "We are in the process of testing the *T-74* as a research vehicle, which will lead to the introduction of the *T-80* in a short time. Some of the *specific* things we are doing are: Up-armoring the vehicle, increasing the engine power from 700 hp to the 900-1,000-hp range, which will give us a better power-to-weight ratio even though the armor improvements will result in a vehicle in the 45-ton range rather than the current 40-ton range of the *T-64/72s*; incorporating a hydro-pneumatic system in the suspension that will allow the crews to adjust the silhouette of the vehicle and decrease the vulnerability; and improving the fire control system."

"But," and he slammed his fist down on the podium so hard that the edge of it splintered, "no matter whether or not we come out with the *T-74/80* in the near future, you will still have a decided advantage over the Americans for at least the NEXT 10 YEARS! The reason is simple. As of the end of this year, there will be less than 100 *M-1s* in existence, and the Ministry of Armaments has already produced more than 6,750 *T-64s* and 8,050 *T-72s*. The Americans, thanks to a niggardly Congress and the bureaucratic morass their development programs must go through, cannot even catch up for the next *10 years!* That is all. Good day." And he stalked out.

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Army Research, Development, and Acquisition Magazine, September-October 1980, page 19. (Fuel consumption in the chart on page 11.)

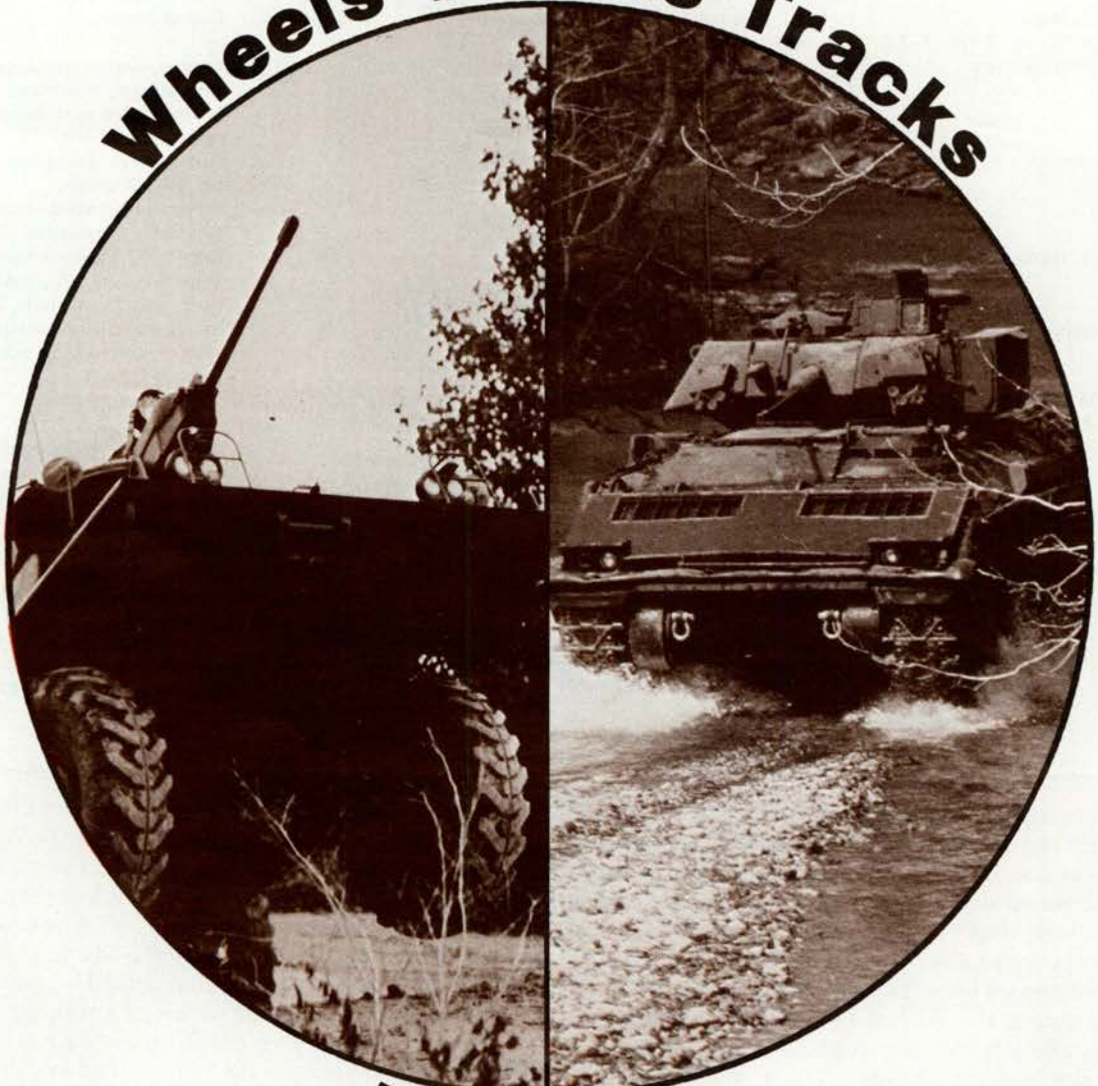
Ground Defense International, No. 63, April 1980, pages 55-62. (Technical data comments contained in pages 3-10.)

Military Review, October 1980, page 89. (Comments on page 12 pertaining to armor structures of the *T-74/T-80*.)

Rand Note, N-1288-DR&E. (U) U.S. & Soviet Tank System Technologies, page 23. (Table on page 11.)

MAJOR PHILLIP C. GUTZMAN has had extensive experience with tank units, including command of a company in Vietnam. His other assignemnts have included duty as a brigade and battalion S-3, battalion XO, and command of a training battalion. He is currently involved in R&D where he has nearly 10 years experience with combat vehicles, including almost 2 years with the *M-1 Abrams* tank.

Wheels Versus Tracks



By Clifford D. Bradley

After more than 3 decades, the U.S. Army is starting to show an interest in wheeled combat vehicles. It is just possible an upcoming evaluation of wheeled combat vehicles will result in some type of wheeled system being introduced into certain elements of the Army's fighting forces. The Marines are also currently investigating the merits of wheeled combat vehicles; they are especially attracted by the availability of several different wheeled combat vehicles on the market.

During World War II, the U.S. Army used *M-8* and *M-20* armored cars in armored reconnaissance units. Apparently both of these vehicles fell short of the Army's expectations from a performance, combat effectiveness, and reliability, availability, and maintainability (RAM) viewpoint. They were phased out of the Army's combat vehicle fleet shortly after World War II.

Some factors that may have influenced the Army's decision to favor tracks over wheels for the past 30 years follow:

•Mobility differential between tracks and wheels not in keeping with national policy to have a "fight anywhere army."

•Steadily increasing weight of combat vehicles favors tracks over wheels in cross-country mobility, especially in soft soils.

•User perception of wheeled vehicle vulnerability to a growing number of threats.

•Converging acquisition costs of wheeled and tracked combat vehicles.

•For equal mission volume, the tendency of wheeled combat vehicles to be larger.

•National emphasis on fewer, more survivable vehicles.

During the past 20 years, wheeled vehicles have been considered during the concept formulation phase or validation phase for such vehicle programs as the *M-114*, the *M-113*, the Armored Reconnaissance Scout Vehicle (ARSV), the Mechanized Infantry Combat Vehicle

(MICV) or Infantry Fighting Vehicle (IFV) and, most recently, the Multiple Launcher Rocket System (MLRS). However, when mobility requirements emphasize cross-country performances—particularly soft soil requirements on a worst case basis as opposed to mobility performance comparison over a broad and more realistic terrain spectrum—tracked vehicles win out.

While the U.S. Army made the decision to phase out wheeled combat vehicles after World War II, other countries did not follow this approach. Wheeled vehicles continued to be used to some degree by most major countries, including the Soviet Union. Through the 1950s and 1960s, wheeled vehicle technology generally paralleled or followed the progressive improvements made in the civilian sector of the automotive, farming, lumber, mining, and construction industries. Ironically, the U.S. was in the forefront of technological advancements in these areas, and foreign governments took full advantage of this in their wheeled combat vehicle developments.

The world-wide trend toward the wheeled combat vehicle has shown a sharp increase in the past decade. Some 86 countries throughout the world have wheeled combat vehicles in their TO&E units. At least 15 or more countries have demonstrated that they can design, develop, and produce some rather progressive and innovative wheeled combat vehicles; and during the past 5 years, 20 or more countries have initiated programs leading to prototype testing or acquisition that will soon add new wheeled combat vehicles to their armies.

Some of the factors that may have contributed to the world-wide resurgence of wheeled combat vehicles follow:

- Improved wheeled vehicle mobility and RAM, and reduced vulnerability.
- Increased firepower lethality for a given weapon firing impulse and weight.
- Reduced development and production time.
- Reduced support cost, simpler logistic support.
- Less vehicle training required.
- Proliferation of small emerging nations and greater likelihood of low-intensity conflict.

Wheeled combat vehicles are quite impressive with the level and types of armament that are being mounted on them. They mount weapons in the 90-mm and 105-mm class that can fire several types of ammunition, including high explosive (HE) and high explosive antitank (HEAT) at velocities up to 3,000 ft/sec with muzzle momentum or impulse up to 1,400-1,800 lb/sec. The firepower of these combat vehicles is approaching that of U.S. World War II main battle tanks. Thus, any oldfashioned notion that these new wheeled combat vehicles are simply mobile platforms for machineguns can be quickly discarded for a more enlightened appreciation of their capabilities. Modern day armament is mounted on wheeled combat vehicles such as the French *AMX-10RC,* British *EV-601 Saladin,* and Canadian *Cougar.*

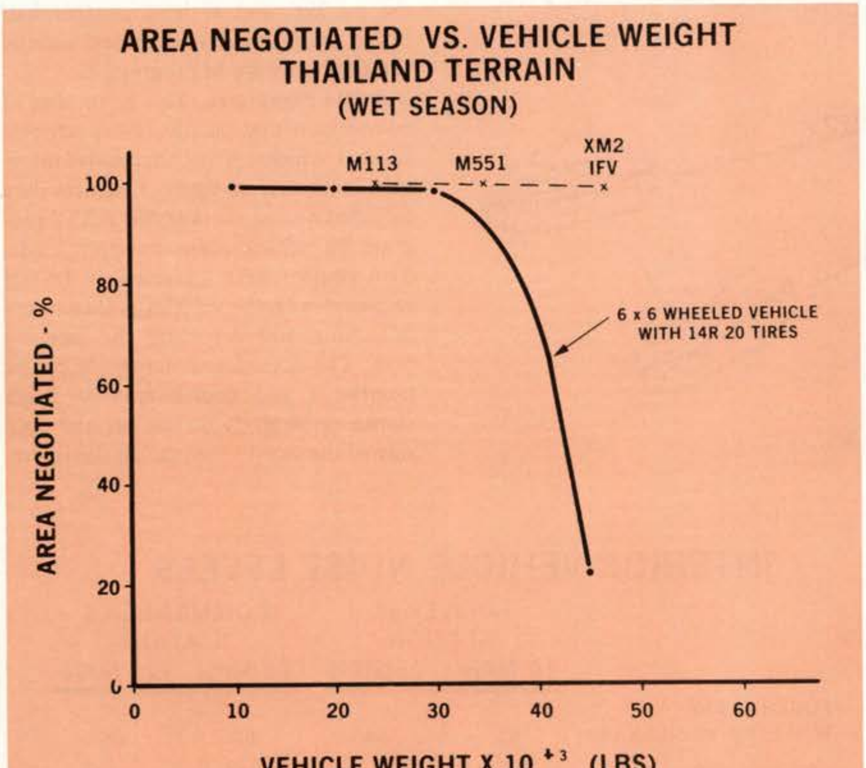


Figure 1

Technical Considerations

To gain a better comprehension of the merits of modern wheeled combat vehicles, some of the more controversial comparisons with track vehicles will be discussed from a technical, cost, and RAM standpoint.

Mobility. Whenever wheeled and tracked vehicles are assessed, one of the first and most obvious comparisons is system mobility in soft soils, invariably to the disadvantage of the wheeled vehicle. This drawback for wheeled vehicles has not changed over the years for any kind of realistic comparison. There are obviously certain terrains that can be selected to optimize or "showcase" the advantage of either. Generally, the analytical as well as hardware or test-bed comparisons are made on terrain in which the soft soil and ditch bridging advantages of track are well demonstrated. If that is the expected area of operations, tracks may be the best choice. However, wheeled vehicles with new and modern engineered suspension and aggressive tire design are also demonstrating greatly improved cross-country performance. The real difference in a go or no-go comparison in soft soils will simply be a function of ground pressure or vehicle footprint. The key to proper selection is to choose the vehicle best suited for the job. The curve in figure 1 shows the percent of area that can be nogotiated versus vehicle weight for a 6 x 6 vehicle with 14R20 tires. The curve also tells the mobility story very well—at approximately 28,000-32,000 pounds, a 6 x 6 wheeled vehicle starts to show mobility degradation in the terrain selected and gets rapidly worse with weight. This same sudden decline in mobility would occur with an 8 x 8 vehicle with the same tire size at 38,000-40,000 pounds. With a 4 x 4, the sharp degradation in mobility would begin to occur at approximately 22,000-24,000 pounds. It is generally conceded by world-wide designers of wheeled vehicles that 40,000 pounds is the upper weight limit for wheeled vehicles that use reasonably-sized commercial wheels and tires.

Vulnerability to Battlefield Threats. Another comparison generally brought out, often subjectively and without full information on the subject, is wheel and track vulnerability to such battlefield threats as small arms, HE shell fragments, and certain size mines. If in the weight class under consideration armor protection can be considered essentially equal and generally in the 7.6-mm and HE fragments class, then vulnerability of the ground contact mobility elements offers a basis for comparison. If one is willing to accept the limited test data that came out of a small sample comparison of the ARSV wheeled and tracked candidates in the 18,000-20,000 pound class, the data shown in figure 2 is somewhat surprising, in that the test shows wheels to have a small advantage over tracks. If the data is shrugged off as being statistically inconclusive from a level-of-confidence standpoint, it must be conceded that it certainly *is not* a clear mandate for the superiority of tracks as regards vulnerability in this weight class.

It is equally important to note that since the demise of the ARSV program, much progress has been made in providing greater immunity to small arms and HE fragments for combat tires than has been made for tracks of similar weight vehicles. At least two combat tires are now available from the commercial market that will guarantee operation for 25-50 miles and higher after multiple penetrations at only a small reduction in performance. One or two other combat tires are about to enter the market, and at least another half dozen promising developmental combat tire programs are in progress.

Audio Signatures. This is an area of comparison that clearly favors wheeled combat vehicles. The comparative information shown in figure 3 depicts data gathered during the *XM-800* ARSV program on vehicle noise detection levels. Two courses were traversed in the test sequence with the vehicles evaluated approaching and departing the listening post. The detection distance for course number 1 and course number 2 are shown respectively on the left and right side of the word "meters" in the figure.

XM800 ARSV VULNERABILITY EVALUATION

	AREA OF IMPACT	RESULTS
	• THREAT: SMALL ARMS	
TRACKED	PERFORATION OF SHOE AREA, BROKEN AND DAMAGED PINS, DAMAGED END CONNECTORS, BROKEN CENTER GUIDE	VEHICLE IMMOBILIZED BECAUSE OF BROKEN PIN.
WHEELED	PERFORATION OF WHEEL, LOSS OF AIR FROM TIRE	ROAD TESTED FOR 4 MILES AT 15 MPH (TIRE DRIVEN ON RIM OF WHEEL).
	• THREAT: HE SHELL FRAGMENTS	
TRACKED	HOLES THROUGH SHOE, BROKEN PINS	VEHICLE IMMOBILIZED BECAUSE OF BROKEN PINS.
WHEELED	LARGE PERFORATION WITH LOSS OF AIR FROM THE TIRE	VEHICLE WAS DRIVEN 3.5 MILES ON FLAT TIRE. NO RIM DAMAGE.
	• THREAT: MINE ATTACK	
TRACKED	TRACK CUT IN HALF	VEHICLE IMMOBILIZED.
WHEELED	TIRE PERFORATED & SHREDDED, SMALL HOLE IN WHEEL	VEHICLE COULD RUN ON TIRE FOR LIMITED NUMBER OF MILES (TEST NOT RUN).

Figure 2

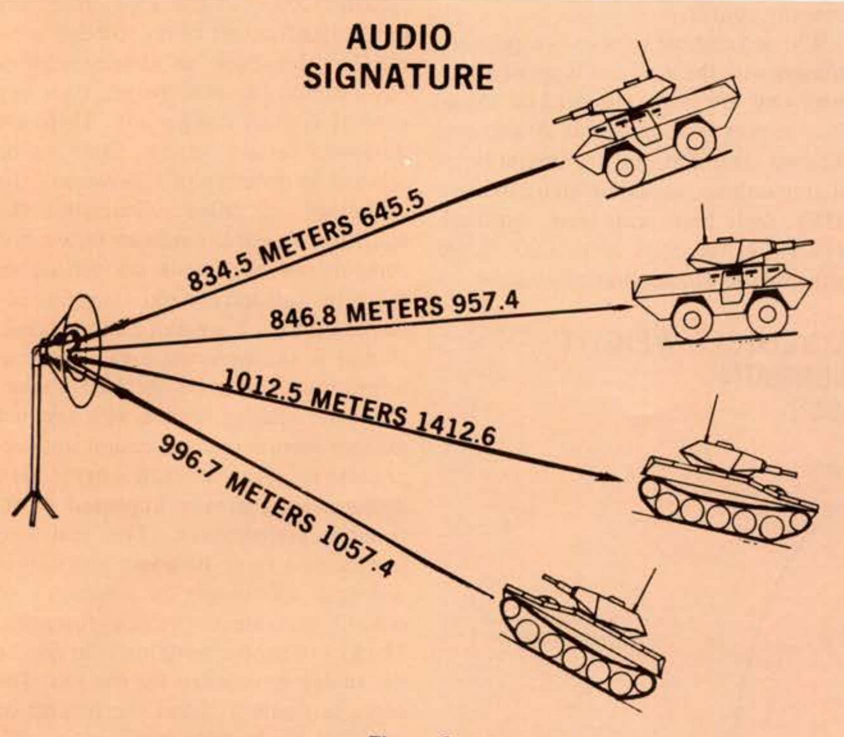


Figure 3

INTERIOR VEHICLE NOISE LEVELS

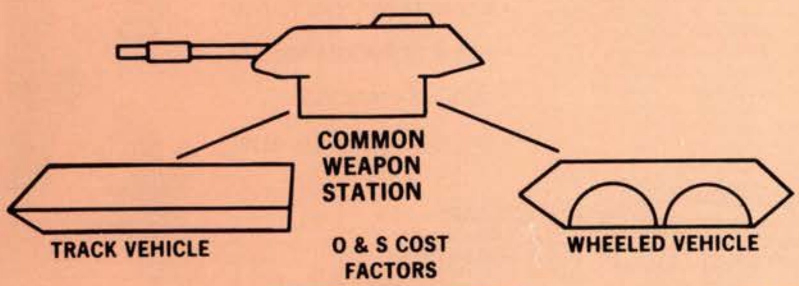
	DRIVER'S STATION		COMMANDER'S STATION	
	10 MPH	25 MPH	10 MPH	25 MPH
FOREIGN 4x4 WHEELED VEHICLE (db)	85	94	80	85
M113A1 APC (db)	110	104	105	104

Figure 4

It is noteworthy that both candidate vehicles used the *GM 6V53T* diesel engine, rated at approximately 300 horsepower.

Interior Vehicle Noise Levels. In order to show a comparison of interior vehicle noise levels, data on file at Aberdeen Proving Ground from an earlier test is used. Figure 4 shows interior noise levels at two crew positions and for two different speeds for the tracked *M-113A1* and a typical foreign 4 x 4 wheeled vehicle. The values shown are decibel levels as measured. The comparison clearly favors the wheeled vehicle.

OPERATIONAL & SUPPORT COSTS
(PER VEHICLE/YEAR)



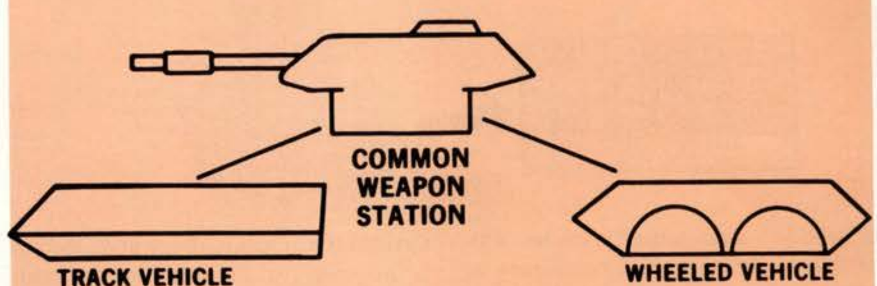
TRACK VEHICLE	O & S COST FACTORS	WHEELED VEHICLE	RATIO
$2.10	MAINTENANCE COST PER MILE	$ 0.70	3:1
$.27 PER MILE	POL	$ .14 PER MILE	2:1
10,000	MILES TO OVERHAUL	20,000	1:2
$61.00	AVG PART COST PER MAINTENANCE ACTION	$37.66	3:2
$10,500	MAINTENANCE COST PER YEAR	$3500	3:1

Figure 5

Costs

Acquisition Costs. Probably one of the most controversial and most debated comparisons of wheeled and tracked combat vehicles is the initial or acquisition cost, sometimes referred to as fly-away cost by the cost analysts. This is the area where folklore and opinions run rampant and very little true facts or actual cost data is revealed, especially in the U.S. where the Army has such a small official data base to draw from. The truth is, there is very little difference in the initial cost of modern day wheeled and tracked combat vehicles when the several cost-producing factors are presented and compared. Perhaps the illustration depicted in figure 6 will help explain this. First of all, the sophistication of modern day turreted weapon stations account for approximately half the cost of modern combat vehicles in the 10-20 ton weight class, regardless of whether they are wheeled or tracked. Thus, whatever cost differential exists must be in the 50 percent represented by the hull/chassis and automotive subsystems. Once again, in both the wheeled and tracked vehicles of this weight class, there is little difference in the size, weight, and cost of the hull armor; although some concede the fabrication cost of the wheeled vehicle may be due more to surface complexities, more weldments, etc. Most of the automotive hardware, such as commercial engine, seats, bulkheads, batteries, linkages, fuel tanks, and so on, are common to both wheeled and tracked vehicles. Thus, the main cost discriminators must be from the engine flywheel to the ground. The main items that are peculiar to tracked vehicles are special types of transmission, final drives, and track, suspension, and running gear. Items peculiar to wheeled vehicles are commercially available transmissions, transfer cases, axles, wheels, and tires. The cost differential for these items is conceded by most vehicle cost analysts to be approximately 10-20 percent of the overall chassis cost in favor of the wheeled vehi-

RAM



TRACK VEHICLE		WHEELED VEHICLE	RATIO
.60	MAINTENANCE RATIO	.30	2:1
1100 MILES	MEAN MILES BETWEEN FAILURE	2200 MILES	1:2
.76	OPERATIONAL READINESS	.92	.8:1
1 MANHOUR	MEAN TIME TO REPAIR	1 MAN HOUR	1:1
.94	RELIABILITY - 100 MILE MISSION	.96	1:1

Figure 6

cle. A small increase in sophistication of wheeled components in this area in order to match track performance can quickly eliminate the small cost differential and even cause the wheeled vehicle to cost more. When the 50 percent cost attributed to the weapon station is figured, the 10-20 percent differential for the chassis becomes only 5-10 percent for the entire vehicle comparison. A comparison of wheeled and tracked vehicles of comparable size, weight, and complexity—such as the *V-150 Commando* and the *M-113A1*—confirms this when both are adjusted to a common quantity production base.

Operational anu Support Cost. The wheeled combat vehicle shows a clear-cut advantage over a similar weight tracked vehicle in the operational and support cost area. The data shown in figure 5 is a combination of test results of wheeled and tracked vehicles with similar weight, size, and complexity at Aberdeen Proving Ground and analysis by the Tank/Automotive Research and Development Command (TARADCOM) system analysts. Again, the weapon station is considered to be common to both vehicles and is not a major consideration in the comparison of the data presented.

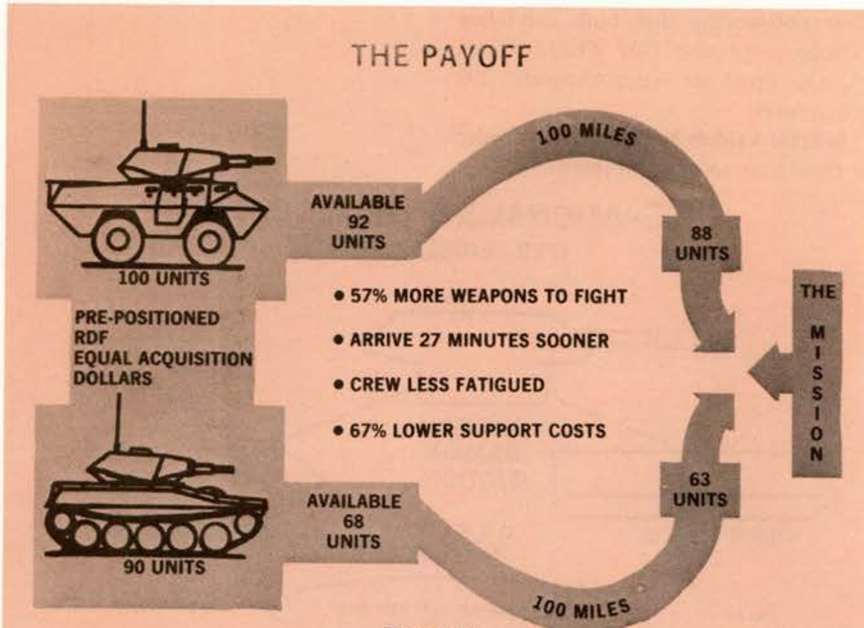


Figure 7

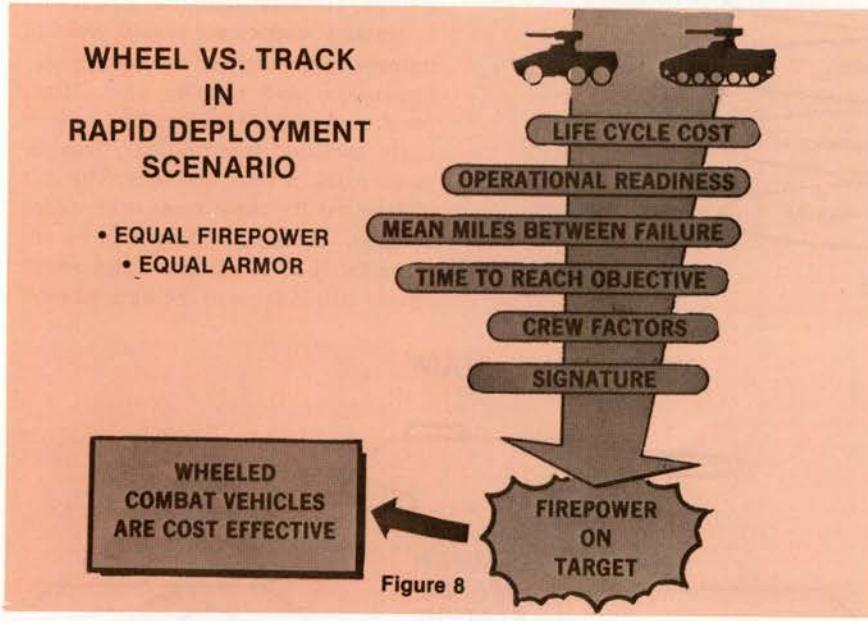


Figure 8

RAM

This is also an area where the wheeled combat vehicle shows a clear-cut advantage over a similarly equipped tracked vehicle. In fact, the data shown in figure 6 is from actual comparison tests of the *V-150 Commando* and the *M-113A1* that was conducted at Aberdeen Proving Ground. Once again, the weapon station is assumed to be common to both vehicles and is not considered in the data presented. Thus, the chart reflects only the RAM comparison for automotive and mobility systems.

Having discussed background and compared technical considerations, costs, and RAM for wheeled and tracked combat vehicles, how can one best decide whether a wheeled or tracked vehicle is best suited for a given role? First, some type of screening criteria must be established. This is based on the expected mission requirements, especially as related to vehicle firepower, expected terrain, mobility, protection. and weight, because wheeled vehicles must be under the 20-ton threshold. Having first established the possibility that both a wheeled or tracked vehicle may perform the role, the following additional criteria may be addressed in order to consider a wheeled vehicle:

- Below weight threshold.
- High mileage mission.
- High road speed requirement.
- Extended operation away from support base.
- Good acoustic signature.
- Selectivity in off-road operation.

Now let's postulate a mission which makes use of the aforementioned technical considerations, cost, and RAM comparisons for wheeled and tracked combat vehicles. Let's further stipulate that the wheeled or tracked combat vehicles mount a 75- to 90-mm cannon, have equal armor protection, and are part of a prepositioned Rapid Deployment Force. Also, let's base the number of each type of wheeled or tracked vehicle on an equal force acquisition cost. Based on the 10 percent acquisition cost differential discussed earlier, the initial acquisition investment will buy 10 percent more wheeled vehicle units, shown as 100 wheeled versus 90 tracked units in figure 7.

Now let's stipulate that, at some specific time, the force will be required to move 100 miles over 52 miles of primary roads, 42 miles of secondary roads, 3 miles of trails, and 3 miles cross-country and then perform a mission involving the main cannon weapon. Based on the RAM data and the operational and support cost comparisons discussed earlier (and if the number of weapons arriving at the mission destination as a measure of effectiveness (MOE) is used), there appears to be a decided advantage favoring the force structure made up of wheeled combat vehicles. It should be noted that for the mean miles between failures (MMBF) shown on the RAM chart (2,200 for a wheeled vehicle and 1,100 for a tracked vehicle), the 100-mile mission was not a major determinant in the results. For longer missions or for additional missions without maintenance, the wheeled vehicle advantage would become more important. Simply compared, for an equal investment in the force, the wheeled combat vehicles can place 57 percent more weapons at the mission destination; can be operated for 67 percent lower support costs; and travelling over the terrain profile show, can arrive 25-30 minutes sooner with less crew fatigue.

Summary

There has been no drastic change in the mobility differential between wheeled and tracked combat vehicles of similar weight since the U.S. Army phased out their wheeled combat vehicles 3 decades ago. Tracked vehicles have been and will continue to be clearly superior to wheels in snow, mud, soft soils, and extremely rugged terrain, where the relatively lower ground pressure and bridging effect of the track provide greater mobility than a wheeled vehicle. On the other hand, when the ground is more firm, even though uneven or bumpy, the modern-day wheeled vehicle can compete favorably with a tracked vehicle and, on roads, can easily surpass tracked vehicle performance.

Because of the 18-20 ton weight limitation of wheeled combat vehicles, they cannot be considered as candidates for missions requiring heavy armor protection. However, for light armor roles, wheeled vehicles must be considered because of their demonstrated advantages in operational and support costs and RAM, even though system acquisition costs for tracked and wheeled vehicles may be comparable. The key points for wheeled combat vehicles are shown in a graphic summary in figure 8.

It really is time to take another look at wheeled combat vehicles for specific roles because there is definitely a place for them. The Army appears to be moving in that direction.

Photo on page 24 provided by FMC Corporation.

THINGS ARE STARTING TO HAPPEN

When the accompanying article was started, there was no armored wheeled combat vehicle program underway. Since then, several programs have either begun or are planned which could lead to wheeled combat vehicles as either the interim or final solution to particular military needs.

In mid-1980, the Marine Corps obtained six wheeled combat vehicles from Canada for evaluation. The selection included three Cougars mounting a 76-mm cannon, and three Grisslies mounting twin machineguns. Their Field Analysis Concept Test (FACT), although not intended to select or evaluate a particular vehicle, will study weapon system tactics and determine the optimal organization for employment.

Light Armored Vehicle (LAV) Program

For their immediate or short-term needs, the Marines will issue a Request for Proposal (RFP) in mid-February for three light, armored combat vehicles. The contract to be awarded on or about April 1, 1981, will call for immediate delivery of the three vehicles configured for the prescribed roles. After evaluation, a production contract is expected to be signed around September 1981 for delivery starting in one year. While a wheeled vehicle will not be stipulated in the RFP, the wording of the document and the early delivery will almost certainly result in a wheeled vehicle selection.

Mobile Protected Weapon System (MPWS)

In response to their RFP for studies that address the short-term (hybrid) and long-term (conceptual) requirements for the Marines' MPWS Program, approximately 10 to 12 proposals for each have been received by the Marine Corps and are now being evaluated by the Source Selection Board. While no exact breakout of the proposals are known at this time, it is common knowledge in the development community, based on the firms who responded, that a significant number are wheeled vehicle proposals.

The Army is planning to acquire wheeled combat vehicles, including several variants, to be evaluated by the 9th Division for tactical mobility for Light Division 86. They will probably consider the same sources for quick acquisition as the Marines' LAV Program.

Wheeled combat vehicles may be highly competitive candidates in the Army's soon to be launched Mobile Protected Gun (MPG) Program.

The situation has, in less than a year, changed from almost no interest in wheeled combat vehicles to at least two procurement efforts and four Mission Element Needs Statements.

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Cavalry's Last Campaign

by First Lieutenant Johnathan Harbuck

The ghastly stalemate that characterized the First World War forced a complete restructuring of military thinking among the major warring nations. It had been almost a century since the last great European war, and military principles had changed almost beyond recognition. With the perfection of machineguns, land mines, and breech-loading artillery, the tactical pendulum had swung briefly towards defensive combat. The return of mobility to the battlefield would have to await the development of the tank, for horse cavalry had been rendered obsolete by 20th century technology.

Yet, even while countless cavalry regiments were wasting time in France awaiting tactical opportunities that never came, other regiments were playing a major role in a mobile campaign on another continent. The theater was the world's oldest battleground, and the regiments came from every corner of the British Empire. Cavalry, whose era of dominance was coming to a close, was to enjoy one last, glorious moment before retiring from the field of battle.

The Middle East in 1914 was ruled more in name than in fact by the Ottoman Turks. The Ottoman Empire was large and heterogenous, stretching from the Black Sea to the southern tip of the Arabian Peninsula and from Constantinople east to the Tigris River and Persia. Tracing its roots to the Age of Enlightenment that had marked the spread of Islam, the Ottoman Empire had once known periods of enormous power and influence, but had long since grown decrepit. By the coming of World War I, the Empire had come to be called "The Sick Man of Europe."

Incredibly inept diplomacy on the part of the British in the last years of peace was largely responsible for driving the Ottoman Turks into an Austro-German alliance. However fortuitous it may have seemed in Berlin at the time, Turkey's entry into the war on the side of the Central Powers promised little in the way of a threat to the Allies, for she was not at all prepared for war. Her leaders were corrupt, her army was outdated, and an undercurrent of revolt was sweeping through her Arabian provinces. Even so, early British efforts to knock her out of the war met with no success, partly because of poor planning and partly because the British War Cabinet viewed the Middle East as a sideshow.

The first effort came in November 1914, when a British expedition landed in Mesopotamia and began to fight its way up the Tigris-Euphrates Valley towards Baghdad. After a stop-and-go advance, the British force was surrounded and besieged 100 miles short of its objective. Seventeen months later, disease-ridden and half-starved, they were forced to surrender.

In April 1915, the British made a second attempt to knock the Turks out of the war by forcing the Dardanelles, the narrow straits that separate the European and Asian land masses. Conceived as a means of turning the flank of the Central Powers, capturing Constantinople, and opening a supply route to flagging Russia, the campaign met failure after dismal failure until, in January 1916, the attack was broken off.

Early Success, 1917

The disasters in Mesopotamia and the Dardanelles, coupled with the launching of new offensives in France, led to a shifting of British attention away from the Middle East for a time. Yet the Palestine Campaign, which eventually drove the Ottoman Empire down, had actually begun in early 1915. In January of that year, the Turks had opened an attack across the Sinai peninsula aimed at capturing the British-held Suez Canal. The attack had been beaten off with little effort, but it was not until the following year that General Sir Archibald Murray and a small British Army responded by attacking Palestine.

Laying railroad tracks across the Sinai as they moved from their base in Egypt, the British drove hard into southern Palestine, only to be halted at the Gaza Gate by well-entrenched Turkish units.

Undeterred, the attackers swung inland and attempted to outflank the Gaza positions only to find that the Turks had prepared a defense-in-depth along the "Gaza-Beersheba Line," stretching more than 50 miles to the east. Assault after bloody assault was hung- up in barbed wire and cut to ribbons by the momentum of the campaign; assault after bloody assault was hung up in barbed wire and cut to ribbons by machineguns. Thus did the third British effort to invade the Ottoman Empire come to an end in May 1917 in a manner not unlike the catastrophic offensives in France.

"The Bull." In June 1917, General Sir Edmund Allenby assumed command of all British and British Empire forces in Egypt—it was an event that was to affect the war in the Midd'e-Eastern Theater dramatically. At least one of his biographers has implied that Allenby was a genius. This seems to be an exaggeration actually, for history notes only a handful of leaders whose brilliance permanently affected the conduct of war. Allenby was no genius, but like most great commanders, he possessed above-average intelligence and a certain tactical flair. His success can be attributed to his meticulous preparation and to the positive force of his personality.

Allenby was characteristic of most British officers of his day. Laterally descended from Oliver Cromwell, educated in the classics, and commissioned from Sandhurst in the Cavalry, he had seen extensive service in the Boer War of 1899-1902. He was a big, muscular man, prone to fits of violent temper, but commanding the affection of his friends and the respect of his subordinates. He had been a controversial figure in France during the early part of the war, earning praise from some and criticism from others for the way he handled his cavalry during the retreat from Mons in 1914 and the Somme Offensive of 1916.

Never at his very best as a subordinate, Allenby revealed an aggressive brilliance when given absolute command of his own theater of the war. His decisiveness was infectious, and his men began to call him "the Bull." His aggressive nature was to dominate the campaign to the very end of the war.

The Army. The British Army now entrenched along the Gaza-Beersheba Line was British only in a symbolic way. It was composed of 3 cavalry divisions and 4 infantry divisions.

The mounted troops included one Australian/New Zealand division (ANZAC), one pure Australian division, and one division of British county Yeomanry. (It was customary, even as late as the World War, for British colonies and dominions to contribute large bodies of troops to the British war effort. Such were the Australian and New Zealand contingents.) The 3d Division, the Yeomanry, was composed of reserve volunteer horsemen, a unit not unlike one of America's present-day National Guard divisions. It is one of the ironies of the war that the famed "regulars," cavalry regiments like the Scots Greys, the 17th Lancers, and the Life Guards, sat out the war on the Western Front, while their relatively obscure colonial and reserve counterparts played such a dramatic role in the conduct of the Middle-Eastern Campaign.

The 4 infantry divisions were even more colorful in their composition than the cavalry units. Soldiers from Great Britain, Australia, New Zealand, India, Egypt, South Africa, Hong Kong, and the West Indies all marched together. There were Gurkha *sepoys* from Nepal, Jamaican riflemen, Malays from Singapore, and even 3 battalions of Jews recruited in England for the campaign.

In all, Allenby could put more than 50,000 men, 172 field guns, and more than 100 machineguns in the field.

A closer look at the mounted divisions would be appropriate, since they were to play a decisive role in the upcoming campaign. Each was composed of 3 cavalry brigades; each brigade was supported by a machinegun squadron and a battalion of Royal Horse Artillery.

The ANZAC troopers were mostly veterans of the savage Dardanelles fighting and had grown accustomed to serving as either cavalry or infantry, according to the situation. Next to these cocky, self-reliant colonials rode the volunteer horsemen from the home counties.

Unblooded but self-confident, mounted on every conceivable breed of horse, and armed with carbines and pistols as well as sabers, the Yeomanry regiments were quite unique. They traced their origins to the Boer War when volunteer regiments of "mounted infantry" were raised to fight the Boer commandos. They were unorthodox and sometimes unruly, but they had spirit and initiative, and such qualities counted for much in Allenby's eyes.

The Opponent. The Turkish Army across the line was something of a paradox. The Gaza—Beersheba entrenchments, designed by German advisors, were formidable, but the Army that manned them was not. The Turkish soldier, with all his courage and tenacity, could not overcome the rot caused by decades of neglect. Corrupt and inefficient management, commonplace in the Ottoman Empire, had taken its toll on the army.

Morale in the whole Turkish Army began to fail when the British redoubled their efforts in Mesopotamia and finally captured Baghdad in March 1917. Discipline became lax, while the desertion rate rose dramatically. In an effort to save the situation, Germany came to the aid of her faltering ally in 1917 and began to assemble a handful of reliable Turkish regiments in northern Syria.

Stiffened with a German expeditionary force and commanded by German Field Marshal von Falkenhayn, the army was initially given the task of recapturing Baghdad from the British. Upon Falkenhayn and his task force rested the final hope of the Ottoman Empire—somewhat hopefully, the Turks christened the unit "Yilderim" (Thunderbolt).

Erich Falkenhayn, an aristocrat, was an officer cast from a pure Prussian mold. He had planned the Verdun Offensive as chief of the German General Staff from 1914 to 1916. Although removed from his post when the attack ultimately failed, Falkenhayn nevertheless enjoyed a reputation as a tough, competent commander.

History will probably conclude that he was not the perfect man to command the Yilderim Army, however, for he was somewhat unimaginative and tended to think along conventional lines. He devoted little time or energy to studying the region. He surrounded himself with a German staff that, although efficient, prevented him from learning much about the Turkish troops under his command. Although he had the good sense to realize that a counteroffensive in Mesopotamia would be futile so long as the British threatened Palestine and Syria, he based his decision to reinforce Gaza on the mistaken belief that Syrian railroads were as efficient as German ones. They were not, and his army's move south took much longer than he had expected.

Meanwhile, Allenby, full of confidence and spoiling for a fight, was ill-disposed to wait for him.

Battle Joined. The assault on the Gaza-Beersheba Line was a masterpiece of preparation. For months, the British commander had been examining Palestine in detail, while steadily strengthening his force with a stream of reinforcements. He had surrounded himself with intelligent staff officers and had studied everything about the region: its resources, its geography and history, even its flora and fauna. He devoured intelligence reports on the enemy, together with accounts of ancient campaigns in the region written by classical authors. He spent hours poring over the Old Testament.

When the attack came on October 31, it was set up by a masterpiece of deception: One of the officers in Allenby's staff managed to "plant" a map-case near the Turk lines. This plant convinced the defenders that the main thrust of the assault would be made toward Gaza, but the main effort came farther inland, near Beersheba.

A short artillery barrage was followed by a full-scale infantry attack that pierced the line in several places. (Allenby, a true cavalryman, usually placed more faith in speed and surprise than in overwhelming firepower.) As successful as the infantry attack was, it nevertheless fell to the 4th Australian Light Horse Brigade (ALH) to capture the town of Beersheba.

Allenby had feared that Beersheba's water wells would be destroyed by the defenders before the infantry could reach them, so he sent 1,000 troopers on a reconnaissance-in-force to the east of the city with the purpose of locating alternate water sources. Moving along a dry watercourse, which put them below ground level and therefore out of sight of the entrenched Turks whom they happened to be outflanking, they eventually found themselves within a few thousand yards of Beersheba on the extreme left flank of the defenders!

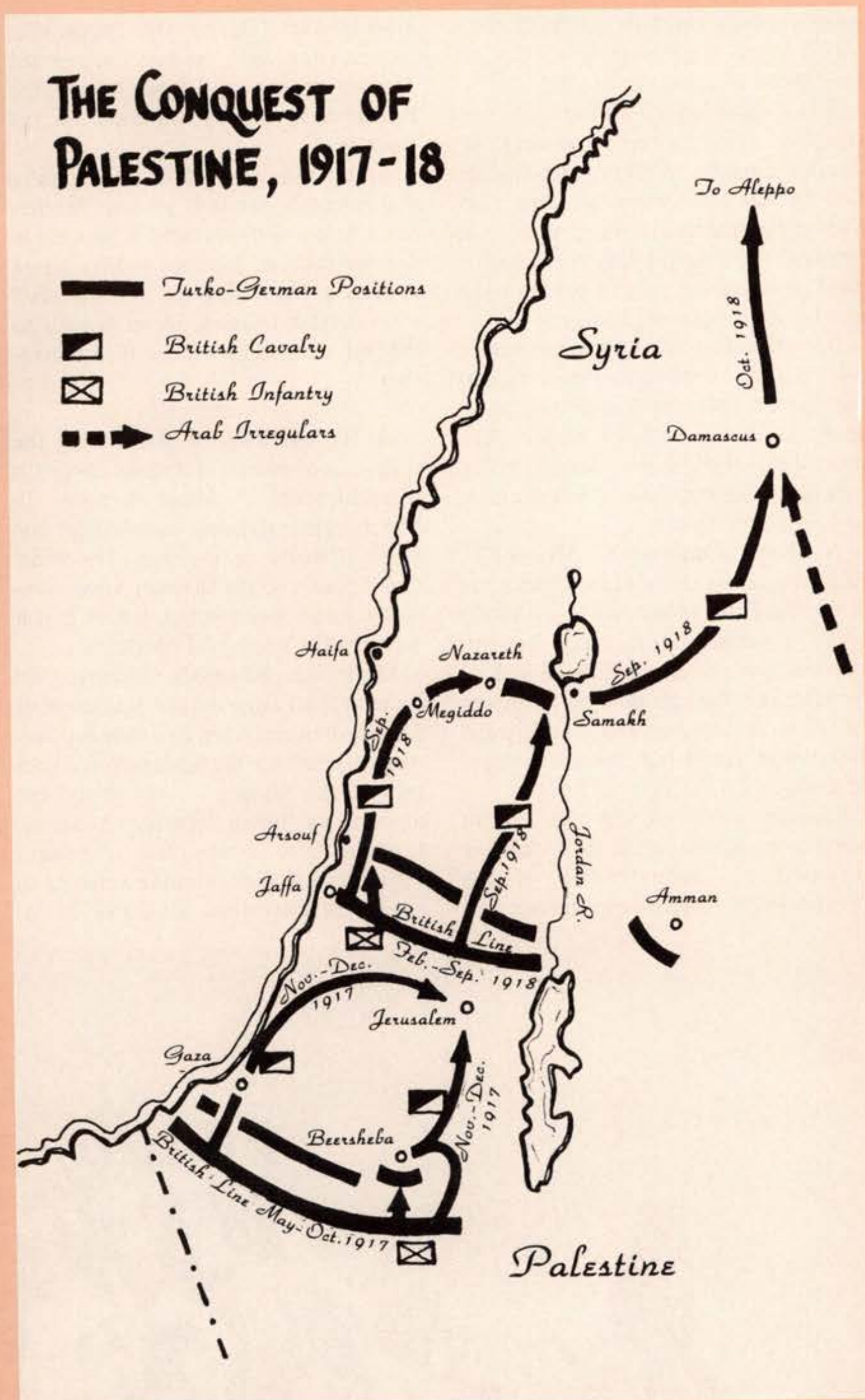
The astonished Turks tried to swing their artillery and machineguns around to bear on them, but it was too late. Seizing the opportunity, the Australians delivered a wild, impromptu cavalry charge that broke on the Turks like a thunderclap. Riding with complete abandon, they swept over two lines of trenches before their unfortunate adversaries could lower their sights to fire on them.

A number of the attackers dismounted to clear the trenches of the enemy infantry while the remainder rode exultantly into Beersheba and captured the town after some spirited street fighting. When the dust had cleared, the plucky Australians had taken 1,000 prisoners and 9 field guns. So quickly had their charge developed that they had suffered only 32 killed and 32 wounded.

The following week, a parallel attack was launched against Gaza. Giving the defenders ample time to react to the penetration at Beersheba, Allenby shifted his attack to the west, this time sending his adversary reeling. The breakthrough at Gaza came after sappers had cleared a corridor through the wire and minefields, and 3 squadrons of the Yeomanry Division rode down on the defenders with characteristic British aplomb.

The day's action has been called, in the words of one writer, a perfect example of the "demoralizing effect of a cavalry charge." Pouring through the gap cleared by the engineers, 172 troopers and 18 officers charged four battalions of Turkish infantry and three artillery batteries. Oblivious of casualties, they routed the Turkish riflemen, engulfed the batteries, and sabered or captured almost 200 of the enemy. At day's end, all 3 squadron commanders were dead, together with nearly 70 of the British troopers and 100 horses, but a Union Jack flew over Gaza and the enemy was in full retreat. The Gaza-Beersheba Line had been breached, and Allenby's army was driving northward.

Jerusalem Falls. The momentum that had built up during the assault carried the British all the way to the Holy City. Writing in his diary, a British soldier had described the battle just fought as a "tiger fighting a sick tomcat," and, in fact, the tiger was on a rampage.



skirts of Jerusalem, but finally retired northward on December 8 and left the city undefended. It was then that the Allied troops caught a breathtaking glimpse of a sight that no conquering army had seen for more than 700 years when the Crusaders had first looked down on the sacred capital from the high ground to the south of the city.

It was a historic moment, but never more so than the next morning, when a Moslem dignitary wearing a frock coat and a fez approached the British lines under a flag of truce. It was the mayor of Jerusalem, coming to offer the keys of the Holy City to the conqueror.

Two days later in a ceremony deliberately devoid of pomp, Allenby formally entered Jerusalem. Coming more as a pilgrim than as a conqueror, the cavalry general, who was Cromwell's descendant, passed through the Jaffa Gate on foot, followed by his multiracial army. The Britons, Australians, Indians, and Negroes of the Egyptian Expeditionary Force mixed freely with the Greeks, Jews, Arabs, and Armenians of the populace; no guns were fired and no bands played, but the bells of Jerusalem tolled to commemorate the event.

Consolidation and Reorganization

When Jerusalem fell and was presented to the government and nation as a Christmas present, the War Cabinet urged Allenby to occupy the rest of Palestine and to continue the advance all the way to Aleppo. But such an advance would have been impossible, for Falkenhayn continued to harass the invaders and even mounted a short-lived counterattack.

The fighting surged up to the end of the year, until a rough line was established north of Jerusalem reaching from Jaffa on the coast to north of the Dead Sea. It was here that the two armies sat out the winter.

Allenby had managed, through intelligence deceit, to draw the Turks out of their positions and confuse them as to his intentions. After delivering his one-two punch, which first staggered and then upended his opponent, he was able to capitalize on his advantage through steady pressure.

Falkenhayn threw the Yilderim force into the battle, but they could not offset the imbalance. Badly led and poorly equipped, the Turks had little resilience and could not meet the demands of a battle of maneuver. The defense line had been broken, and no amount of frantic reorganization could reforge it. From the moment Gaza fell to the Yeomanry Division, the capture of Jerusalem was a foregone conclusion.

The east-west pincers movement caught the Holy City in December. Falkenhayn, having already given up hope of holding the city, had fled to Damascus. By mutual agreement, there was to be no fighting in the city itself, holy to Jews, Christians, and Moslems alike.

The Turks resisted stoutly on the out-

Logistics. If the autumn campaign had crippled the Turkish Army, it had been no walkover for the British either. When compared to the gloomy stalemate in the trenches of France, the Middle-Eastern Theater seems to the modern observer to have been amazingly mobile: One usually pictures a khaki-clad horde moving inexorably northward like a host of ants. In fact, Christmas 1917 found Allenby's army in dire need of a rest and refit.

The Gaza fighting had demonstrated

how costly modern combat could be to horses; it is even more important to note the terrible strain that the long advances inflicted on man and beast. Chief among logistical problems in southern Palestine was the scarcity of water. Peacetime practice in most armies was to water cavalry horses 4 times daily, for they needed a minimum of 10 gallons a day when working under such climatic conditions. Actual practice, however, was much more stern: Horses frequently went 50 to 60 hours without water, sometimes covering 60 miles in the meantime.

Although the British employed several remarkably hardy breeds of horses, the attrition in the ranks of the cavalry divisions was prohibitive. The need for water could influence entire battles, and the supply system was never able to provide enough when wells were scarce. One of the benefits of the 4th Australian Light Horse Brigade's lightning-fast seizure of Beersheba was that they captured the water wells intact. The Turks had prepared charges to destroy them but had not had time to set them off.

No less punishing to the army than lack of water was the nature of the terrain in Palestine. Unsuitable roads proved to be a constant headache to Allenby. Local maps were little help, for most were 40 years out of date.

Roads regarded by the locals as "serviceable" often proved serviceable only to pack animals. Artillery had to be carried by camels, supply convoys often had to be transferred from wagons to donkeys. The Royal Engineers had to work at a feverish pace to harden roads and lay more railroad lines.

But decades of Ottoman neglect proved difficult to overcome, so that by the end of 1917 the British had hopelessly outrun their line of supply. With the coming of the stormy season, Allenby wisely elected to consolidate his gains and refurbish his army.

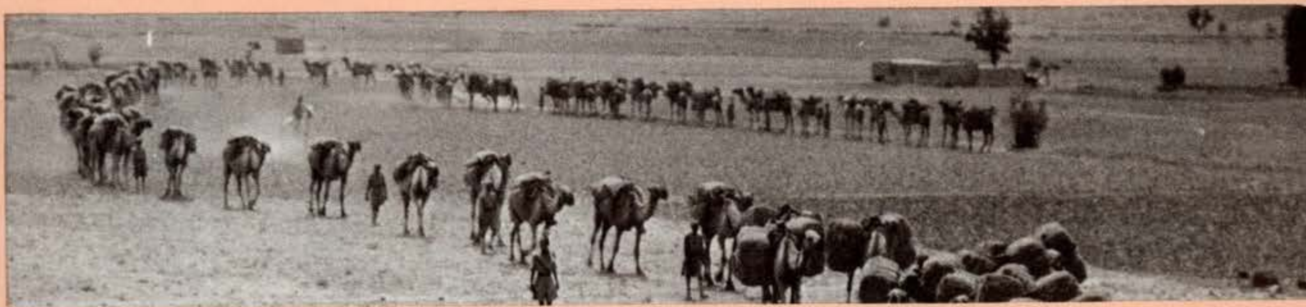
A New Opponent. Meanwhile, Falkenhayn was replaced as commander of the Turko-German Army. In March 1918, General Liman von Sanders assumed control of the theater and all German and Turkish units in Syria and Palestine. As commanders, Sanders and Falkenhayn could not have been more different.

Roughly associated with the Turkish Army as an advisor since 1913, Sanders possessed an understanding of the Turkish soldier that his predecessor had never shown. During the Dardanelles Campaign of 1915, he had commanded Turkish troops and had fought the British to a bloody standstill on the beaches.

Although he did not have Falkenhayn's tactical genius, Sanders nevertheless demonstrated a tenacity in defense that his Turkish soldiers found appealing. Replacing his German staff with Turkish officers, he set himself to the task of holding off the British invasion.

A Reshuffling. It was during the spring that events in France forced a reorganization of Allenby's army. In March 1918, Germany launched her last great offensive of the war. The strain that it placed on the German Army eventually led to its downfall, but at first it was a rather successful operation.

Much to Allenby's dismay, the General Staff removed the equivalent of 2 entire divisions from Palestine and sent them to reinforce the beleaguered armies in France. Altogether, the army lost most of its British infantry battalions, together with 9 complete Yeomanry regiments—60,000 frontline veterans in all! As replacements, a number of In-



dian infantry and cavalry regiments were sent from France to Egypt to be expanded with fresh Indian recruits.

It was felt in London that the Indians would be more generally useful in the Middle East than in France, and surely Allenby was glad to receive such enthusiastic soldiers, but the overall effect was stunning: The heart had been cut out of his army, and operations had to be suspended until the Indian battalions could be expanded and the volunteers could be trained.

Each Indian battalion was broken down into separate companies; each company, in turn, served as a nucleus around which the new battalions were built. Each new battalion was rigorously trained in Allenby's depot in Egypt until it was deemed reliable enough to join the line in Palestine.

It was exhausting work, but the Indian recruits demonstrated aptitude and enthusiasm. Most of the summer was spent trying out the new battalions in powerful raids across the Jordan River towards Amman, or northward against Sanders' defense line.

Thus did the nature of Allenby's desert force completely change. The removal of the British cavalry regiments and infantry battalions had stripped the old army to the bone, and the Indian formations that fleshed out the new one gave it an entirely different look. Volunteers all, the Indian soldiers were nevertheless quite unlike the county militiamen of the Yeomanry Division or the plucky colonials of the ANZAC formations.

It has been noted that most of Britain's colonies and dominions supplied volunteers during wartime, but most of these belonged to fledgling battalions raised during mobilization. The Indian Army, on the other hand, was a professional force of flint-hard veterans, justly regarded as the finest colonial army in the world. Formed during the earliest days of Western trade in India, expanded and hardened through the ages by wars against native rulers and European rivals, the Indian Army by the time of the Great War had been employed in campaigns all over the Empire.

Since 1858 when they came under direct control of the British government, Indian regiments had been sent to fight in Burma, Afghanistan, West Africa, China, the Malay States, Egypt, and South Africa, to say nothing of the perennial border skirmishes with the hostile tribes on India's northwest frontier. The cumulative effect of so much campaigning over the years was that the army was composed from top to bottom of combat veterans.

The British managed over the years to build an army in India that was remarkably efficient despite its heterogenous, multiracial composition. That Hindu, Sikh, and Moslem men could soldier side-by-side under the command of British officers and Indian officers promoted from the ranks can be attributed to the success that the British had in focusing all allegiances on the unit itself.

The Indian soldier belonged to that uniquely un-Western social stratum, the "martial caste," and that is why his loyalty was directed to the regiment, rather than to the Crown or to the Empire. It also helps to explain why the staggering casualties sustained by the Indian regiments in France, East Africa, and Mesopotamia failed to neutralize them.

The Indian cavalry squadrons arrived in Egypt armed with the same weapons they had carried for almost a century. It will be remembered that the ANZACs and Yeomanry were accustomed to operating as mounted infantry, preferring to fight dismounted with the carbine rather than mounted with the saber. Although they carried carbines, the Indian horsemen generally opted for mounted combat with the saber and the lance.

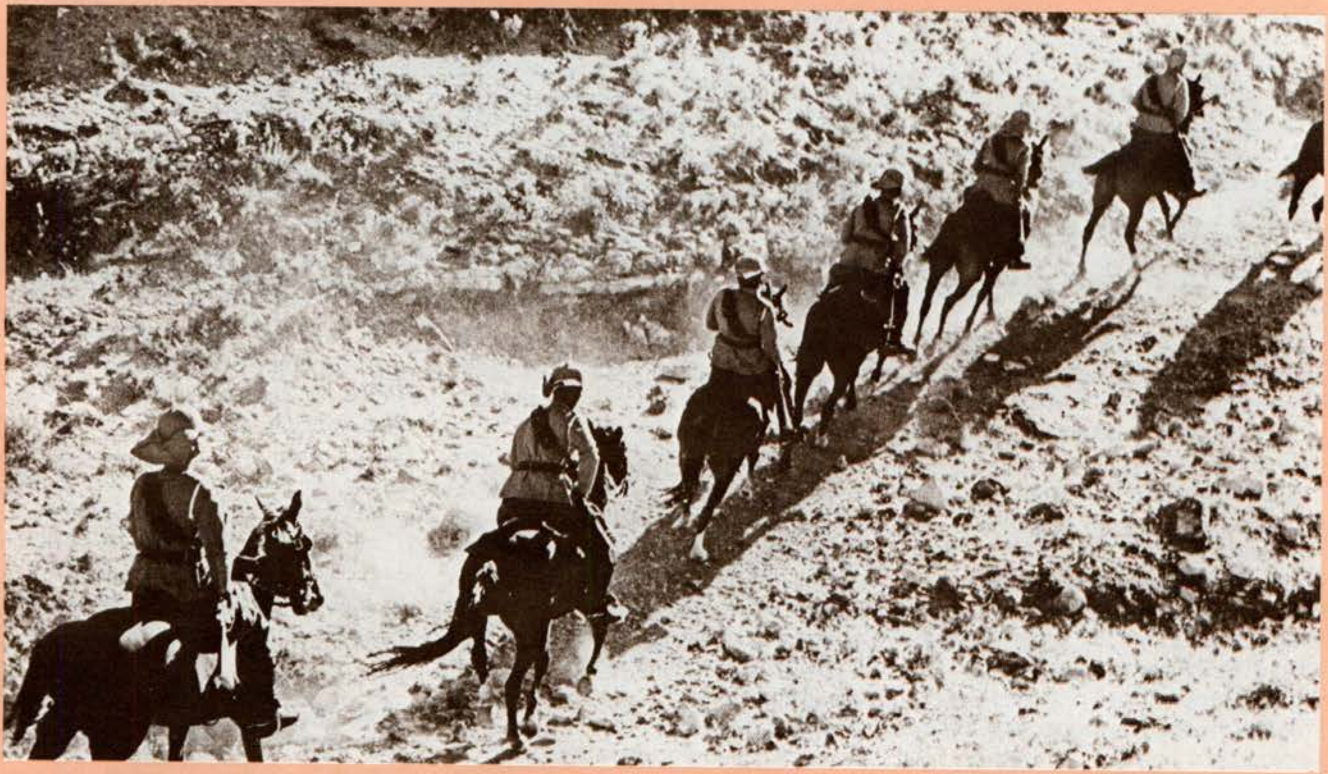
In a way, it was fortuitous that these professional horsemen should have arrived when they did. The Autumn battles of 1917 had been fought mostly at close quarters (dismounted trench fighting at Beersheba, grim slugging matches on the outskirts of Jerusalem, and so forth), which was the kind of fighting the Yeomanry were accustomed to and the ANZACs were tempermentally suited for. The coming battle, however, would call for rapid maneuver. The Battle of Megiddo—the last of the cavalry operations—was about to begin.

Total Victory

The Plan. Allenby had begun the Gaza battles in order to break the deadlock in southern Palestine with the hope of capturing Jerusalem. But the offensive that he launched on September 19, 1918, was aimed at nothing less than the destruction of the Turkish armies in the Middle East. The summer raids had convinced Allenby of the deterioration of his opponent, and he concluded that a single battle could decide the campaign. Even given the advantages he held, the operation that the British commander envisioned was daring in the extreme.

The plan called for steady pressure by the infantry to force the Turks northward, while, at the same time, 2 divisions of cavalry made a sweeping run up the coast to cut the enemy's line of retreat. In essence, Allenby planned to cast a net over northern Palestine to snare more than 100,000 troops in a single stroke. It was a remarkably ambitious plan, and the inherent dangers—the exhausting ride for the cavalry and the threat of a stubborn defense in the hills south of Megiddo—called for extensive planning and flawless execution.

The Stroke. As in his Gaza battle the year before, Allenby made maximum use of deception. Instead of a feint on the coast and a heavy assault inland, this time he struck on the coast at Jaffa after elaborate measures to convince Sanders that his main strength lay to the east. Once again, the enemy was caught completely off guard. Although Allenby



possessed only a two-to-one superiority in numbers, the deception had compelled Sanders to scatter his forces, thus giving the British a local superiority at Jaffa of nearly four-to-one.

After a short artillery barrage, a vicious infantry attack succeeded in opening a breach in the Turkish line. At that point, the cavalry went into action. Like a football halfback running an off-tackle play, 2 divisions shot through the hole and tore hell-bent up the coast. Their breakthrough was made on historic ground. Only a few miles away at Arsouf, King Richard the Lion-Hearted's horsemen had routed a host of Moslem infantry in 1191.

Meanwhile, to the south, the Turkish line was already beginning to break under the relentless pressure of Allenby's infantry attacks, and retreating units began to stream northward along several avenues of escape.

The riskiest part of the cavalry's ride was through the forbidding hills that extend southeastward from Haifa, effectively dividing northern Palestine into two separate plains. A well-placed battalion of infantry could have held the rocky passes for days, but so rapid was the cavalry's progress that the passage was made unopposed.

Emerging from the hills just south of Megiddo, an Indian squadron—riding point for the two divisions—met a marching column of Turkish infantry. The infantry obviously intended to fortify the hills, but caught in the open as they were, they were helpless. A quick charge by the cavalry broke their formation, and in the ensuing melee, they were slaughtered. With lightning speed, the mounted column swept on through Megiddo to Nazareth, Christ's home and Sanders' headquarters.

It was scarcely 24 hours since the opening of the battle, and already the German commander was forced to run to avoid capture, narrowly escaping northward to try to organize a hasty defense. By the end of the second day of the offensive, September 20, both cavalry divisions had gained their major objectives, and all northward avenues of retreat were closed to the Turkish Army. The net had been cast.

To the south, the pressure of the British infantry's advance had turned the retreat into a rout, and the Turkish Army into a mob. Disorganized bands were fleeing across the Jordan River (the only part of Allenby's net that had not closed) and streaming towards Damascus. Sanders made one last effort to hold a line between Nazareth and Samakh to allow as much of his pulverized army as possible to escape to the north. The right wing of the position never formed—the Turks disappeared from the line as quickly as they were put into it—and the town of Samakh itself, fortified with German machinegunners, fell quickly to the advancing cavalry.

As at Beersheba, it was the 4th Australian Light Horse Brigade, riding to contact, who made a moonlight charge over unfamiliar ground to storm the defenses. The German machinegunners took a heavy toll of horses and riders, but the Aussies reached the buildings, dismounted, and captured the town after some savage street fighting.

By September 21, the advancing infantry had completed the victory. The Battle of Megiddo has been called one of the most absolute victories in history: In 3 days, the British had demolished three field armies and taken over 50,000 prisoners. Palestine had been entirely cleared and Syria lay naked to invasion. The Turkish Army had been dealt a blow from which it could never recover, and Allenby professed himself "almost aghast" at the extent of his success.

Denouement

The remainder of the campaign was almost anticlimatic. Led by the ever-advancing cavalry, Allenby's units swept up the Golan Heights in a mad dash northward, taking more than 25,000 prisoners as they went. Joining them in the run for Damascus was a maverick army of Bedouin Arabs under the flamboyant and enigmatic leadership of Lieutenant Colonel T.E. Lawrence.

For the past 2 years, since the outbreak of the Arab Revolt, Lawrence had been marauding east of the Jordan River with small irregular bands—blowing bridges, ambushing trains, and reporting Turkish activity to Allenby's headquarters. As Turkish control over the region became weaker, Lawrence's partisans grew bolder and more powerful. They had taken a terrible toll among Turkish stragglers after Megiddo, slashing at columns of refugees as they fled across the Jordan River to escape Allenby's advancing infantry. Now they raced headlong for Damascus, exacting terrible vengeance upon their former overlords for centuries of maltreatment.

Allenby and Lawrence reached Damascus simultaneously on October 1, investing the city without opposition. Nor were Allenby's troopers opposed as they continued the advance without infantry another 200 miles northward. At last, on October 31, the Ottoman Turks asked for an armistice. Their empire was lost, their Army was demolished, and Allenby's divisions stood in northern Syria in the ancient city of Aleppo, the very doorstep of Turkey.

The conquest of Palestine and Syria had taken General Allenby and his Empire Army exactly 1 year to achieve. From first to last, it had been regarded as a sideshow by the authorities in London—a victory that would boost national morale but have little bearing on the outcome of the war. Yet the importance of the morale factor cannot be dismissed; for the last year of the war, the Middle-Eastern Theater provided the only bright spot in an overall gloomy picture.

The victory was also politically significant, for the replacement of Turkish rulers with British, Arab, and French ones led to events of which the effects are still being felt today.

The post-war administration of the Middle East was resolved by the Sykes-Picot Agreement of 1918. The map was redrawn, and the British were given the newly-defined provinces of Palestine, Trans-Jordan, and Iraq, while the French were allowed to administer Syria and Lebanon. The rest of the Ottoman holdings on the Arabian peninsula were granted to Prince Faisal, under whose sponsorship Lieutenant Colonel Lawrence had led the Arab Revolt, and made into the Kingdom of Saudi Arabia.

In 1920, the League of Nations upheld the terms of the Sykes-Picot Agreement, granting the provinces in question to Britain and France as legal mandates, but the arrangement was hardly agreeable to Allenby, who resented French influence, or to Faisal and Lawrence, who resented non-Arab influence of any kind.

It was historically that the campaign enjoyed its greatest measure of significance. The cradle of civilization, conquered in turn by Israelites, Assyrians, Greeks, Romans, Arabs, Crusaders, and Turks, had been conquered once again. The horseman had spent his last hour on the military stage, but it had been a successful performance.

It is quite significant that Allenby's cavalry rode for the last time at Aleppo. Four thousand years before, Hittite horsemen had built the city; 2,000 years before, Alexander the Great's cavalry, the first in Europe, had routed the Persians just a few miles away. History had turned full circle: Cavalry's cradle had become cavalry's grave.

Observations on the Palestine Campaign

A few general lessons suggest themselves to the particular benefit of any army that may one day find itself campaigning in the Middle East. The North African Campaign of 1940-1943 has sometimes been described as "a tactician's dream and a supply sergeant't nightmare;" the caveat translates well to Allenby's campaign and would probably apply equally well to a future war.

Even though the growth of Israel has done much to transform Allenby's battlegrounds from arid plains to productive communities, much of the region remains backward. Poor roads and scarce water supplies could play havoc with the operations of a modern army by impeding advance, hindering resupply, and tearing vehicles apart. Encumbered by so many tactical millstones, a modern commander may be forced, as was Allenby, into periodic halts to consolidate, rest, and refit.

But if the logistical problems of North Africa apply to the Middle East, so do the tactical possibilities. Allenby succeeded at Megiddo where his colleagues were failing in France because he introduced *shock* and *maneuver* into a war dominated by firepower. Because they moved quickly and with absolute authority, Allenby's cavalry struck a decisive blow at Megiddo despite advancing unsupported, with exposed flanks. Rommel, commanding the 7th Panzer Division in 1940, applied the lesson to armor and achieved a similar breakthrough that decided the Battle of France. Given the proper situation and a well-equipped armored force to exploit it, a modern commander on such a battlefield could well duplicate Allenby's success. Indeed, when modern armor adds its advantage of considerable *firepower* to *shock* and *maneuver*, the possibilities for successful tactical operations are endless.

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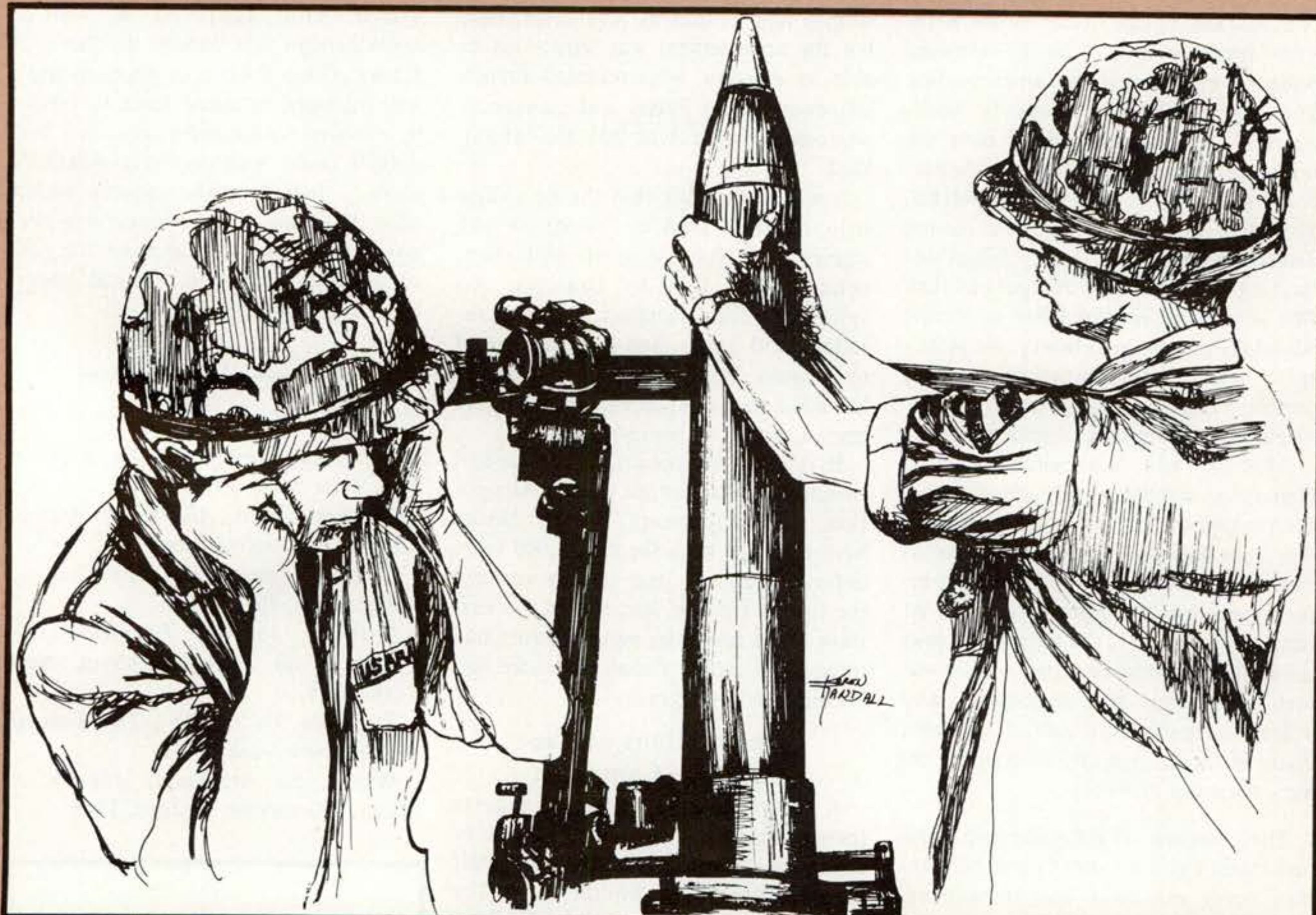

Cavalry Mortars in the Desert

By Captain John J. Midgley, Jr.

Finding and killing the enemy in a desert environment will pose a host of problems for U.S. cavalrymen. Virtually every aspect of armored cavalry troop operations—from gunnery to resupply—will require some rethinking. Current doctrinal manuals, particularly FM 17-95 and FM 90-3, take some important first steps in outlining many of the difficulties, but the drills and procedures a troop will need to fight effectively are left for commanders and staffs to develop. One of the most important and least discussed aspects of desert cavalry operations is fire support by troop mortars.

Three key considerations will face the troop commander employing his three 107-mm mortars in the desert; organization for combat, communications and fire control, and training problems.

Organization for Combat. Organization of the mortar section is briefly discussed in FM 17-95. About all the commanders will find is that the three troop mortars should be consolidated "whenever possible" under the executive officer's control. The Desert Operations manual is equally vague and never specifically addresses cavalry mortars at all.

Most cavalry troops have organized a three-gun "section' and habitually train that way; the tactical advantages of the mortar section can be enjoyed in the desert as well as conventional environments. Three considerations might favor employment of the troop mortars in battery; the first and most important is massed firepower. Remembering that dispersion is vital to survival in the desert, the troop commander may choose to consolidate mortars to gain the advantage of extended coverage. The mortar section firing a single volley can cover a 150-meter frontage, and the section can fire an open sheaf or use range and lateral spread patterns to provide suppressive fires over a broader area. Smoke screens can be formed more quickly and maintained longer with three guns than with one and coordinated HE/illumination missions are easier to fire.

Unfortunately, the advantage of massed firepower—which is most frequently used to justify use of the mortar section—is countervailed by some considerations the desert cavalryman needs to keep in mind. The normal dispersion of vehicle and personnel targets will probably prevent the troop commander from using his mortars for destruction or neutralization of targets of opportunity. This type of fire will likely remain within the province of field artillery, close air support, and direct fire weapons systems. If this is true, the mortar's most probable role in desert operations will be suppressive fire and screening—neither of which requires a three-gun section to perform the mission. The problems of indirect suppressive fire and hasty screening in the desert will be discussed later; it should suffice to conclude here that massed firepower alone is probably not a good reason to consolidate the troop mortars.

Greater Responsiveness. A second potential advantage to consolidation is the greater responsiveness of the section to the troop commander. This increased responsiveness is certainly a fact: The mortar section will probably operate on the troop command frequency and fire only when authorized by the commander or his FIST chief; but it may not be an advantage in the desert. This apparent paradox springs from two interrelated considerations. First, the normal dispersion of units operating in the desert (particularly so for screening and reconnoitering units, or any element in an economy-of-force role) makes it likely that contact will be made by a platoon—not the entire troop—and the commander has only one chance in three of being with the platoon making contact. If the commander has reserved control of mortar fires for himself, he may find himself simply approving calls for fire from a platoon leader while he moves to the area where contact was made. In this event, the commander is not controlling at all; he is obstructing a process that would have been much quicker if the platoon leader had control of his own mortar.

The second consideration is related to the problem of dispersion. When performing reconnaissance or security missions, the cavalry troop will probably be in an area that has not been included in artillery directional control surveys. Coupled with the inherent inaccuracies of desert area maps and the difficulties of navigation, the lack of survey control points means the mortar section will be hard-pressed to locate itself with the accuracy needed for speedy adjustment. Since the section will probably not be within visual distance of at least two platoons, the section leader must rely on calls for fire from scouts who are even more hard-pressed to estimate target grid locations. The resulting combination of errors is always frustrating and could be costly.

So, although consolidation may provide the troop commander with more responsive mortar fire, the need for tight control at troop level, and the accuracy of fire provided should weigh heavily in the commander's mind when he organizes for combat.

Consolidated Mortar Sections. Consolidated mortar sections are attractive in any environment because FDC training, which most cavalry officers and senior NCOs are ill-equipped to supervise and evaluate, is less troublesome. If only one squad leader is proficient at fire direction, he can handle the FDC chores for all three guns and the section will be able to fire. Indeed, a cavalry unit deployed with short notice could find this advantage of consolidation compelling. It would be unfortunate, though, if troop commanders were forced to consolidate mortars because of a training shortfall. Each squad leader must be proficient in FDC procedures before deployment to give the section more survivability and greater flexibility.

These "advantages" of the consolidated mortar section, then, have major reservations when the troop is required to operate in the desert. A few other considerations should be remembered by the troop commander as he organizes for desert combat.

Some Drawbacks. Mortar-locating radar will pose a real threat to cavalry troops as well as to battalion mortar platoons. The troop mortar section will be a lucrative target, since it consolidates all troop fire support and will certainly move less frequently than a single mortar travelling with a platoon. Finding adequate masking terrain to cover some of the ascending portion of the section's fire can be difficult, which will make the radar's task far easier. Intelligence officers may fret about the possibility of the three-gun section providing an order-of-battle indicator that will allow radar units or target acquisition batteries to distinguish cavalry troops from main battle area battalions with their four-gun platoons.

A second drawback of the mortar section could be labeled "overkill." We must remember that an advantage is derived from the section only when all three guns are firing at the same target. The troop commander must ask himself how often this large volume of fire will be required. First, he must decide what he expects his mortars to do—supress, neutralize, or destroy targets in his area. Then, assuming that the mission he selects and the number of targets that he expects to find can be managea by mortars to some degree, he must compare the alternatives of the consolidated section firing, for example, one volley of three rounds and a separate squad firing three rounds. It should be increasingly clear that the relative merits of the section do not always outweigh those of three separate squads.

Communication is a significant problem for cavalry commanders, and the problem will be amplified by range and environmental factors in the desert. Some suggestions for minimizing the impact of mortar fire-direction traffic on troop communications will be offered later; the specific disadvantages of the mortar section on communications should be examined here. If the mortars operate on the troop command frequency, one call for fire can tie up the command net very thoroughly. What happens if two platoons need fire support simultaneouslv? Trv nlaying this situation on a CPX and listen to the resulting confusion. Even if the net was able to accommodate concurrent calls for fire, the section can only fire one mission at a time. Hopefully, direct support artillery can provide some assistance, but the commander who expects to support two or three platoons with section fires must consider how he plans to provide this support in the first few minutes after contact, when information and orders must move quickly and clearly over the same frequency needed for fire direction.

Probably the most serious drawback to the mortar section in the desert is the limitation of an effective range. In zone reconnaissance or screening operations, platoon frontages of up to 3,000 meters can be expected. If the mortars consolidate, the best they can do is follow the center platoon, and the commander has a situation in which his unit *frontage* is more than one and one-half times the range of his indirect fire support. Targets more than 3 kilometers forward of the two flanking platoons may well be out of range of the mortars; yet, it is at this range that mortar suppressive fires and smoke would be most useful.

When to Consolidate. While a consolidated section may have appeal in conventional environments, it should be apparent that serious drawbacks face the troop commander who operates this way in the desert. From the preceding discussion, we can outline some circumstances when consolidation might be considered:

• *Troop deliberate attacks or night operations.* In these situations, the troop will probably be in a fairly narrow sector, have good intelligence on the enemy dispositions, and require close control of indirect fire.

• *Rear area security operations.* If the troop is in the rear of a larger unit, directional control will probably be good and tight control of indirect fire is a must.

• *Priority of mortar fire is given to one platoon.* In this case, the section can mass fire in support of a fairly small sector. If the commander does this, he probably needs to take a hard look at what his other platoons are doing.

Other circumstances could certainly be imagined; if the commander recognizes the very real limitations of the section, he will be able to compare this alternative with the use of separate squads with each platoon—a method that has distinct advantages in the desert.

Separate Squads. Employing the troop mortars as separate squads bears close scrutiny when the troop operates in the desert. The advantages of this method are all derived from the dispersion and lack of survey common to desert cavalry operations.

One major advantage of separate squads is the immediate responsiveness of the mortar squad to the platoon leader, who really needs the kind of support a mortar can provide. A cavalry platoon leader has no organic weapon he can use to effectively suppress an artillery OP or moving formation 4,000 meters in front of his platoon. A mortar attached to the platoon provides this capability: The platoon leader can place HE or smoke on targets still too distant to engage his platoon.

The astute advocate of the consolidated mortar section will probably observe that this advantage is really only an argument for mortars, not for separate mortar squads. This observation would be correct if timely, accurate mortar fire could be provided by the section, but the preceding discussion has shown this to be difficult in the desert. Separate squads can provide such support—a second advantage to this approach.

By following the platoon closely (900 meters or less) and maintaining observation of the platoon sector, a mortar squad using the direct lay method of fire virtually eliminates the need for grid coordinates in the call for fire. Suppressive fire can be on the way in less than one-half minute if the squad leader is trained to react to observed enemy fire by laying on the source and firing until ordered by the platoon leader to cease fire. This simple drill (which uses the most basic mortar firing technique) provides fast, accurate indirect fire when the platoon leader needs it, without reference to a map or surveyed firing chart. The accuracy of the first round can be improved if any tank commander in the platoon transmits a range to the target when the engagement begins.

The advantage of direct lay allows the platoon leader to capitalize on the speed and accuracy of a well-trained gun crew without cumbersome technical fire direction procedures and completely circumvents the problem of desert navigation. Locating the squad with a platoon provides the additional benefit of extended coverage—a potentially decisive advantage.

The difficulty of covering an entire troop with a consolidated mortar section has been discussed. It should be clear that a platoon mortar squad can cover even a 3-kilometer-wide sector with relative ease. The custom of placing the mortar squad 900 meters to the rear of the platoon can be abandoned in the desert; the best place for the squad is probably with the platoon leader, who will usually locate where he can observe the platoon and the terrain to the front. This will permit the squad leader to employ the line-of-sight direct lay technique without moving the carrier.

A final advantage of the separate squad should be discussed. Commununications are greatly simplified. The direct lay drill can be executed by a well-trained platoon without any radio transmission at all. At worst, an abbreviated call for fire can be sent over the platoon net, and the troop command frequency will be left uncluttered.

Some Problems. Despite the significant benefits of employing troop mortars as separate squads, some objections are raised. The most common objections center around "fragmenting" the fire of the troop mortars and difficulties inherent in training proficient squads.

While it is true that separating the squad makes massing the fires of all three mortars difficult, the effect on troop operations is minimal. First, simply increasing the squad's rate of fire will allow a great quantity of ammunition to be placed on a target by a single squad in a short time. Second, if the troop commander's objective is neutralization or destruction, he would probably do better to use artillery, tactical airpower, or direct fire and maneuver (as was discussed above). Finally, if the commander has no choice but to mass the fire of his mortars, he may be able to do it even with squads separated if he can provide an accurate target location (which is a prerequisite for the section to fire at all).

Training problems usually center around the difficulty of keeping squad leaders proficient in technical fire direction. If direct lay is emphasized, every member of the gun crew will be able to master the squad leader's duties in a short time. In fact, direct lay is required of all mortar crewmen on the Mortar Gunner's Examination, which is part of the Performance Certification Component of the 11C Skill Qualification Test. Certainly, the squad must maintain proficiency in all methods of fire direction, but the amount of training required for minimal proficiency is not very great.

When to Separate. A few rules of thumb, based on the above discussion, can be offered outlining considerations for employing separate mortar squads with each platoon. These missions might include:

•*Reconnaissance.* In the desert, reconnaissance missions are likely to occur along road nets, passes, and other key terrain features; open terrain will allow commanders to assign broad sectors. Separate mortar squads can provide more complete coverage in this case.

•*Delay or active defense.* Unless the mortar section fires are part of the squadron commander's planned fire support in a killing zone, commanders will probably want to allow platoon leaders the added flexibility of an organic mortar. Restrictions on smoke ammunition would require close coordination.

• *Screening or economy-of-force missions.* In these missions, the force commander does not usually expect decisive engagement; separate squads will allow the platoon leader to develop each situation early and maintain the flexibility vital to success in economy-of-force roles.

Section Communications. As with the section guidelines, many other considerations will enter into the commander's decision. If section organization is adopted, the commander must decide how to communicate with the section. The key problem is keeping the troop command net open during initial contact to allow orders and information to be passed quickly. A dedicated mortar fire direction net will probably not be available; even if it was, this net would make communication more difficult and would require a dual-net capability on the mortar carriers. The section must operate on the command frequency; the problem is—how?

One way to accomplish fire direction on the command frequency is to establish a standing operation procedure for the mortars to fire at any initial contact reported by a platoon without waiting for a call for fire. If the section calculates firing data as soon as the spot report is transmitted, the commander and FIST can make quick eye-to-eye coordination and allow the mission to be fired (by acknowledging the spot report "ROGER—MORTARS FIRE—OUT") or order the mission stopped and use direct-support artillery or other assets. Formal calls for fire have no place on the command net and are unnecessary since the spot report contains the target location and description. This approach eliminates needless traffic and streamlines requests for the section's fire.

Use Them! As separate squads or as a consolidated section, the mortars represent a significant aspect of the armored cavalry troop commander's combat power. The mortars are useful only when they are firing, and in the desert they will fire often. If the special nature of the terrain and the enemy situation are used as the basis for organizing the mortars for combat, the troop commander will improve the effectiveness of these deadly weapons.

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Developing Tommorrow's Combat Vehicles—Part II

by Captain John M. Keenan

The Armored Combat Vehicle Technology (ACVT) Program, designed to use the results of testing with experimental test beds to determine requirements for new weapon systems, has moved to Fort Knox. Extensive testing of the HIMAG (High Mobility Agility Vehicle) and the HSTV-L (High Survivability Test Vehicle—Lightweight) (table 1) test beds is now being conducted by the Armor and Engineer Board (Armor Board), U.S. Army Armor Center. The Armor Center now has the opportunity to evaluate highly mobile lightweight armored vehicles, medium-caliber automatic antiarmor cannons (MC-AAAC), and two distinct implementations of variable sophisticated fire control systems.

The results from these tests are required by the Army and Marine Corps to assess the effectiveness and burdens (cost, maintenance, etc.) of light and medium weight combat vehicles, which incorporate improved armored vehicle technologies. To buy technology based only on paper studies or to reject technology based solely

Table 1. ACVT Test Beds

	HIMAG	HSTV-L
TEST WEIGHT	45 Tons	20.5 Tons
PRIME CONTRACTOR	Teledyne Continental Motors (TCM)	AAI
FIRE CONTROL	Delco	Texas Instruments (TI)
WEAPON	ARES 75-mm MC-AAAC	ARES 75-mm MC-AAAC
ENGINE	TCM 1360 (1,500 hp)	AVCO LYCOMING 650 (650 hp)
SUSPENSION	TCM Hydro-pneumatic	TCM Hydro-pneumatic
TRANSMISSION	Allison X-1100	Allison X-300-4A

on intuition is not acceptable.

The initial series of engineering characterization tests of the test beds was conducted at Aberdeen Proving Ground, Maryland, from February 1980 to September 1980. Both HIMAG and HSTV-L completed safety release tests and were certified for troop use. The ARES 75-mm MC-AAAC mounted on both test beds was proven to be a viable contemporary direct-fire weapon. The achieved rates of fire, in burst, were 1 second between rounds for HIMAG and 1.3 seconds for HSTV-L. Firing dispersions were gathered for HIMAG and HSTV-L. The Aberdeen test results are now being analyzed.

On-vehicle instrumentation data was used to evaluate the dynamics of vehicle reaction to firing impulse as it related to chassis, sights, guns, and automatic feeders. Range data was collected to include projectile velocity at the muzzle and target, round impacts and down range meteorological conditions. The data from these tests is now being incorporated into the analytic models used by U.S. Army Development and Readiness Command (DARCOM) laboratories to evaluate conceptual vehicles of the future. Preliminary analysis of round impacts indicates that both test beds performed as well as ammunition dispersion will allow. Firing tests on the HSTV-L have reduced early misgivings about the feasibility of a lightweight chassis as a firing platform for a high velocity automatic cannon.

Table 2. FCS Comparisons

HIMAG FCS by DELCO	HSTV-L FCS by TI
• HIMAG: Yoke Controls/Periscopes.	• HSTV-L: Isometric Thumb Controls TV sights (gun director).
• FCS Config. 2—An M-60A3 Approximation (disturbed reticle).	
• FCS Config. 3—Gun director with manual tracking and linear lead. (Contemporary, similar to XM-1.)	• Manual—Contemporary.
• FCS Config. 4 (Rate-aided)—Config. 3 plus tracking assistance, isometric controls, and TV sights.	• Rate-aided—Same as HIMAG Config. 3 (FCS takes into account sensor inputs of moving firer, i.e., speed and motion).
• FCS Config. 5 (Auto-Track)—All tracking functions automated by auto track which locks on visible or thermal signature of target.	• Auto-Track—Same as HIMAG Config. 5.
• FCS Config. 6 (Closed Loop)—Config. 5 plus the capability to track projectile and automatically adjust subsequent rounds (demonstration only).	

The Armor Board's test will provide data on the advanced fire control system (FCS) options incorporated in these vehicles (table 2) and evaluate their contribution in moving firer versus stationary target situations and stationary firer versus evasively moving target situations. The underlying purpose of these test events is to evaluate quantitatively successive levels of fire control sophistication and their performance in a full spectrum of conditions.

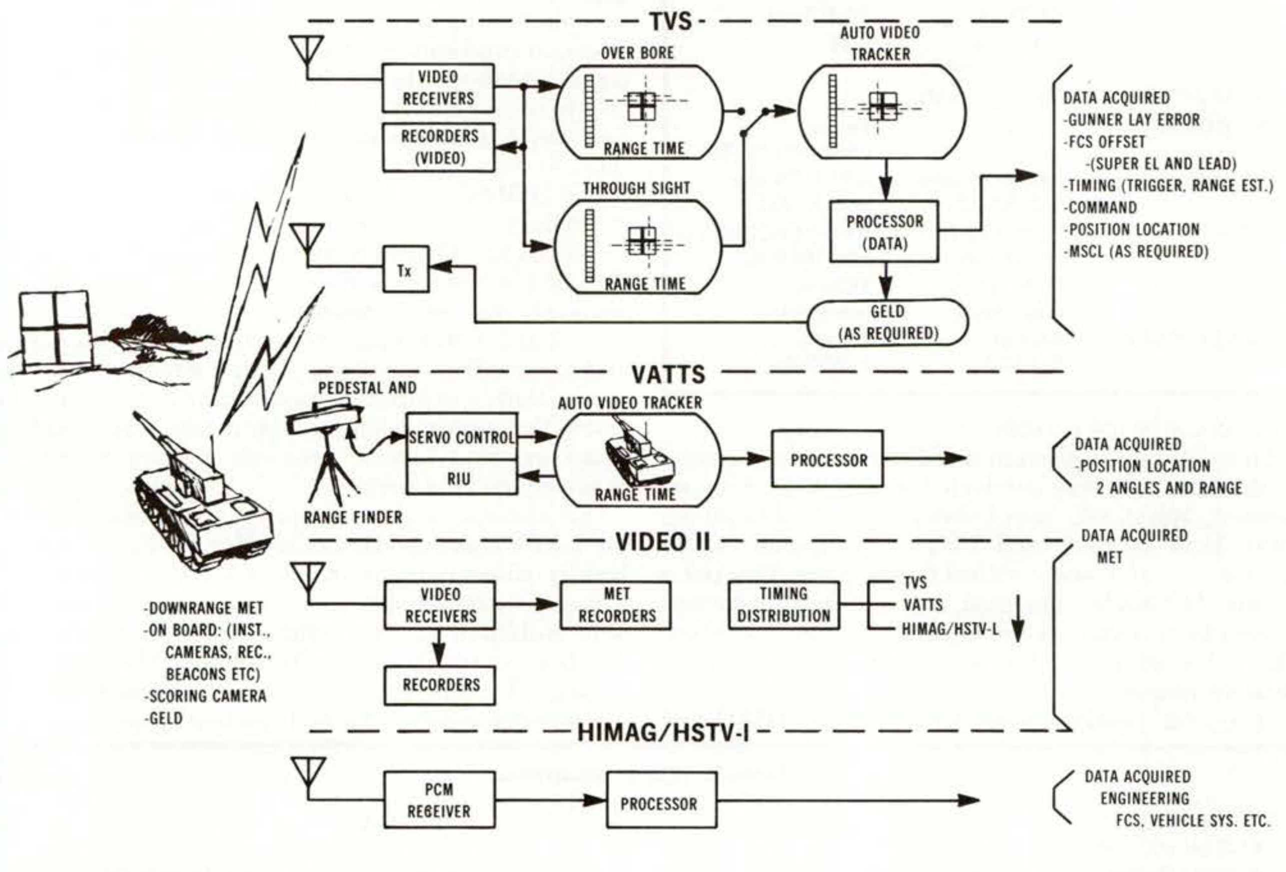
The HIMAG and HSTV-L systems use gun director technology, i.e., sight and gun are independently stabilized and the gun is slaved to the sight in two axes. (The *M-1* is a one axis system.) A major cost growth in armored vehicles is related to sophistication of fire control and turret complexity driven by moving target and moving firer situations. It has not been empirically proven that contemporary training and fire control have given the armor soldier a significant advantage in situations that involve evasively moving targets or evasively moving firer.

One of the technology options that will be tested with the HSTV-L exclusively is the "Hunter/Killer" option. Hunter/Killer, as implemented by Texas Instruments, is a target designation system using a 360 degree rotatable, stabilized thermal sight (Hunter) linked through the fire control computer to another thermal sight (Killer). The benefit of Hunter/Killer permits the tank commander to search for and "lock-on" a second target while the gunner is engaging the first. The Target Servicing Rate Subtest (TSRST) will develop the time lines concerning achievable rate of fire and differences between Hunter/Killer and "Killer only" implementations. The *M-60A3* will be tested under the same conditions as a contemporary base case.

The test conditions will be a modified Table VIII exercise. Modifications to the current crew qualification course will reflect a firer's evasive high speed movement, burst fire, and evasive targets in a target rich environment. Both Marine Corps and Army crews are participating in this test.

The test program at Fort Knox required several distinct range facilities and instrumentation requirements. The first requirement was a dedicated test range. The Wilcox Aerial Gunnery Range on the north-east corner of the reservation was selected and developed as a

Table 3. Wilcox Instrumentation (Present)



tank test range. Wilcox Range offered several distinct advantages as a test range. The most important advantages were the overlooking hills for instrumentation systems and the valley floor, which permitted a large maneuver area for moving targets and firing vehicles.

Instrumentation was also a major requirement for the evaluation of the test beds. Wilcox Range has become a focal point for the Armor Board's instrumentation effort. HIMAG and HSTV-L were both instrumented by their builders under contract to the Tank-Automotive Command (TACOM). Armor Board data acquisition systems are being used to collect data on test conditions (such as weather), round impact locations, position location of moving firer and moving target, and pointing data from over-bore video and through-sight video (see table 3). All instrumentation data is merged and formatted for delivery to the DARCOM analytic agencies supporting the test for incorporation into the Armor Board's data base. This task is being performed by the BDM Corporation under contract to the Armor Board.

The Armored Combat Vehicle Technology Program has added a large measure of sophistication to the Armor Center's ability to evaluate armor technology in the hands of the soldier. The addition of Wilcox Test Range and its associated instrumentation offers unique capabilities for testing vehicles, weapons, and other military hardware.

The products of the HIMAG and HSTV-L tests will enable the Army and Marine Corps to make a quantitative assessment of the value of highly mobile vehicles, complex fire controls, and medium caliber automatic cannons. The Armor Board's tests have put sophisticated hardware in the hands of the soldier and Marine crews so decision makers may choose the technology best suited for given missions, based on test data rather than "user wish lists" or "industry promises."

Additional reports on the ACVT Program will periodically appear in ARMOR. Ed.

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FORGING THE THUNDERBOLT

Armor Officer Advanced Course

Program of Instruction

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Threat Ground Forces—Offensive Doctrine	3
Threat Ground Forces—Defensive Doctrine	3
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Task Force Defense Examination Retest	6
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**TEWT (Tactical Exercise Without Troops)*
***COMBAT (Company Oriented Maneuver and Battle Action Training)*
****CBS (Computer Battle Simulation)*
*****SARK (Seville Automatic Remote Keying)*

Armor Correspondence Courses

So you think you have training problems! Not enough qualified tankers or troopers to do the job, inexperienced personnel filling in where needed. Never enough time to adequately train.

Training is the cornerstone around which any successful organization survives. Without training, there is no coherent organization, no logical technique designed to give an edge over competition.

Within Armor Branch, the Resident Program meets the challenge of training personnel to defeat the enemy. However, skills acquired through resident training may become dulled by time; or personnel may be programmed to attend resident training in the future, but need certain skills now. This is where the Armor Correspondence Course Program (ACCP) fills the gap. ACCP is designed for officer and enlisted alike, and is tailored to meet the challenges of the 1980's.

The Armor Correspondence Course Program (ACCP) offers 223 individual subcourses and 14 complete courses.

Officer Courses

Armor Officer Basic Courses (AOB). AOB is currently offered in two specialty areas, 12B (Armor) and 12C (Armored Cavalry). They are designed to prepare officers to perform at tank company or armored cavalry troop level. Both courses consist of five phases. The 12B course consists of 62 subcourses totaling 268 credit hours of instruction. The 12C course consists of 61 subcourses totaling 256 hours of instruction.

Armor Officer Advanced Course (AOAC). The AOAC program of instruction prepares company grade officers for command at tank company level or for staff duties at battalion level in both divisional and nondivisional units. The course is offered in six phases, comprising 88 subcourses totaling 399 credit hours. It is designed to be completed in 3 years.

Junior Officer Maintenance Course (JOMC). Presently, the U.S. Army Armor Center has the only schooling to prepare a junior officer of any branch for motor officer duty at organizational level. The JOMC consists of 16 subcourses totaling 153 credit hours.

Armor Field Grade Officer Refresher Course (AFGOR). This course provides Armor field grade officers, and officers of other branches who have completed the Command & General Staff College course, refresher training in armor organization, doctrine, techniques, procedures, and equipment. The course consists of 18 subcourses totaling 120 credit hours.

Special Combat Arms Training Course (SCAT). There is great similarity in advance course training between Armor, Infantry, Air Defense, and Field Artillery. Therefore, the proponent agencies for these advanced courses have devised SCAT courses. These are specifically aimed at cross-training graduates of the Armor, Infantry, Air Defense, and Field Artillery Advanced Courses so that they can qualify in another combat arm without having to enroll for the entire branch career course. The Armor SCAT program consists of 17 lessons totaling 111 credit hours. An Armor Officer Advanced Course diploma is awarded for successful completion of Armor SCAT. Enrollment is limited to graduates of the Infantry, Air Defense, and Field Artillery Advanced Courses.

Armor Cadet Familiarization Course. This course is designed for military cadets who anticipate an Armor assignment or want background information. It teaches the basics of Armor and consists of 12 subcourses totaling 94 credit hours.

Noncommissioned Officer Courses

Noncommissioned Officer Basic Course (NCOB). The NCOB program trains enlisted personnel to perform the duties of noncommissioned officers in the grade of E-6 within CMF 19. It also enables an NCO to increase his job knowledge, improve his MOS proficiency and study for the SQT in CMF 19. The course consists of two phases. Phase I deals with the common skills necessary for all NCO's in CMF 19. In Phase II, those in MOS 19D, 19E, 19G, and 19J receive hardware instruction in their specific MOS field. The amount of subcourses and length of courses are dependent upon the MOS, as depicted in the chart below.

MOS	Phases	Subcourses	Credit Hours
19D	I, IIa	42	175
19E	I, IIb	43	212
19G	I, IIc	46	206
19J	I, IId	47	210

MOS Proficiency Courses. The following MOS proficiency courses were developed to provide enlisted personnel in grades E-1 through E-5, correspondence material designed to increase job knowledge, improve their MOS proficiency, and prepare for their SQT. Personnel in grades E-6, E-7, and E-8, do not have an MOS proficiency course designed specifically for their level. They are expected to remain proficient by attending the NCOB and NCOA courses. If these NCOs feel weak in a subject area or just want to review an area, they should selectively enroll for the subcourse by subject content. The MOS Proficiency Course 19Z50 enables the senior Armor noncommissioned officer to study and gain proficiency in the 19Z50 MOS. It consists of 28 subcourses totaling 182 credit hours of instruction. An individual MOS Proficiency Course is available, tailored to the specific MOS's listed below.

MOS	Subcourses	Credit Hours
19D10	27	117
19E10	26	133
19F10/20	19	94
19G10	28	127
19H10	19	91
19J10	31	139
19Z50	28	182

Noncommissioned Officer Advanced Course (NCOA). This course trains NCO's in CMF 19 to perform at the E-7 level. It, too, helps the NCO increase his job knowledge and MOS proficiency, and study for the skill level 4, SQT. Like the NCOB course, the NCOA course is in two phases, the common skills phase and the MOS specific phase. Below is a chart depicting the NCOA course by MOS

MOS	Phases	Subcourses	Credit Hours
19D	I, IIa	44	273
19E	I, IIb	45	276
19G	I, IIc	49	274

No one in the Armor community is left out. However, enrollment in a complete course may not be the answer to everyone's training needs. A soldier may be proficient in one area and only need selected subcourses to maintain all-around proficiency. In this case, all an individual would have to do is enroll for selected subcourses.

Enrollment is easy. All it takes is a completed DA Form 145, (figure 1) and concurrence of the local commander or his delegated representative. When applying for enrollment, make sure all applicable blocks are filled in and signatures of the applicant and approving authority appear in blocks 7 and 9, respectively. Block 4 is where you list the options desired for enrollment. If you want a complete course, write it out, i.e.: Armor Officer Basic (12B). If all you desire is selected enrollment, then list the subcourses by subcourse number: ARO 100, ORD 729, or ISS 210. Print legibly to ensure that you get the courses you desire. Block 6 must be completed, listing all previous schooling attended.

For individuals, one additional option for enrollment is supervised on-the-job training (SOJT). The Armor Correspondence Course Program does not presently offer an SOJT course of instruction. Some technical fields (turret mechanics, ordnance, etc.) need the SOJT program as an option for personnel in those fields. The biggest disadvantage of these programs is often the lack of equipment to complete the lessons and a supervisor to monitor the student's progress.

Groups as well as individuals can benefit from ACCP courses. A group leader is selected and applies on a DA Form 145, to which he attaches a separate roster of those in his group. Then the entire group is enrolled, but the training materials are sent only to the group leader, who hands them out to the group during the study sessions.

But, you ask, who has the time to take all the TC's away from the platoon? Who will do maintenance if my mechanics are at school? There isn't enough time in the day! Time will have to be planned, allotted, and rigidly adhered to. But the benefits in a well-planned, comprehensive training program, will be reaped by a better trained, highly proficient, tactically sound, more cohesive fighting unit.

To find out more about the Armor Correspondence Course Program, consult DA Pamphlet 351-20-2 for complete course descriptions, enrollment information, eligibility requirements, administrative information, and subcourse descriptions. The Armor Center also has an Armor Correspondence Course catalog that is available from the Extension Training Management Division of the Directorate of Plans and Training at the following address:

Commander
USAARMC and Fort Knox
ATTN: ATZK-DPT-EM
Ft Knox, KY 40121
AUTOVON 464-5430/5715
Commercial (502) 624-5430/5715

The complete Army Correspondence Course Program can be found in the DA Pamphlet series 351-20. A complete list of pamphlets and schools follows.

Volume	Proponent School
351-20-1	U.S. Army Air Defense School, Ft. Bliss, TX
351-20-2	U.S. Army Armor Center, Ft. Knox, KY
351-20-3	U.S. Army Aviation Center, Ft. Rucker, AL
351-20-4	U.S. Army Chaplain Center & School, Ft. Wadsworth, NY
351-20-5	U.S. Army Engineer School, Ft. Belvoir, VA
351-20-6	U.S. Army Field Artillery School, Ft. Sill, OK
351-20-7	U.S. Army Infantry School, Ft Benning, GA
351-20-8	U.S. Army Soldier Support Center, Ft. Benjamin Harrison, IN
351-20-9	U.S. Army Institute for Military Assistance, Ft. Bragg, NC
351-20-10	U.S. Army Intelligence Center and School, Ft. Huachuca, AZ
351-20-11	U.S. Army Military Police School and Training Center, Ft. McClellan, AL
351-20-12	U.S. Army Missile and Munitions Center and School, Redstone Arsenal, AL
351-20-13	U.S. Army Ordnance School, Aberdeen Proving Ground, MD
351-20-14	U.S. Army Quartermaster School, Ft. Lee, VA
351-20-15	U.S. Army Signal School, Ft. Gordon, GA
351-20-16	U.S. Army Transportation School, Ft. Eustis, VA
351-20-17	The Judge Advocate General's School, Charlottesville, VA
351-20-18	U.S. Army Intelligence School, Ft. Devens, MA
351-20-19	Academy of Health Sciences, Ft. Sam Houston, TX
351-20-20	Chapter 1. U.S. Army Command and General Staff College, Ft. Leavenworth, KS
	Chapter 2. U.S. Army Sergeant's Major Academy, Ft. Bliss, TX
	Chapter 3. U.S. Army Logistics Management Center, Ft. Lee, VA
	Chapter 4. Joint Military Packaging Training Center, Aberdeen Proving Ground, MD
	Chapter 5. U.S. Army War College, Carlisle Barracks, PA
	Chapter 6. Defense Civil Preparedness Agency Staff College, Battle Creek, MI
351-20-21	Chapter 1. U.S. Army Organizational Effectiveness Center & School, Fort Ord, CA
	Chapter 2. Defense Language Institute, Foreign Language Center, Presidio of Monterey, CA
	Chapter 3. Defense Equal Opportunity Management Institute, Patrick Air Force Base, FL
351-20-22*	U.S. Army Chemical School, Ft McClellan, AL

*Note. Volume 22 has not been published and is not due in the field until fiscal year 1981. Until then, Chemical School information can be obtained from DA Pamphlet 351-20-13, dtd Feb 79.

Ronald Reagan

President and Cavalryman

A former cavalryman, Ronald Reagan, is our country's 40th President. The President's service as a cavalryman began in April 1937 when he enlisted as a Private in Troop B, 322d Cavalry (U.S. Army Reserve). In June 1937, he received a Reserve Commission from ROTC as a Second Lieutenant of Cavalry. Called to active duty in April 1942, he remained a cavalryman until June 1942 and then was assigned to the Army Air Corps.

Although most of President Reagan's active military service was with the Air Corps, he never forgot his days as a trooper. While Governor of California, he proclaimed 12 December 1968 (the birthday of U.S. Armor and Cavalry) as United States Armor (Cavalry) Day and urged all Californians to observe appropriate ceremonies honoring the men, past, present, and future of the United States Armor.

During the proclamation ceremonies, he was presented an honorary membership in the U.S. Armor Association and a copy of Frederic Remington's "Old Bill."

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 58)

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PROFESSIONAL THOUGHTS

A Commander's Training Center Experience

My tenure as a Basic Combat Training (BCT) company commander was both profitable and painful. The support and loyal cooperation I received from subordinates and superiors alike was generally gratifying and inspirational. My drill sergeants provided me with, and I hope I provided the battalion commander with, a reasonable degree of loyal dissent when such was called for.

The Company Officer(s)

I observed that many commanders imagined that they were in the ideal leadership climate, and desired to appear thus: formal, reserved, frigidly courteous, impeccably neat in appearance. This type of commander does not meet the requirements of the BCT environment. The normal duty hours are so long and the intimacy with cadre so great that the effective commander must achieve both a strong personal relationship and a strong professional relationship with his men.

It probably cannot be gainsaid that most lieutenants at Fort Jackson were hard-working, energetic, able, and tractable. My experience in working with lieutenants, though, was largely negative. I passed fully one-half of my command tour without the assistance of a lieutenant. During that time I worked quite hard myself. Each time I received a training officer (I had three), I found that he was unwilling to put forth as much effort as myself.

A Lukewarm Defense of the Training Officer

Most company commanders, after considerable wrestling with the matter of how best to employ their single lieutenant, decided to use him in the capacity of executive officer, instead of as a training officer. After a time, the battalion commander reached a similar decision and made the executive officer system a policy within the battalion. The reason for his decision was simple—the training officer was grossly inefficient and, in many cases, counterproductive. I therefore felt that to officially recognize that the lieutenant ought to operate primarily from the orderly room was a wise decision. When most young officers in the training center went to the field, they found that they were overshadowed by a senior noncommissioned officer who could quite commendably perform the job. Unless they were exceptional lieutenants, they lost their confidence after making a few poor decisions.

Several practical questions present themselves: Is the training of one officer worth sacrificing the efficiency of the unit? How much is the lieutenant benefiting from the field experience? How much could he be learning in the executive officer position? Shouldn't the commander spend the majority of his time in the field, and if so, doesn't the lieutenant's position then become further weakened? My answers to these questions are obvious. I think that the commander should spend most of his time in training, and the lieutenant most of his time in the orderly room. It is vital that the lieutenant become proficient in unit administration matters.

Education and Professionalism

We have our troops practice drill maneuvers so that they might develop a capacity to execute instructions without hesitation or thought. To be useful, military knowledge also must be subconscious, and thereby readily available. We can train the mind to the powers of analysis and prudent thinking by studying virtually any worthy subject. But only through the study of military matters will an officer be conditioned to act in the proper military way when called upon to do so in time of war.

The officer, then, must develop his military instinct through careful study from the day of his commissioning until the day of his retirement. He must read military history, he must read English literature, he must visit battlefields, and he must read still more in order to know what he should. It is my firm conviction that the Army will not grow until the composite of its individual minds grows. Why not, on a weekly basis, reconstruct important battles of times past for the edification of young officers, or geography classes or language instruction or periodic visits to nearby battlefields? Too many of my peer and subordinate officers live in a cultural and intellectual Sahara, and I am appalled and more than a bit embarrassed.

To probe further, I would like to challenge the aptness of the system which is at present the prime structure of our military education. There is an apparent army-wide fixation on the value of management techniques—but upon little else. There is much talk about the development of the whole man, but concentration upon the disciplines which count for something is omitted.

War

A considerable number of young men, I feel sure, must be disheartened by a problem for which I have no solution: whereas war was at one time an illustrious contest waged between two well-prepared, proud opposing forces in which the margin of victory or loss was to a significant extent a function of the characters of the contestants. Today it appears to have been reduced to a mere disgusting matter of money and machinery. Modern war is, like most everything else in our society, a godchild of mass production.

It is, and maybe I commit heresy by writing this, rather lamentable that an exceedingly large number of soldiers who participated in the Vietnam conflict came away deceived on many accounts. They may be pardoned for believing that they were at grips with real war, when certainly they were not. Most of our soldiers did not imagine that they ultimately would be consumed. Most of them did not participate in a conflict in which death was the general expectation, in which whole brigades were annihilated by the flail of artillery or machineguns. Yes, the Vietnam experience, with all its attendant shoddiness, was a terrible experience. Surely, some very fine and courageous men suffered and/or died in Vietnam—all praise be rendered to those men. My point, however, is that too many of the wrong lessons were learned in Vietnam, and consequently many trainees are being influenced wrongly by these Vietnam veterans.

The press has long called Vietnam "the ultimate in a platoon leader's war." That is to say, large numbers of small units operated in semi-isolation. Platoon leaders necessarily became intimately associated with their men. Higher authority frequently was invisible, merely a voice on a PRC-77. The absence of direct influence by higher headquarters tended to produce a casual attitude in the small unit.

At Fort Jackson, I observed that the noncommissioned officers and officers who appeared to be better for the Vietnam experience were those who perceived the deficiencies in their combat schooling. Many of the younger officers and younger E-5s and E-6s were the worse for that education. To them, the lessons contained in the manuals were inapplicable, and therefore lightly considered today. They were the ones who wanted to quit short of the mark, the ones who could yell the loudest, but really could not lend themselves to lead trainees to meet a rigorous, strict set of standards.

The Chaplain

In BCT even the most indifferent souls seem particularly apt to receive the consolation of religion. At this point in the soldier's life, it is essential that the chaplain issue advice appropriate to the situation. The trainee is interested in knowing that there is a source of aid to which he might turn in his hour of difficulty. He is not, realistically speaking, especially concerned with what Jethro did for his fellow Israelites. Character-building should begin in training and be reinforced in religious activities. Our chaplain understood the needs of the trainees and attended to them magnificently.

Axioms

The following ideas were the fundamental components of my touchstone theory of command. I tried to make all the actions of my company revolve about these notions.

- A first-rate company is one in which intricate, loyal teamwork is at all times evident. This is the spirit that renders a combination vastly superior to the individuals of which it is composed. Action priority one is to assemble the team. One may not always obtain the desired personnel, but, in most cases, he possesses the means to cripple or eliminate the soldiers who refuse to cooperate in the team-building effort.
- Planning—things must be done in a harmonious sequence. The foundations have to be laid, the data assembled, and the premises must bear the weight of their conclusions. A well-conceived plan, enthusiastically executed, will always yield positive results. A good commander is he who arrives at the results of planning without being bound to his plans.
- Do not act hastily. The commander must permit events to unfold until the point in time is reached at which he may intervene smoothly and effectively. The timing of many actions is often as vital as the actions themselves.

Conclusion

The English historian Alexander Kinglake wrote, "A scrutiny so minute as to bring an object under an untrue angle of vision, is a poorer guide to a man's judgment than a sweeping glance which sees things in their true proportion." Indeed, this essay has not been concerned with a narrow focus, but with broad examination. This has been a simple set of personal observations—it is my hope that soldiers in the field will bump their views against mine, to consider the issues I have raised, as we together labor to make our Army better able to fulfill its purpose.

CPT JOHN M. VERMILLION
Captain, Infantry
West Point, NY 10996

Airborne Armor and Cavalry

Recently **ARMOR** magazine (Sep-Oct 80) featured an article, "Airborne Armor and Cavalry," by 2Lt Thomas D. Dinackus. While an extremely well thought-out article, there are several omissions that should be discussed. First, the article focuses only on recent U.S. experience and does not consider other nations' experience with airborne armor. The effect of enemy artillery on jeep-mounted TOWs is not considered, and finally, a viable alternative disbanding the 82d Airborne Armor Battalion is not even considered. Armor prides itself as operating as a combined arms force. Are we really prepared to concede that we can't form combined arms teams with light armor and airborne infantry?

Examining the history of airborne armor, we find that during World War II, two light tanks were developed and used by airborne units. The first airborne tank was the British *Mark VII* light tank, *Tetrarch,* which was used in the invasion of France in 1944. It remained in airborne service until 1949[1]. The U.S. *M-22 Locust* light tank was developed especially for air transport. The *Locust* was used by British airborne forces in the Rhine crossing on 25 March 1945. The *Tetrarch* was armed with a 40-mm gun and the *Locust* with a 37-mm gun. Neither tank was a particularly good antitank weapon, but did offer armor protected firepower[2].

During the battle for Dien-Bien-Phu, the French flew a squadron (equivalent to a U.S. Army company) of 10 *M-24* light tanks into the area. The tanks had to be disassembled into seven different loads for air transport. Reassembly required 2 days for each tank[2].

Turning from history to present, Lieutenant Dinackus proposed that the antiarmor defense of the 82d Airborne Division be left to jeep-mounted TOWs. While this does appear to offer a mobile weapon system, it ignores an unpleasant fact. Many Third World countries have large amounts of artillery, mortars, and rocket launchers. Angola has 110 122-mm *BM-21* multiple rocket launchers (MRL)[3].

Syria has more than 800 artillery weapons between 122- and 180-mm[4] and Ethopia has more than 224 artillery pieces[5]. A single *BM-21* battalion has 18 launchers with 40 tubes on each launcher. This means that, in less than 40 seconds, 720 rockets can impact on a company-sized target. If U.S. antitank defense was to depend on unarmored carriers such as jeep-mounted TOWs, the TOWs become a high value target, and are very likely to be targeted by hostile artillery.

Finally, let's examine one other country's answer to the airborne problem. The Soviet Union has 8 airborne divisions[6]. Organic to these divisions are *ASU-85* assault guns and BMD armored fighting vehicles. Each airborne division has an assault gun battalion with 18 *ASU-85s*[7]. Of the three airborne regiments, 2 have a BMD company with 10 BMDs[8]. One of the regiments is fully equipped with the BMD as an airborne infantry fighting vehicle[9].

ASU-85s are frequently employed as if they were tanks working with infantry. For example, Colonel I. Kononov, writing in *Military Herald,*[10] describes a company of BMDs parachuted into a drop zone. A platoon of *ASU-85s* supported the company, much as tanks support BMDs in a motorized rifle unit.

The BMD was initially assessed to be a light tank when first seen in 1970[11]. When one adds up the firepower, it is easy to see why the BMD was regarded as a light tank. It carries a 73-mm main gun, 4 *Sagger* antitank guided missiles, a coaxial 7.62-mm machinegun, and 2 fixed forward-firing 7.62-mm machineguns[12].

In addition to the driver and gunner, a squad/track commander, two riflemen, and a RPG-7 grenadier are carried. The power to weight ratio is 36 to 1, the highest of any armored fighting vehicle (AFV). The BMD only weighs 8 metric tons and is airdroppable[13].

Each Soviet airborne division has 110 squads mounted in infantry fighting vehicles (IFV). Mounted in IFVs, these 110 squads should be more or less invulnerable to artillery fire.

Imagine an *ASU-85* battalion attacking, supported by two companies of BMDs against a U.S. airborne company. Firing at the airborne company are 18 85-mm guns, 20 73-mm guns, 20 AT-3/*Sagger* ATGMs and 78 7.62-mm machineguns—a devastating amount of shock action.

Now imagine a platoon of rear area soldiers (not infantry) dug in to protect a strategic bridge. Suddenly, tracked vehicles are heard in the woodline, 500 meters away. Bursting out of the woods are 10 BMDs, moving at 80 kmph and firing 30 machineguns at the platoon, equipped with a few LAWs. To believe the platoon will defend the bridge expects a lot of the defenders.

Lieutenant Dinackus advocates disbanding the *Sheridan* battalion in the 82d Airborne Division because there is no mechanized infantry in the airborne division. There is an alternative suggestion. Buy a wheeled armored personnel carrier that can carry infantry and convert a brigade of the 82d Airborne Division to mechanized infantry. The three battalions so converted could be employed as "pure" foot infantry if required. TOW launchers could be adapted to put the missile and gunner under armor. Only enough armor to withstand artillery fire is required; concede loss of the vehicle if it is hit with a direct-fire antitank weapon. Attempting to armor against an ATGM is impossible for an air-delivered system.

Critics of the proposal will immediately claim it is not practicable because the vehicles will take up too much airlift. While a valid criticism, is it better to deliver two battalions that cannot survive on the battlefield or one battalion that will live on a battlefield dominated by artillery and attack as part of a combined arms team? One could speculate that eventually the Soviets will convert all their airborne divisions to be fully mechanized. Can the country that invented mass production not move airborne infantry out of Stone Age mobility limits (2-1/2 miles per hour) imposed by our current equipment?

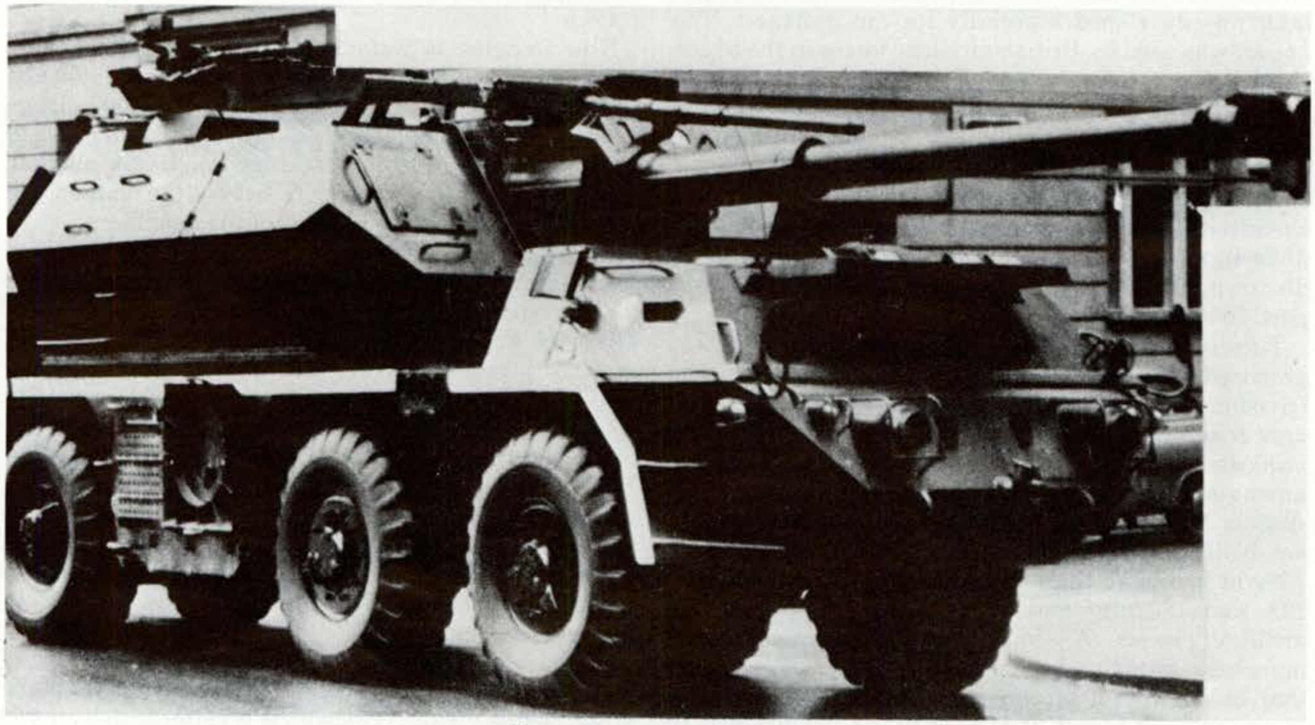
Imagine fielding an airborne force capable of moving 60-70 kmph after landing. If the Soviets can do it, why not the U.S.?

GERALD A. HALBERT
Captain, MI

Footnotes

[1] Peter Chamberlain and Chris Ellis, *British and American Tanks of World War II,* ARCO Publishing Company, IC, NY, 1969, p. 26.
[2] Bernard B. Fall, *Hell in a Very Small Place,* J. B. Lippincott Company, 1966, p. 97.
[3] *The Military Balance,* 1979-1980, Facts on File, Inc, NY, 1979, p. 49.
[4] *Ibid.,* p. 45.
[5] *Ibid.,* p. 50.
[6] *Ibid.,* p. 9.
[7] Handbook 550-2, *Organization and Equipment of the Soviet Army,* Combined Arms Combat Development Activity, Ft Leavenworth, 15 July 1980, p. 2-15.
[8] *Ibid.,* p. 2-16.
[9] *Ibid.,* p. 2-17.
[10] *Military Herald,* No. 6-78.
[11] *USAREUR PAM 30-60-1,* Part 1, Volume III, 15 February 1973, p. 117.
[12] *DIA Warsaw Pact Ground Forces Equipment Handbook: Armored Fighting Vehicles, p. 3-14.*
[13] *Ibid.,* pp. 3-12, 3-13.

NEWS NOTES



New Czech SP Gun

Currently undergoing trials in Czechoslovakia is a new self-propelled gun (SPG) based on the chassis of an 8 x 8 vehicle fitted with a central type pressure regulation system.

The fully armored cab is at the front, and the fully armored turret, capable of being traversed through 360 degees, is centered on the armored engine compartment at the rear.

The exact caliber of the ordnance is uncertain but is thought to be either 152-mm or 155-mm. As far as can be judged from the prototypes, the ordnance is not based on any existing weapon and is not fitted with a bore evacuator, although a muzzle brake is fitted.

The SPG is thought to be based on the chassis of the Tatra 813 (8 x 8) truck or Tacta 815, which is widely used in the Warsaw Pact both as a troop carrier and a prime mover for artillery. No specifications of the SPG are available at present, but combat weight is about 20,000 kg and maximum road speed about 70 kmph.

Information and photographs courtesy of Jane's Defence Review.

International Test and Evaluation Association Founded

Readers of **ARMOR** are invited to become charter members of the newly incorporated International Test & Evaluation Association (ITEA). ITEA's members seek to advance the art of test & evaluation and secure recognition of T&E as a full partner in the work of industry, academia, and government.

ITEA's President, Dr. Allen R. Matthews, reports that chapters are already forming at Patuxent River NAS; Norfolk; Pt. Mugu; in the Washington, D.C. area; and at centers of T&E expertise across the nation. The association plans a variety of chapter activities: professional working groups, technical meetings, national and international symposia and publications.

For membership information and a copy of the latest ITEA newsletter, write ITEA, Attn: Membership Committee, P.O. Box 603, Lexington Park, MD 20653, USA.

The Seventh Army Training Command

The single manager for training in Europe is the Seventh Army Training Command, Grafenwoehr, Germany, APO New York 09114. The command includes the U.S. controlled major training areas in Graefenwoehr, Wildflecken, and Hohenfels; the Combined Arms Training Center at Vilseck, Germany; the Training Support Activity, Europe, at Roedelheim, Germany; and the NATO Missile Firing Installation in Crete. The command also schedules U.S. usage of all other NATO training facilities available to U.S. Army, Europe, conducts new equipment training for major systems, and exercises staff responsibility over all training matters for CINCUSAREUR. To facilitate the latter task, the commander of the Seventh Army Training Command is also the Assistant Deputy Chief of Staff for Training.

New Light Tank Unveiled

A new light tank was displayed for the first time a few months ago at the Association of the U.S. Army (AUSA) annual meeting and exhibit in Washington, D.C. Called the Rapid Deployment Force/Light Tank (RDF/LT), it is a candidate for use by both the Army and the Marine Corps.

The tank was designed and built independently by AAI Corporation of Baltimore, a subsidiary of the United Industrial Corporation. The new tank could be available in 1983, about five years earlier than the normal military development cycle.

This 14-ton light tank, designed to meet rapid deployment force criteria, does the job of 3 heavy combat vehicles and is air-deliverable in quantity.

The tank features a 75-mm automatic cannon, and the 45-degree elevation capability of the main armament provides antiaircraft defense and long range artillery support at high firing rates to 12 kilometers range.

The RDF/LT can be quickly air-delivered in significant numbers anywhere worldwide. A C-5A transport can carry six of the light tanks and a stretched C-141 can carry three. The tank is also helicopter-transportable.

Colonel Heiberg Honored

More than 800 Armor officers, NCOs, soldiers, and their spouses and guests gathered recently at Fort Knox to celebrate Armor's 204th Birthday and to honor Colonel (Ret) and Mrs. H. H. D. Heiberg.

Colonel Heiberg began nearly 36 years of his military service as a Second Lieutenant of Cavalry after graduating from West Point in 1919. The same year he joined the U.S. Cavalry Association (Armor Association) of which he is still a member. He played an important role in the mechanization and development of armor in the U.S. Army, beginning with the evolution from the horse to the tank in the early 1930s. Today, Colonel and Mrs. Heiberg reside near Fort Knox where he was first stationed in 1932.

The event was sponsored by the Armor Association's Thunderbolt Chapter.

Unit Reunions

The 1st Armored Division Association's 34th annual reunion will be held Aug. 26-29, 1981, at the Airport Hilton Inn, 2500 South High School Road, Indianapolis, IN 46241 (317-244-3361). For more information, contact CSM (Ret) W. S. Beasley, P.O. Box 1048, Cocoa Beach, FL 32931.

The 1st Cavalry Division Association's 34th annual reunion will be held Aug. 13-16, 1981, at the Four Seasons Motel, Pueblo, CO (303-566-5900). Reservations may be made with COL (Ret) Wilbert Irwin, 2505 Avondale Dr., Colorado Springs, CO 80917, or Nicholas Herniak, 1011 Mystic Ave., Canon City, CO 81212.

The 6th Armored Division Association's 34th annual reunion will be held July 22-25, 1981, at the Hyatt Regency Hotel in New Orleans, LA. About 600 are expected, including MG (Ret) Robert W. Grow, 86, the CG of the 6th for the last two years of WW II. The Iowa native joined the military in 1915, and has also served as CG of the 3d AD and the Armored Replacement Training Center at Fort Knox; chief of the U.S. military mission at Teheran, Iran; and the Army Attache at Moscow.

The 14th Armored Division Association's 17th annual reunion will be held July 23-26, 1981, at Stouffers' Five Seasons Hotel (off I-380) in Cedar Rapids, Iowa.

The Society of the First Division, composed of members of the First Infantry Division in World War I, World War II and Vietnam, will hold its 63d annual reunion at West Point, New York, August 20-23, 1981.

The 7th Armored Division Association's 35th annual reunion will be held September 2-6, 1981, at the Opryland Hotel, 2800 Opryland Drive, Nashville, TN 37214. For more information, contact Al Spinazzola, 6246 Olde Orchard Road, Columbus, OH 43213 (614-861-2587).

ARMOR's 34th Editor

Major Charles R. Steiner, Editor-in-Chief of *Armor* was commissioned in Armor from the University of Notre Dame. His various command and staff assignments have included tours with the 1st Squadron, 17th Cavalry, 82d Airborne Division; 7th Squadron, 1st Cavalry and 13th Combat Aviation Battalion in RVN; the 1-72d Armor in Korea and 2d Squadron, 6th Cavalry at Fort Knox. Other assignments have included instructor duty at the Armor School, ROTC duty at Georgetown University, and a tour as associate editor of *Soldiers Magazine*.

OPMS-EPMS

DOPMA

Not all the procedures for implementing Defense Officer Personnel Management Act (DOPMA) have been fully developed; however, answers to most frequently asked questions are provided below:

Q: I'm an RA major; when can I expect to be retired if not promoted to lieutenant colonel?

A: Current RA majors have tenure to 21 years service; RA majors under DOPMA do not have such a guarantee. Those promoted to RA major before 15 September 1981 are tenured to 21 years of service.

Q: What does the message cancelling the 1981 RA promotion boards mean?

A: 1981 RA boards are eliminated. In their place, those RA officers who have not been once nonselected for captain, major, or lieutenant colonel RA promotion will be considered by boards in October 1981. Those selected will be promoted. Those nonselected will be retired, separated, or selectively continued in grade.

Q: What does the active duty list (ADL) mean?

A: Other than regular Army (OTRA) and RA will be integrated into one active duty list in the grade and relative order of seniority of their serving Army of the United States (AUS) grade as of 15 Sep 81.

Q: What will my RA DOR be under DOPMA?

A: RA officers who have not failed for promotion will be given a new DOR that is to serve as their ADL DOR on 15 Sep 81. Their active duty selection will serve as their RA selection as well.

Q: What about a Reserve officer on extended active duty?

A: OTRA officers will no longer compete for reserve promotion. Like RA officers, their active duty grade will be their permanent and only grade.

Q: Am I still protected if I get in the 18-year sanctuary?

A: Eighteen-year lock-in for retirements is still in effect.

Q: I have a reserve commission higher than my active duty grade. How does DOPMA affect me?

A: OTRA officers who have a higher reserve grade than their active duty grade will be able to retire in their reserve grade unless promoted to that grade or higher prior to retirement.

Q: How will selective continuation be used?

A: DOPMA has a selective continuation option designed to be used to meet Army needs at the grades of captain and major. Implementation of this option is at the discretion of the Service secretary. A decision on the way selective continuation will be implemented is expected in the April-May timeframe.

Q: I'm on the lieutenant colonel list; will I have a three-year lock-in under DOPMA?

A: The new three-year lock-in grade requirement for retirement upon promotion above major applies only for those selected for promotions after 15 Sep 81. Prior to that time, those either promoted or on the list have a two-year obligation to retire in grade. While the Secretary of the Army can now waive the time-in-grade lock-in, only the President will have the authority to do so under DOPMA.

Q: I'm past 11 years of service; will I become RA on 15 Sep 81?

A: Integration of OTRA officers will continue to be through integration boards. Maximum age limits have been relaxed and will apply to boards convened after 15 Sep 81.

Q: Will OTRA officers be automatically integrated into RA under DOPMA?

A: The policy for integration of OTRA officers currently on active duty has not been determined and will be considered along with the all RA force issue. Resolution is anticipated in the April-May timeframe.

Q: If I'm involuntarily separated will I be able to collect $30,000?

A: Officers involuntarily separated will, if otherwise entitled, be able to collect separation pay under the old or new law, depending on which is most beneficial to them. Remember, the old law accumulated at two months pay per year to a maximum of $15,000; the new law accumulates at 10 percent base pay per year to a maximum of $30,000.

Q: The law does not mention nonselected RA lieutenant colonels who are AUS colonels.

A: RA lieutenant colonels who have twice been nonselected for RA colonel, but are AUS colonels, are automatically advanced to their AUS rank and have a mandatory 30-year retirement.

Q: Will the field grade overstrengths cause a RIF?

A: There will be no reduction-in-force as a result of DOPMA, nor will there be a dry-up of promotions. The major and lieutenant colonel lists for 1981 and 1982 will not exhaust as fast as anticipated, but the slow down will be minimal. A maximum slow down from one to two months for each grade is expected.

Q: Will I, as a Reserve officer, be forced to integrate in order to complete 20 years of service?

A: Field grade OTRA officers currently on active duty may be invited to convert to RA, but it is not anticipated that they will be forced to go RA to complete 20 years of service for retirement if otherwise qualified. Rules for officers coming into the field grade after the effective date of DOPMA will be announced at a later date. Field grade officers with over 20 years may be required to integrate if they expect to continue on active duty past their current period of obligated or expected service.

Q: How will my mandatory release date (MRD) be affected by DOPMA?

A: DOPMA per se does not affect your MRD if you are a Reserve officer. The eventual decision on an all RA force may cause your status to change and impact on your MRD. As of now, Reserve officers are still retired with 20 years of active federal service (AFS).

Q: I'm an RA captain and have not been considered for

RA promotion to major, but have been nonselected for AUS major three times. I will have 14 years of AFS in 1982. How will DOPMA affect me?

A: RA officers who have not been considered for RA promotion when DOPMA goes into effect—if still on active duty—will receive two ADL considerations under DOPMA. For the example in question, the captain will be considered by the 1981 AUS board and the 1982 and 1983 ADL boards before being separated or selectively continued if not promoted.

Comments from the Branch Chief

The letter of instruction to the last E-8 promotion board contained the following instructions concerning drill sergeant duty: "Duty as drill sergeant is important and demanding. Quality performance in this duty is to be considered as particularly indicative of the professional potential of the noncommissioned officer and the manner of performance in this duty should be carefully considered." These instructions indicate the importance of this duty. In previous notes I have had SFC Short, our drill sergeant coordinator, prepare a summary of "how to" volunteer for this duty. Despite these articles, daily I see numerous letters to the field and listen to calls requesting missing information. I also see applications returned for correction and I find myself concerned about the number of these returned applications that are never resubmitted. I am concerned because of the increased workload generated in the branch and in the field when we must send applications back or request missing information. However, my greatest concern is the number of Armor soldiers who may become frustrated by the paperwork involved in applying for drill sergeant duty and give up applying.

My goal is to get an NCO on drill sergeant duty as soon as possible without an admin hassle. To aid this effort, we have sent a message to all MILPOs listing the common errors we have noted. Additionally, SFC Short has summarized these common errors below.

- Not processed IAW procedure 3-34, DA Pamphlet 600-8.
- Incorrect, out-of-date, or missing PT test results.
- Missing statement of mental evaluation.
- Missing recommendation from commander in grade of lieutenant colonel or above on E-5 males.

So, if you are ready to accept the challenge of being one of the most professional trainers possible, request your assignment as an Army drill sergeant!

Congratulations to the 223 CMF 19 NCOs selected for promotion to E-8.

ROBERT J. GRAHAM
LTC, Infantry
Chief, Infantry/Armor Branch

Army Recruiters

Selection of Army recruiters is the responsibility of MILPERCEN. Armor NCOs who desire a challenging tour as an Army representative in a civilian environment must meet the following prerequisites:

- Grade E-5(P) or E-6.
- Minimum EERWA of average or higher for soldier's PMOS and grade.
- No more than 14 years in active service.
- Minimum GT score of 110 and ST score of 100.
- High school graduate or GED diploma, with 1 year of college.
- Dependents (to include spouse; sole parents not acceptable): Grade/Dependents not to exceed E-5/2, E-6/4.
- Between 21 and 35 years of age.
- Minimum physical profile of 232221.
- Must meet height and weight standards IAW AR 600-9.
- U.S. citizen by birth or naturalization.
- Not serving on an enlistment for which he/she drew a variable reenlistment bonus (VRB) or selective reenlistment bonus (SRB).
- Completed 1 year since reclassification IAW AR 600-200.
- No lost time on current enlistment nor more than 5 days "lost time" on all previous enlistments.
- Must not currently be assigned to a Military Enlistment Processing Command (MEPCOM) or Recruiting Command in a support MOS.
- Must have 24 months or more service remaining on current enlistment upon completion of recruiter training course, or must extend or reenlist IAW Chapter 3, AR 601-280.
- Hold both a valid military and state drivers license or a valid state drivers license and be qualified to obtain a military drivers license.
- Not currently enrolled in the Army's Drug and Alcohol Abuse Program.
- Have favorable civilian and military disciplinary record, to include a good motor vehicle driving record.
- Have no marital, emotional, or medical problems (to include immediate family), which could hamper a soldier's performance of recruiting duties.
- Possess excellent military bearing and appearance and have no obvious distracting physical abnormalities or mannerisms.

Qualified soldiers who wish to volunteer for recruiting duty may submit a DA Form 4187 (Personnel Action) together with a current DA Form 2 and 2-1. The request must be indorsed by a lieutenant colonel or higher in the chain of command, verifying that the applicant is reflective of the NCO Corps, is able to represent the Army in a civilian environment, and meets criteria of AR 601-1 and MILPO message 81-80. Requests will be fowarded thru command channels to Cdr, MILPERCEN, ATTN: DAPC-EPM-P, 2461 Eisenhower Avenue, Alexandria, VA 22331.

Trial Prerequisites for Airborne, Ranger, and Special Forces Courses

Pending publication of changes to AR 614-200, AR 614-110, DA Pamphlet 600-8, and DA Pamphlet 351-4, the following trial prerequisites for admission to Airborne, Ranger, and Special Forces courses will be implemented effective 28 Feb 81. These are Army Physical Readiness Test (APRT) trial prerequisites and will be validated over a one-year period following implementation.

Standards. Applicants must achieve or exceed the following standards on the APRT before admission to the courses indicated:

COURSE	REPETITIOUS PUSH-UPS (Two-minute time limit)	REPETITIOUS SIT-UPS (Two-minute time limit)	TWO-MILE RUN (Min: Sec)
Airborne (Male)	45	45	15:59
Airborne (Female)	21	32	17:55
Ranger	45	45	15:59
Special Forces	45	45	15:59

Exceptions to the above standards, based on an overall evaluation of an individual's physical abilities, may be granted by the Commandant of the U.S. Army Infantry School and/or Commandant of the Institute for Military Assistance on a case by case basis for a period of ninety days after implementation.

Administration of the APRT. All candidates for Airborne, Ranger, and Special Forces courses will be administered the APRT in their unit and again upon arrival at the course.

Unit responsibilities. Units will ensure that:

• The APRT is administered no more than 30 days prior to the date of application.

• A completed DA Form 705 (APRT Scorecard), signed by the Company Commander, accompanies the application.

Fort Benning/Fort Bragg responsibilities. The Commandant, U.S. Army Infantry School, and the Commandant, Institute for Military Assistance will:

• Administer the APRT to students upon their arrival at the course.

• Place applicants who fail to meet the established APRT standards on a one-week administrative hold. During this time the applicants will be given additional PT. Upon conclusion of the one-week period, these applicants will be re-administered the APRT. Applicants who attain the standards will be enrolled in the course. Applicants who fail to achieve the standards will be returned to their unit or reported to DA for reassignment.

Additional prerequisites. In addition to the APRT standards listed above, applicants must also meet the following prerequisites:

Airborne. Airborne applicants must meet the physical qualifications for parachute duty established in AR 40-501.

Ranger. Ranger applicants must:

• Meet the physical qualifications for Ranger duty established in AR 40-501.

• Execute 6 chin-ups.

• Possess the entry skills based on the Infantry Soldier's Manual (FM 7-11B) and set forth in DA Pam 351-14 dated Jan 80.

• Complete a road march IAW the standards specified in paragraph 3-2B, AR 672-12, Expert Infantryman's Badge.

• Successfully complete the following three events of the Combat Water Survival Test (CWST):

• *Fifteen-meter swim.* Applicants must swim with soft cap, fatigues, boots, pistol belt, first-aid pouch, two canteens filled with water, two ammunition pouches, harness, and rifle. The applicant will enter the water backwards, wearing his equipment and holding his weapon at port arms. As a safety precaution, the harness will not be fastened. The swimmer will surface, turn around, and swim with the weapon under the water, gripping the weapon directly above the upper hand guard and keeping it in line with and close to the body to reduce drag, with the muzzle pointed in the direction he is swimming. If the swimmer accidently drops his weapon while swimming, he may retrieve it and continue to swim without being penalized. If the swimmer completes the event but drops his weapon or harness and does not retrieve them, the scorer will record the letters "WS" on the scorecard (DA Form 705), which indicates that the applicant is classified as a weak swimmer and will need special attention during training.

• *Equipment removal.* The applicant must enter the water at a point where the water is over his head with the same equipment as prescribed for the 15-meter swim, surface, compose himself, submerge his harness, drop his weapon, and swim to the side of the pool without panicking.

• *Three-meter drop.* In this event, the soldier, wearing the same equipment as prescribed for the 15-meter swim and with his weapon held at port arms and extended at arm's length away from the body, enters the water, blindfolded, from a three-meter highboard. He must surface, compose himself, remove his blindfold, and swim to the edge of the pool without panicking.

Special Forces. Special Forces applicants must:

• Meet the physical qualifications for Special Forces duties established in AR 40-501.

• Successfully complete the three events of the Combat Water Survival Test as described above.

Recognition Quiz Answers

1. Leopard I improved armor turret on an M-48 chassis. The Germans use the M-48 chassis for firing-in all their production turrets prior to marriage with the Leopard chassis.

2. SA-8 Gecko—Short-range, low-altitude, all-weather, surface-to-air-missile. It is amphibious and has an integrated rotatable turret. It's fully self-contained, highly-mobile, amphibious, and air-transportable.

3. Hind A, M1-24, combat assault helicopter—Powered by two 1,500 shp turbine engines mounted side by side above cabin. Carries a 12.7-mm **M-6** mounted in nose; also can carry four 32-shot 57-mm rocket pods or four 250-kg bombs or two 500-kg bombs, also 4 AT-2 or AT-3 ATGMs.

4. AT-5 Spandrel, wire-guided, Saclos ATGM system mounted on a BRDM-2 scout vehicle. Mount can be folded backwards into the hull for reloading under armor protection. Maximum estimated range 4,000 meters.

5. T-12 100-mm smooth-bore antitank gun. Similar in appearance to the **M-1955** field gun. Frequently fitted with infrared night sighting equipment. In service in the Soviet and East German Armies.

6. MI-2 Hoplite General purpose, light helicopter. Used for reconnaissance liaison, and armed support. The only military designed helicopter not built in the USSR. Built in Poland.

BOOKS

WORLD POWER TRENDS AND U.S. FOREIGN POLICY FOR THE 1980s by Ray Cline. Westview Press, 1980. 228 pages. $20

When one thinks of pieces with energy and enthusiasm, the former deputy director of the CIA and current director of studies at Georgetown's Center for Strategic and International Studies doesn't miss. In 1976, Ray Cline published a much acclaimed insight into intelligence work, *"Secrets, Spies, and Scholars." World Power Trends and U.S. Foreign Policy for the 1980s* now takes up the theme he gave us in 1977, *World Power Assessment 1977: A Calculus of Strategic Drift.*

Dr. Cline has designed a power model on how to calculate your overall strength, that of any neighbor, and any protagonist or coveted "client state." Power theories have been around a long time, but there is nothing routine about this volume. You might like to read the introductory chapter to help make up your mind as to whether this is old ground replowed, or more akin to exploring parsecs and quasars. For example: "The structure of international ties and conflicts is based on politics, geography, and economics, but not on any neat pattern of geometry. It is politectonics. "Intuitively clear, *n'est-ce pas*?!

His concepts of power are straightforward, in spite of such jargon. The author scores the inherent weaknesses of current international organizations to arbitrate or even to mitigate power struggles, suggesting the obvious directions in which international crises now tend—to resource wars.

On somewhat more familiar though still obscure turf, Dr. Cline builds an assessment of the strategic force balance. This includes a section on measuring nuclear capabilities.

Postscript: In Table 34: Consolidated Ranklist, Final Assessment of Perceived Power, 1978, the U.S.S.R. is number one. We're number two, and not necessarily trying harder.

ARTHUR W. McMASTER
TRADOC

NATO, TURKEY and the SOUTHERN FLANK, A MIDEASTERN PERSPECTIVE. AGENDA PAPER #11 by General Ishan Gurkan. National Strategy Information Center, 1980. 67 pages. No price.

An apt, complementary piece to *Agenda Paper #10, The Soviet Threat to NATO's Northern Flank,* this paper establishes the geopolitical vulnerability of the alliance's soft underbelly.

Turkish General Gurkan sees his nation as the linchpin to security of the southern flank of NATO—the myriad other problems there, such as Greek threats to withdraw from NATO completely, notwithstanding. The essay wants to clearly recommend that U.S.—Turkish relations, which have slipped badly over the past few years, be overhauled. Now!

The author does a fine job reiterating Soviet design on this part of the world. Quoting W. Scott Thompson and his "Power Projection" work, we read, "The Soviet Union may make a quiet breakthrough, already well prepared, in Turkey, which would lead in the mid-1980's to a fundamental change in the balance of power in the Mediterranean. The Soviets would then be prepared for the development of a crisis in the Persian Gulf, where the balance of world power may well be decided in the next decade."

Suggested Western response to the threat to NATO's southern flank, obviously enough, would be to be particularly solicitous of Turkey and Greece, i.e., that they should be treated as equal partners with our other, more centrally located Western allies.

ARTHUR W. McMASTER
TRADOC

ANZIO 1944: AN UNEXPECTED FURY by Peter Verney. Batsford Press, North Pomfret, VT, 1978. 265 pages, maps. $25.50

To younger soldiers, Anzio may be an unknown name; but to the older troops of World War II vintage, it conjures up grim memories—even for one whose baptism was half a world away. Many will recall the stoic humor of Mauldin's cartoon as Willie and Joe stand finally on the Alban Hills looking down at the flat, barren pocket of Anzio; "My Gawd, here they wuz and there we wuz!" That said an awful lot about the Anzio beachhead.

Designed to turn the German flank in central Italy and break open the 1943 Winter Campaign stalemated along the Gustav Line, this inadequately planned and executed landing turned into a beachhead nightmare. It accomplished part of its objective by drawing troops away from Clark's and Alexander's front and lead to the eventual breakout; but the cost was sobering and the gamble was nearly lost.

Verney's book is a narrative primarily of the actions of the many United Kingdom units involved—English, Scottish and Irish. Operations down to platoon level are described in a lively, interesting, and factual way. Verney writes in a typical British, understated technique and livens his story with episodes of the stamina, gallantry, and irrepressible good humor of British soldiers. But he also writes honestly of the grisly face of battle in an Italian winter, of cold and mud, terror and death, of great heroism and pervading, numbing fear.

The research could have been better; the U.S. and German involvement is only lightly covered or omitted. For example, the operations of the 2d Bn, 157th U.S. Infantry, which earned a Distinguished Unit Citation, rate only a few lines, and the reasons for the wholesale German surrenders that started on 29 February 1944 are never fully explained. On the other hand, the maps are plentiful and good. The command decisions (and indecisions) of Generals Clark and Lucas are treated gently for, after all, this is a British story about British soldiers.

In summary, this is an articulate, interesting, detailed, but (unfortunately for **ARMOR** readers) one-sided review of the Anzio battle. Verney is, as he describes the soldier in his slit trench, like one of the "fleas in a blanket, seeing not more than the next nearest wrinkle."

JOHN R. BYERS
Colonel (Ret)
Alexandria, VA

ARMS AND THE MEN (THE ARMS TRADE AND GOVERNMENT) by Basil Collier. Hamish Hamilton, North Pomfret, VT 05053, 1980. 286 pages. $35

This history of the armament industry and its relationships with various governments and the military makes for interesting reading for the military professional. Too often we suffer from tunnel vision in terms of events. The interrelationships between armament manufacturers and government are generally of little immediate concern to us. We usually skip over the newspaper articles on the sale of arms to other nations. We are simply more concerned about the availability of weapon systems for ourselves. The book, *Arms and the Men,* offers us a chance to explore the world of international arms trade from a historical perspective.

One of the book's strong points comes from the author's ability to intertwine the history of Europe, warfare, and the various firms into a cohesive and readable work. *Arms and the Men* begins with an examination of the myth (?) of arms merchants plotting to extend World War I in order to improve their profits. The author then traces the history of warfare from the Middle Ages in an effort to illustrate that the "roots" of the development of the arms industry was the result of changing technologies and the increased size of forces on the battlefield. In the examination of the events of the 18th and 19th centuries, the familiar names of the world arms trade appear: Maxim, Vickers, Krupp, and others. The author explores the firms and the personalities within the firms during this period. Later chapters deal with the issues of armament during the World Wars and the post-war periods. The last post-war period found the major powers supplying and selling weapons to Third World countries on the basis of political and financial considerations. Although the focus is on the European arms industry, the American "branch" is examined in the latter chapters of the book.

The author served as a British Air Force Intelligence Officer during World War II, ending the war as Air Historical Officer, Fighter Command. As one of Britian's official historians of World War II, he established a reputation as a military historian of some renown. His previous works include *The Battle of Britain* and *A Short History of the Second World War.*

One of the intriguing aspects of this book is the sense of *deja vu* one gets as they read the description of corporate bribes in previous decades and centuries. The example illustrated by the author took place during an English debate on whether or not the arms industry should belong to the public sector. Another aspect that becomes clear as one reads the book is that the individual soldier, the final user of any weapon, is usually the last concern in any decision made on arms. The book causes one to ponder the ancient question "Is the tail wagging the dog or . . . ?"

This very readable book is recommended to the military reader. Its historical perspective gives a view of a logistical aspect of conflict that most people chose to ignore or are unaware. The book, however, is not without flaws. First, the portion of the book that reviews the modern era of arms trade is rather skimpy in comparison to the early years. Second, there is really no summary or conclusion which sets the stage for thinking about the future. For example, China, as a potential receiver of modern arms, rates only a paragraph or two. Finally, the book may be beyond the price range of many readers.

Arms and the Men, the history of the armament industry and its relationships with governments, can provide the reader with some insightful knowledge of the development of the "military industrial complex." It is worth the time and effort to read.

ALBERT F. LEISTER, JR.
Major
Department of Behavioral Sciences and Leadership, USMA

CRY COMANCHE by Colonel Harold B. Simpson. Hill Junior College Press, 1979. 186 pages. $10.50

In 1885, faced with rapidly expanding borders and too few soldiers to patrol the frontier, the Congress of the United States authorized the formation of two additional mounted units—the 1st and 2d U.S. Cavalry Regiments. The 1st Cavalry was sent to the Kansas-Nebraska frontier; *Cry Comanche* is the story of the 2d U.S. Cavalry Regiment, also known as the "Jeff Davis' Own."

Active for only 6 years, the regiment was from its beginning an elite organization. Jefferson Davis, then Secretary of War, assumed the authority to maintain the two cavalry regiments as separate branch of the service; thus, he staffed the 2d Cavalry by the merit system rather than by seniority, and he chose the best.

It is believed by many military historians that Davis, seeing the Civil War as inevitable, was forming the leadership of his future Confederate Army while organizing the regiment. Though his motives may be the subject of speculation, this much is fact: 20 of the 34 officers initially assigned to the regiment were Southerners by birth and graduates of West Point; 16 later became Civil War generals—5 for the Union, 11 for the Confederacy; and one-half of the Confederate Army's eight full generals (Albert Sidney Johnston, Robert E. Lee, Edmund Kirby Smith, and John Bell Hood) served with the original 2d Cavalry.

Commanded by Johnston, with Lee as its lieutenant-colonel, the 2d Cavalry Regiment saw long and arduous duty along the thousand-mile Texas frontier. The previous national policy of defensive patrol had proved inadequate and inefficient, and it fell to the regiment to implement the War Department's newly-developed plan of active pursuit and offensive strategy against the Indians. It did so with distinction from 1855 until Texas seceded from the Union in 1861.

Secession forced the return of Federal troops to the North. In August 1861, following a re-numbering of mounted units by seniority, the 2d Cavalry Regiment become the 5th Cavlry Regiment, a designation it still carries.

The regiment's encounters with the Indians and with Mexican bandit Juan Cortinas are well-chronicled by Colonel Simpson. His research has been extensive and he is an authority on his subject. He presents in fascinating detail the political disagreement surrounding the inception of the 2d Cavalry, the logistics involved in forming a mounted regiment, and the reality of military operations on the Texas frontier. *Cry Comanche* is a historical tribute to the 2d U.S. Cavalry Regiment and to all who served with it.

LINDA ANDREWS
Harker Heights, TX

THE ARMOR DESK

The first reaction a visitor to **ARMOR** Magazine experiences is surprise that such a small out of the way operation can turn out such a high quality magazine. **ARMOR** occupies a small house on Vine Grove Road halfway between the Gold Vault and Lindsey Golf Course. Despite its location and small staff, the dedication of its employees to excellence has insured that it remains a critical conduit of information to the worldwide armor community.

As a new editor, it is important to recognize the vital role that each member of the **ARMOR** staff plays in getting an issue before the public.

Leading the line-up is Managing Editor, Royce Taylor. Royce is our resident infantryman having been commissioned in that branch from the University of Kentucky ROTC in 1942. He served for 2½ years in combat in the Southwest Pacific during World War II. Following the war he served in varied assignments, including several with armored divisions, until his retirement as a lieutenant colonel in 1962. He worked for four years as a public relations specialist before joining the Civil Service in 1966. Royce has been in the editing business ever since, working in various positions overseas and at Fort Knox. Royce joined the **ARMOR** staff in 1975 and has rendered yoeman service coordinating the production and management of all aspects of the magazine.

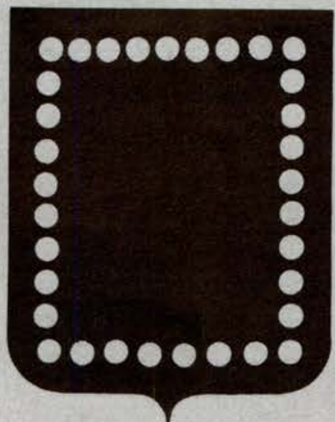
Karen Randall, the Art Director, is well known for her detailed renditions of armored vehicles, equipment and troops. Before joining the magazine in 1976, Karen worked as a commercial artist and graphic arts specialist while attending the University of Louisville part-time. Her paintings, etchings, and pen and ink drawings have earned many awards in numerous art shows and exhibits throughout the Kentuckiana area. She is best known in the armor community for a series of prints of historical and modern tanks and other fighting vehicles she produced under commission for the U.S. Armor Association. The M-48A3 tank and the AH-1S helicopter are the newest editions to her series. She is equally at home working in the small studio at **ARMOR** or in the cramped confines of an M-60A1 turret with a sketch pad in hand.

Jeannie Bright, our Administrative Assistant, has been with **ARMOR** for nearly four years. She entered the civil service after graduating from LaRue County High School, Hodgenville, Ky., in 1974 and worked in various positions with the post AG before joining the armor staff. She is the girl friday of the staff answering phones, greeting visitors, typing correspondence and handling a myriad of tasks too numerous to mention.

Mike Amowitz, the Assistant Editor, is the newest member of the staff. A 1976 journalism graduate of the University of Richmond, the Lynchburg, Va., native has had an extensive journalism background, having been a press aide to a state legislator, a radio announcer and news director, a public relations director for a district planning commission, and most recently a newspaper reporter and photographer. He joined **ARMOR** in 1980 after completing the TRADOC Information and Editorial Career intern program. Mike is the editorial jack of all trades.

While the staff is first rate, the secret of **ARMOR's** success, resides in the contributions of thought provoking and informative articles by our readers. The response has been overwhelming and the success measured most recently by **ARMOR** winning honorable mention in the magazine category of the National Association of Government Communicators' annual Blue Pencil Competition for outstanding government publications. A thank you and best of luck is due LtC Fred Shirley who molded such a fine team and who now becomes the Fort Knox Public Affairs Officer.

CRS



Crest

On a wreath argent and vert, a mound of the last charged in base with a broken meat hook of the first and supporting a castle of two towers of the like, the castle wall embattled of five and charged with a lion rampant sable, armed and langued gules, beneath an escutcheon tierced per pale of the second, the fourth, and the second, charged with a mullet or.

Symbolism

The shield is the green and white of the Armored Force. The thirty-three plates designate the number of the regiment. The white (silver) castle on a green mound is taken from the coat of arms of Mons, Belgium. Only two of the castle towers are shown, representing the two attacks on Mons in 1944 spearheaded by the unit. The capture of Mons from the German Seventh Army is alluded to by the meat hook (a charge found in German heraldry), the broken pieces of which simulate the numeral 7. The liberation of Mons is symbolized by the black lion taken from the coat of arms of Hainaut Province. The award of the French Croix de Guerre with Silver Gilt Star is symbolized by the green, red, and green shield with gold star. The five embattlements of the castle wall represent participation in five World War II campaigns.

Distinctive Insignia

The distinctive insignia is the shield and motto of the coat of arms.

33d Armor

Men of War

Constituted 13 January 1941 in the Regular Army as 3d Armored Regiment and assigned to 3d Armored Division. Activated 15 April 1941 at Camp Beauregard, Louisiana. Redesignated 8 May 1941 as 33d Armored Regiment. Inactivated 10 November 1945 in Europe.

Regiment broken up 7 July 1947, and reorganized and redesignated as follows: 33d Armored Regiment (less certain elements) as 33d Tank Battalion; Headquarters and Headquarters Company, 3d Battalion, and Companies G and H as Service Company and Companies B and C, respectively, 7th Tank Battalion (remainder of 7th Tank Battalion from elements of the 32d Armored Regiment); Reconnaissance Company as Troop E, 83d Mechanized Cavalry Reconnaissance Squadron (hereafter separate lineage). Headquarters and Headquarters Company, 2d Battalion, Companies B, C, and I, and Service and Maintenance Companies disbanded.

7th and 33d Tank Battalions activated 15 July 1947 at Fort Knox, Kentucky, and assigned to 3d Armored Division. Reorganized and redesignated 30 July 1948 as 7th and 33d Medium Tank Battalions. Reorganized and redesignated 15 March 1955 as 7th and 33d Tank Battalions. Inactivated 1 October 1957 in Europe; concurrently, relieved (less Company D, 7th Tank Battalion) from assignment to 3d Armored Division.

Headquarters and Headquarters Company, 2d Battalion; Service Company; and Companies B, C, and I, 33d Armored Regiment, reconstituted 28 May 1948 in the Regular Army and redesignated as Headquarters, Headquarters and Service Company, and Companies B, C, and A, respectively, 62d Heavy Tank Battalion. Assigned 18 June 1948 to 10th Infantry Division. Activated 1 July 1948 at Fort Riley, Kansas. Reorganized and redesignated 15 June 1954 as 62d Tank Battalion. Inactivated 7 July 1957 in Germany. Relieved 1 October 1957 from assignment to 10th Infantry Division.

33d and 62d Tank Battalions and elements of the 7th Tank Battalion consolidated and redesignated 1 October 1957 as 33d Armor, a parent regiment under the Combat Arms Regimental System (Headquarters, Headquarters and Service Company, 33d Tank Battalion, concurrently, redesignated as Headquarters and Headquarters Company, 33d Armor).

Campaign Participation Credit

World War II

Normandy
Northern France
Rhineland
Ardennes-Alsace
Central Europe

Decorations

Presidential Unit Citation (Army), Streamer embroidered *Hastenrathscherpensel* (Headquarters and Headquarters Company, 1st Battalion, 33d Armored Regiment, and Companies A, F, and I, cited; WD GO 66, 1945).

French Croix de Guerre with Silver-Gilt Star, World War II, Streamer embroidered MONS (33d Armored Regiment cited; DA GO 43, 1950).

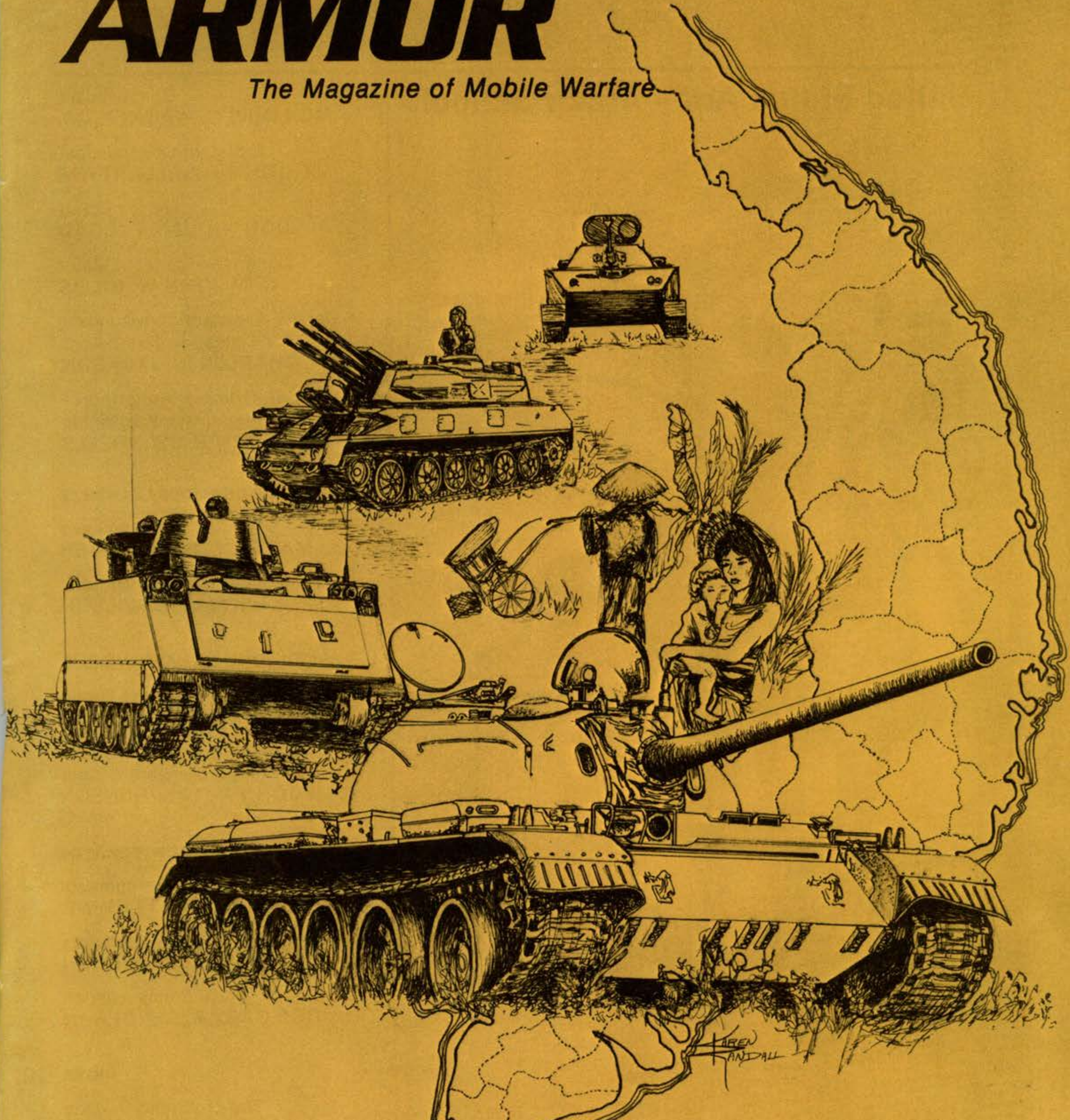
Belgian Fourragere 1940 (33d Armored Regiment cited; DA GO 43, 1950).

Cited in the Order of the Day of the Belgian Army for action 3-13 September 1944 in BELGIUM.

Cited in the Order of the Day of the Belgian Army for action 20-25 December 1944 in the ARDENNES.

ARMOR

The Magazine of Mobile Warfare



July-August 1981

United States Army Armor School

"To disseminate knowledge of the military arts and sciences, with special attention to mobility in ground warfare, to promote professional improvement of the Armor Community, and to preserve and foster the spirit, the traditions, and the solidarity of Armor in the Army of the United States."

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July-August 1981 Vol XC, No. 4

FEATURES

DEPARTMENTS

COVER

On 30 April 1975, a North Vietnamese Army tank roared through the gates of the Presidential Palace in Saigon signaling the defeat of the Republic of Vietnam. The North Vietnamese armored forces had been mauled in the 1972 offensive, but they learned their lessons, reorganized, and in 1975, fought back, using armored fighting vehicles supplied by their allies or captured during the offensive. Beginning on page 48, the decisive role of North Vietnamese armor in the 1975 campaign is recounted by Lieutenant K.N. Stacey, Royal Australian Armor Corps.

LETTERS

Flyswatter Deserves More Study

Dear Sir:

Mr. Douglas's *Flyswatter* concept in ***ARMOR*** (January-February 1981, pp. 28-30) is an interesting proposition to which I would like to add some comments that may help him pursue it better. First, the original concept has not been dormant all these years, as the French have worked on the *Javelot* during the interim. Although I have not run down the entire history of the French system, I have seen literature on it for at least the past 9 years. It has grown into a vehicle-mounted box of sixty-four 40-mm spin-stabilized rockets that are aimed at the target by radar and/or an electro-optic fire control and fired to a range of over 1,500 m in groups of 8, 16, or 32. This shows that the technologies and interest are still alive to some extent, although in a size far too large for a man-portable weapon.

The second point I would like to make is with respect to getting a useful warhead effect against the target. I have followed and written about the *Hind* helicopter for quite a while. I doubt if old 20-mm, gun-fired projectiles would do much damage. I also doubt that the Army would ever use old projectiles in the manner suggested because they just always have to cook up something new.

On the other hand, a great deal of research has also been performed on air defense in order to design the West German *Gepard* and the two U.S. *DIVAD* contenders. From these, I suspect that the warhead for the *Flyswatter* concept should be about 25 to 30-mm with a high-explosive fill content equivalent of a gun-fired shell of 35 to 40-mm. This could be achieved because the rocket warhead could have a longer length-to-diameter ratio if it had a combination of spin and drag stabilization or fin stabilization. I also suggest the warhead could use a base detonating impact/fly-by proximity fuze and an internal configuration that yielded a forward shaped-charge jet and sideways *Walleye*-type linear shaped-charge jets. This would allow the warhead to pierce and damage lightly armored vehicles and aircraft that it might hit. The linear shaped charges and proximity fuze would give a cluster of these rockets the same planar pattern in the vicinity of the target that the Air Force wide-area munitions had against tanks on the ground, namely, a criss-crossing, spiderweb pattern. The effectiveness against aircraft and helicopters would have to be determined through testing.

The third point is with respect to getting hits on the target. The *Flyswatter* approach is based upon a "shotgun" technique of putting a lot of lethal projectiles into a given area. In contrast the *Redeye, Stinger, Strela*, etc., try to fly a warhead to a target so that the fired round always theoretically hits the target. Unfortunately for the latter, they get into the countermeasures game with electronics.

Dumb-bullet air defense systems such as guns and the *Flyswatter* are, on the other hand, dependent upon the fire control for aiming at the target with the proper lead. Fire control solutions are known to be driven by the time-of-flight, which is of course determined by the engagement range and the rocket's velocity. Just like a tank gun firing APFSDS, the *Flyswatter* would be best if the rockets were as fast as present technology would permit. Just as Mr. Douglas has noted, a modern sight and modern propellants would control the effective range of his *Flyswatter* concept. If the warheads were lethal enough, he might even get more than 1,000 m out of 5 to 6 rounds.

I believe that Mr. Douglas' concept deserves further study with emphasis on new propellant and warhead technology. When these are selected, the prototyping of a few basic systems could provide data for the determination of how much further it should be pursued. The product-improved version might also be configured with a laser or mm-wave based lead computing sight so that the effective range could be stretched out as far as the rocket technology would permit.

JOSEPH E. BACKOFEN, JR.
Ordnance Technology Section
Battelle Columbus Laboratories
Columbus, OH

AWOL Free

Dear Sir:

The article on "AWOL Prevention" by Captain Mark P. Hertling *(Jan-Feb 81)* was very good in all respects except for his remarks about having the longest AWOL-free days in FORSCOM. He may have the current running record in FORSCOM but in no way is it the longest record. As the recent commander of Battery C, 1st Battalion, 37th Field Artillery, Ft. Wainwright, Alaska, I would like to inform Captain Hertling that this unit has a record of over 3 years and 4 months. As Captain Hertling noted, luck has a lot to do with the number of AWOL-free days. No matter how good the program is or how outstanding the first sergeant and NCOs are, luck has a part in any record. To all those units in the Army with long-running, AWOL-free days, such as A-3-77 Armor, I wish you continued success in your program and a lot of good luck.

GEORGE M. CLAXTON
Captain, Field Artillery
Houston West Recruiting Area
Houston, TX

Compliments to the Sergeant Major

Dear Sir:

I read the article "The Driver's Seat" (Jan.-Feb. 1981 issue) with great interest. I felt, as did CSM Gillis, that here was another article theorizing on what has happened and why. We do not need to determine what happened, but to apply remedial action to correct what happened.

There is a theory in management that states simply that the more a person takes upon themselves to do, and does well, the more latitude (translate as authority and responsibility) that person will get from his manager. Now that we all see that, for our Army to be successful, the NCOs must play a greater role in leadership, training management, and training, it is incumbent upon them, to take up their role without "waiting for it to be thrust upon them." That thrust will never come of its own volition.

I fully agree with CSM Gillis that, in exercising authority, all three versions of leadership—authoritarian, persuasive, and psychological—have to be employed. But we use the authoritarian style less than we should. I believe that most of us are afraid of the authoritarian style. We are afraid because we have been taught that it is wrong and we don't use it because we all want to be loved, and who will "love" the big, bad boss?

As an ex-first sergeant, I feel that the respect and even love and admiration of the troops will come, regardless of your style, only if you know what you are doing, show the troops that you know, and are fair and even-handed in your dealing with all of them, and that rewards and benefits are forthcoming from you as readily as punishment.

Troops respect what you know and what you do. One of the bright spots is the realization in the Army today that NCOs at all levels are the trainers of today. Each of us, by implementing that concept and by making it work in our sphere of influence, will benefit themselves, their troops, and the Army. Let's not wait for the System to "give" us our authority, let's take it by initiative and motivation.

A.H. STERNBERG
MSG, TXARNG
HHB/1-133d FA

Comments on the T?

Dear Sir:

I have been studying the photo on page 33 of the JanuaryFebruary issue of ***ARMOR***, and might offer a possible explanation of the unidentified short tube immediately to the right of the main hatch. The container could be a protective case for a night scope for the 12.7-mm antiaircraft gun. Since the size and shape are right for such a device, and knowing the Soviet concern for air defense, I propose this as a possible answer. Additionally, outside storage, in a watertight container, is not unreasonable for such a device, especially in view of the limited amount of interior space inside the turret.

ROBERT PATRICK ARNOLDT
Oak Park, IL

Looking for Tank Destroyers

Dear Sir:

In the July-August 1980 issue of ***ARMOR,*** you printed a letter of mine describing a book I'm writing on the Elsenborn Ridge, Belgium, sector of the Battle of the Bulge in December 1944. My letter was an attempt to contact veterans of four tank destroyer battalions (612, 644, 801, 893) that played a critical role in stopping attacks of the German First SS Panzer Corps in that sector.

The letter produced zero response from TD veterans. So I'm making my plea again. If during the period December 16-25, 1944 any of your readers served with one of the four units that participated in the defense of Elsenborn Ridge, I would be most interested in hearing from them. Ex-infantrymen, tankers, artillerymen, and engineers are filling me in on their experiences.

JOSEPH C. DOHERTY
PO Box 7412
Benjamin Franklin Station
Washington, DC 20044

Questions Concerning the CFV

Dear Sir:

There was a most disturbing statement made in Clifford D. Bradley's article, "Future Close Combat Vehicles,": "In the case of the CFV for all armies worldwide, the role or mission has not been a major determinant in shaping the configuration, characteristics, or size of this vehicle, as it has been in the cases of the tank and the IFV."

It took the Army many years, beginning with the *MICV-65,* to decide on the proper role of an IFV, but the *M-2* finally resulted. The *MICV-65* was a part of the *XM-551* or *Sheridan* concept which contemplated, in addition to it, a whole series of common chassis vehicles: a lightweight MBT, armed with a 75- or 105-mm gun or a 152-mm gun-launcher; a 155-mm self-propelled mount; vehicles variously armed with a *Vulcan,* twin 30-mm AA guns; the *Mauler* (a 20-mm gun), a laser RF with one machinegun; vehicles for command, recovery, bridging, cargo-carrying; an airborne crane; an armored engineering vehicle, and an ambulance. So far as I know, only the lightweight MBTs actually were built. At least those are the only one represented by photographs in the files of the U.S. Army Audio Visual Agency. A lot of money had been sunk into the *Shillelagh,* so a potential reconnaissance vehicle was made out of a lightweight MBT.

Over the years, IFV designs abounded, but finally, the *M-2* evolved as a suitable companion for the *M-1* tank. But why did the *M-3* turn out to be practically a twin? The answer might seem to bear out the fear expressed by Captain Randy Tatum in his letter to the editor in the same issue. In it, he questions the upgunning of divisional cavalry units with a "60-ton tank and a CFV that is as tall as a barn," because it will obscure cavalry's reconnaissance role.

Or it may be that Mr. Bradley is right and that the *M-3* was adopted just to get something better than the *M-114* rather than trying to define "the role or mission of a CFV." The article, "A New Option for the *M-551,*" seems to be perpetuating the interim MBT character of the *Sheridan* rather than converting it to a reconnaissance role. It is probably too late to accomplish that, but it seems a tremendous waste to scrap all those potentially usable vehicles.

ROBERT J. ICKS
COL, USAR (Ret)

Maintaining Professionalism

Dear Sir:

I find that prolonged assignment in the rear echelon tends to cause atrophy of skills and knowledge that are vital to a functioning combat arms officer.

Being a member of the Reserve Components makes it more difficult to stay current simply because the opportunity for experience is limited. When I worked full time as an operations and training officer for the National Guard, staying up to date was easy. Now that I work under the G-1 directorate at the state headquarters, keeping abreast of what's going on in the combat arms is a challenge. The lack of conversation and exchange with others, limited or nonavailable reading materials, and the tendency to neglect your basic branch skills in favor of paper shuffling, make it tough to stay competent, let alone current. I submit that, as a potential commander or up front leader, an obligation exists for *every* combat arms officer to stay as current as possible with the changing aspects of the trade.

Sooner or later, we all digress from the turret to the fancy office or nebulous staff duty. We all know that its part of what goes with the job, and that's fine. However, I think it's a shame that so many officers, as I suspect, are as far behind in current state-of-the-art knowledge. I'm not sure how to fix this shortfall, but it's a major problem for the part-time Guard or Reserve officer. When keeping the buzz words, "come as you are war," in mind, thousands of semi-well-trained troops can be placed in jeopardy under a leader using bad information, old doctrine, or simple ignorance of what's new.

Among the ways around the problem, the professional journals, extension courses, and many other means to attain technical sufficiency exist. However, too many officers either don't have the time, or frankly lack the diligence to become expert in their branch specialties. If this condition exists in 4 out of 10 officers, it's excessive. We cannot afford one single self-imposed liability if we expect to survive. I question how the officer corps perceives "the sense of urgency." Is it how well we impress the boss with peacetime razzle-dazzle, or is it how we prepare our troops for battle? General Starry's article: "Does Armor Have a 'Ho Hum' Attitude?", (July-August 80) makes the point rather well. While it takes some dedicated effort to round up the means to stay current, I think a well-placed kick in the "grill doors" is in order for many out-of-touch officers.

I notice that the Noncommissioned Officer Education System (NCOES) seems to provide for continuous update and training of the NCO corps. Master gunners are kept abreast of new developments directly from the school. Active officers may not experience the void, and those few full-time (RC) staff members in the training business may also feel up to speed. The majority of (RC) officers, in my opinion, are not as current as they could be, and need to be.

We also realize that the tendency to reinvent the wheel comes around to confuse us all periodically. I'm not sure what method or brand of leadership is necessary to impress on us all the urgency of situation or the vital nature of effective U.S. military readiness, before the fact. Keeping current is not digesting the latest ***ARMOR*** magazine. Unless something better than convenient interest is generated with regard to becoming professionally expert, time for catch up will run out, and the troops will suffer. It's past time to get serious.

SAMUEL T. CONN
MAJ, Armor
KSARNG

AWOL Prevention in the Reserve Component

Dear Sir:

The article, "AWOL Prevention," by Captain Mark P. Hertling in the January-February issue of ***ARMOR*** was very informative and stimulating. I am sure Captain Hertling has been commended on his AWOL Prevention Program. However, most of his program can only be accomplished if an individual is on active duty.

Looking at the "Total Army Concept" we have to develop a program that will work not only in the Active Army but also in the National Guard and the Army Reserve. It is less difficult to control the actions of an individual when we have personal contact with that individual on a daily basis. Here in the National Guard and Army Reserve, we see our soldiers for only 2 days out of 30 and sometimes longer if our drills are scheduled in the beginning of one month and at the end of another. Additionally, when on active duty, the commander has many more disciplinary avenues at his or her disposal. In the Reserve Components, we have very few enforcement procedures that we can use effectively.

The Department of the Army must develop a functional program that is responsive not only to the Active Army, but also to the Reserve Components.

RICHARD A. PACKARD
Sergeant First Class, NJARNG
Personnel Staff NCO

Setting the Record Straight Regarding the Heavy Tank

Dear Sir:

Captain Matheny, in his enthusiasm for the heavy tank, has been a trifle careless with some of his assertions, and we feel it would be allowing him to weaken a good case if we were not to point them out.

The *M-6* heavy tank had a 76-mm gun, not a 75-mm; only a millimeter, but a considerably different weapon to the 75-mm then mounted on the *M-3* and *M-4* mediums. It was developed from the 3-inch AA gun, the *T-9*, and fired a 15.4-lb armor-piercing round with an armor-piercing cap (APC) at 2,800 feet per second. It was probably the most powerful gun in a tank at that time, since the 76-mm on the Soviet *T-34* could only muster 2,175 ft/sec. So the complaint of the Armor Board that it was undergunned was entirely spurious. Moreover, the evaluation of the *M-6* was not delayed until mid-1943; it had been standardized in February 1942 and contracts let for 5,500 tanks. In April of that year, there was a modification to the brakes and cooling system, which overcame earlier objections, but, without further testing, the Armor Board and the Army Ground Forces declared it unreliable and overweight. Eventually, on December 7, 1942 the Chief of the Armored Force declared no requirement, and the whole thing was knocked on the head. It is generally conceded that personality differences and in-house politics did in the *M-6* rather than any tactical shortcomings.

It is, in our view, erroneous to call the *T-95 GMC* "our version of the *Tiger.*" The *Tiger* at least had a turret; it would be better to compare it with the *Ferdinand* or *Tortoise,* both of which were limited-traverse weapons.

Finally, we think it misleading to call the *M-103* "the American version of the British *Conqueror,*" or to say that it "was patterned after the British *Conqueror,*" since there was no cooperative development so far as the vehicles were concerned. traced back directly to the aforementioned *T-95*, while the *Conqueror* began as the A-45 Infantry Support Tank in 1944. You need only to look at the suspensions to see that the two designs are completely different. The only point of contact is in the gun, which the British developed around the US cartridge for commonality's sake.

Sorry to carp; but if we don't get things right now, future historians will be in an even bigger muddle.

IAN V. HOGG
Military Editor
Defence Magazine
Windsor, England

The Army's Not Easy

Dear Sir:

Several thoughts occurred to me while reading the Nov-Dec 80 issue of ***ARMOR***. There are so many different opinions and views on everything from armor plate to types of soles for boots that, on the equipment side of things, you can get 15 different answers to one question. Then there are tactical and doctrinal questions that don't match up, and, as always, there are branch differences of opinion.

There seem to be no concise or clear judgements on anything. This does not do anything for the basic trooper. Constant confusion causes morale problems. Of course, it is not easy to deal with all of the problems and questions at hand. They are many-faceted and complicated, but they must be dealt with.

A current recruiting advertisement says "The Army's not easy...". This is true, but a real soldier doesn't want the Army to be easy. He can handle whatever comes up, he's trained for it, he's got what it takes to meet any challenge.

Running the Army is not easy either. The people above the rank of captain must really address the issues and come up with sound and timely decisions. Leaders at all levels must lead. We have run out of time for indecision. I say let's forget about shoulder boards for green shirts and get the new camouflage and tank crew uniforms to the people. Let's get input for improved training. When I need an *M-88* that has a crew on it, I don't need to hear about supply and recruiting shortfalls, manpower and equipment deficiencies, or the proverbial "Wait one." The total force concept, to me, will work, if available assets, *all* of them, are used as efficiently as possible. We are the Army of the United States; let's act like it. We must all, PFCs and major generals, get with it. We *must* meet global commitments *now*. The survival of the nation demands that we do so.

SSG MICHAEL DALY
Trp E, 105th Cav
32d Sep Inf Bde (Mech)
WISARNG

Bring Back the Regiment

Dear Sir:

The November-December 1980 issue of ***ARMOR*** contained two articles which were interesting and thought provoking, "Increased Combat Power," by Lieutenant Colonel Ralph G. Rosenberg and in the Professional Thoughts section, "Combined Arms Operations—Ours versus Theirs," by Major R.W. Nall.

In the latter article, Major Nall made a good case for the establishment of a combined arms organization *a la* the Soviet motorized rifle regiment as the basic tactical brigade or regimental-sized unit in the U.S. division. Unfortunately, as pointed out by Lieutenant Colonel Rosenberg, the combined arms fixed brigade proposed by the Armor Center was rejected by the Division 86 study because the Army "is not ready." This is not only disappointing, it is a missed opportunity to reorganize the US Army into effective units that, as Lieutenant Colonel Rosenberg pointed out, "recognize how we fight" as combined arms task forces and brigades.

I feel the Division 86 study also missed an opportunity to do away with divisional brigades and the nebulous Combat Arms Regimental System (CARS) and reconstitute the regiment as a unit in being—the basic tactical unit of the division. This is not a reactionary step backwards into an unflexible organization because division commanders could tailor regiments for combat the same way brigades are now tailored for operations. As combined arms units, however, this tailoring would not always be necessary. When an operation is over, attached battalions would revert to their parent regiment. After all, does any brigade in the present division really function only as a tactical headquarters? Of course not. Every brigade in the Army considers certain battalions as its own as if it were a fixed organization. Why not recognize reality and put the proud old regimental colors back in the three tactical command posts of the division?

For some reason, the regiment always served as a morale factor, but soldiers who used to feel pride in a regiment feel no particular affection for a brigade. Also, most soldiers really don't understand CARS, the system of regiments our battalions allegedely belong to but that really don't exist. Yet, the very fact that CARS exists shows how important the regiment is to morale, *esprit*, history and traditions.

I propose that sometime in the near future the Army consider a semi-fixed combined arms (CA) regiment which could be tailored for combat by the division commander if need be. CA regiments would carry the numbers and colors of either infantry or armor regiments depending on whether they are mechanized or infantry heavy or armor heavy. Balanced regiments could either be infantry or armor depending on what regiments had been traditionally associated with a particular division; i.e., balanced regiments in an infantry division would be infantry regiments. The regimental headquarters would still function as a tactical control headquarters and the division base would continue to provide personnel, administrative, and logistical support.

The division artillery should also be a regiment regardless of how it is organized or the number of battalions assigned to it. The air cavalry attack brigade should too. A regiment does not have to be fixed, an unflexible organization any more than a brigade or group does. A regimental designation would give both of these organizations more identity. A modified CARS would still have to exist, however, to give identity to separate battalion-sized units like the division air defense artillery battalion.

I would also like to see a merger (many will cry heresy) of infantry and armor into one maneuver arm. Infantry and armor would live on in the regiments just as cavalry does in the armored cavalry regiments and squadrons today. Officers could still wear the insignia of their specialty, infantry or armor, but would be managed and assigned simply as "line" officers.

Many thanks to ***ARMOR*** for continuing to bring us fine articles like those by Lieutenant Colonel Rosenberg and Major Nall, and for giving us all a forum for ideas on professional matters.

KELLY M. MORGAN
Maj, Armor, USAR
3289th USAR School

Corrections

Dear Sir:

I have read my article "World Tank Production" as published in the March-April 1981 edition. I wish to point out two errors and one update. In table 2, World Tank Production 1979, the total production for Japanese Type 74 should be 150 vice 15. Table 5, World War II Tank Production should indicate the total Soviet Production of 95,099, as including tanks and SP guns. The production figures are from page 441 of *The Great Patriotic War of the Soviet Union 1941-1945, A General Outline,* Progress Publishers, Moscow, 1970. In January 1981, *Soviet Military Review* published an article on self-propelled weapons by COL V. Botin that gave the total Soviet production of SP guns during World War II as over 21,000 SP guns. Thus, the total production of Soviet tanks during World War II is probably slightly less than 74,099.

GERALD A. HALBERT
Captain, Military Intelligence

COMSEC

Dear Sir:

I read with interest the article entitled "The 'V' Maneuver Technique" by Colonel Robert E. Wagner. The 2d Armored Cavalry Regiment (ACR) seems to have discovered an excellent system and is using up-to-date training methods to teach it.

However, the Colonel, or perhaps the entire 2d ACR, doesn't appear to have heard about the new CEOI, and that we are no longer using "6" and combinations including "6" to designate our leaders. Perhaps the Colonel should devote some command emphasis to this to insure they aren't all targeted by the first strike of the bad guys and "V" maneuver goes for naught.

A.H. STERNBERG
MSG, TXARNG

Power-to-Weight Ratios

Dear Sir:

In response to Captain McCaig's letter in your January-February issue, titled "Power to Weight Ratios," I could not agree more that increasing sprocket or wheel horse-power-per-ton yields increasing rates of burst acceleration. However, the ability of the tracks or drive wheels to transmit that power can quickly become the limiting factor. Increasing sprocket or drive wheel torque beyond the traction coefficient will result in smoke and dirt thrown in the air, but remarkably little improvement in forward process.

On the point of torque converters lacking response or holding back the engine after a step increase in throttle opening: I recommend to Captain McCaig that, when full throttle is requested, any engine must first accelerate to high rotational speed before it can provide maximum horsepower for vehicle acceleration. Torque converters permit the engine to accelerate to its own speed, while simultaneously multiplying engine output torque to accelerate the vehicle.

This characteristic is controlled in such a manner so as to maximize vehicle acceleration over a distance. Different engine types also have different response characteristics, independent of this type of control.

Other methods have, and are still being tried to exert transmission control over engine speed for hoped-for improvements in acceleration, as well as fuel comsumption. Independent Army testing, reported in TACOM Technical Report No. 11675, Aberdeen Proving Ground Report No. PG-MT-4848, Amex III: Mobility Evaluation of XM-723 MICV (DT-II Phase), and TACOM Letter Report—Contract DAAEO7-74-C-0019, consistently document a 7 percent sacrifice in acceleration and a 12-21 percent penalty in fuel consumption, due to internal inefficiencies associated with the alternate methods tried thus far.

Lastly, I suggest that Captain McCaig also consider that acceleration response comparisons between vehicles must take into account differences in sprocket or wheel horsepower available per ton. An M-60 tank with approximately 8.5 sprocket horsepower-per-ton cannot respond to throttle changes in the same way as a passenger car at approximately 70 wheel horsepower-per-ton, or even a truck at some interim value.

J.R. LUCAS
Detroit Diesel Allison
Indianapolis, IN

Needs Back Issues of Journal

Dear Sir:

I need the following two issues to have a complete set of Cavalry Journal and Armor-Cavalry Journal; December 1895; and Armor May-June 1956. If any armor readers possess or know the whereabouts of those issues please contact me at P.O. Box 44, Bryan TX 77801. Phone 713/779-6366.

JOHN M. CARROLL

Disagrees with the "V"

Dear Sir:

Your March-April 1981 issue carried an article by Colonel (P) Robert E. Wagner entitled "The 'V' Maneuver Technique." With all due respect to Colonel Wagner's experience and distinguished career, he would have us believe that the "V" is some new and exciting armor-infantry combat formation. The fact of the matter is that the "V" formation was taught to infantry officers in the mid-to-late 1960's while armor/cavalry officers were being instructed on the similar "Y" formation.

The "V" lost popularity as an effective maneuver technique because, contrary to the article, it forced a commander to make contact with the bulk of his unit, thereby severely restricting his tactical options. "Maximum firepower forward" is advisable when the strength and location of the enemy force is fairly well known and within the offensive capabilities of the friendly force. Many commanders proferred (and wisely so) to make contact with as small a force as possible and thus retain the capability to react to the situation with a sizable amount of retained firepower. This thinking ultimately led to the development of overwatch as a maneuver technique—the basis of the series of "How-to-Fight" manuals.

The "two up, one back" organization of the outdated "V" is not the way to give our already outnumbered commanders a fighting chance. Current overwatch doctrine provides for the mutual support and flexibility that the article refers to. It also allows the commander to keep from showing his hand too early in a fight with a superior strength enemy force.

The revitalization of the "V" formation is a throwback to the lock-step tactical thinking of the pre-Vietnam era. By sheer logic, it defeats the purpose for which Colonel Wagner "designed" it—forcing commanders into a "toe-to-toe, linear slugging match."

GUY W. SWAN, III
CPT, Armor
3/3d ACR

Light vs. Heavy

Dear Sir:

The recent letters, articles, opinions, and biases concerning light armor versus heavy armor that have appeared in recent issues of **ARMOR** are interesting indeed, and are not untypical of trends *between the wars*. Thoughts always turn "light" during such periods, and they are dangerous. Motorcycles and dune buggies are fun to play with when one is only being shot at with harmless MILES lasers.

Light tanks are easier than heavy tanks to maintain and transport, look dashing on parades and are easier to yank out of the back of big, slow, low-flying aircraft that are most attractive to heat-seeking missiles, particularly behind enemy lined.

The ultimate role of any equipment, and of course of the soldiers who must fight this equipment, is to be successful in combat. No more, no less. I sense that there has been little consideration of this basic criteria when advancing one's views on these pages. It is with some experience that I can describe the performance of the *Sheridan* in combat, in a single word: miserable.

The 3rd Squadron, 4th Cavalry transitioned in Vietnam from *M-48A3s* to *M-551s* early in 1969. As the commander of that splendid organization during that time, I officially supported the *combat testing* of the *Sheridan* light tank. My personal feelings were quite otherwise. Some of the major dificiencies of the *Sheridan in combat* are described below.

- The electric probe of the firing mechanism was unreliable. (and we had only conventional ammunition).
- The sprockets were excessively worn in the jungle and the "unthrowable" tracks were thrown not infrequently.

The caseless ammunition cracked or broke while in turret ready racks.

- When the turret was penetrated by RPG rounds, the main gun ammunition exploded within 30, and more often within 15 seconds, (thus, no gunner could sit in the gunner's seat; he became the rear bustle guard and the TC fired from the hip).
- .50 caliber ammunition as stored on the turret was consumed almost in minutes—it was necessary to jury-rig racks for extra .50 caliber ammunition.
- The vehicle was not mine-proof, even with belly armor attached.

Most mine/vehicle incidents resulted in the vehicle being a total combat loss.

I cannot comment on the combat durability of the automotive system—we never kept a *Sheridan* long enough in combat to find out.

Perhaps this is a critical conclusion, but I think not: the *Sheridan* in combat proved to be a fragile, unreliable, easily-disabled *light tank* when it was tested against a dismounted infantry enemy whose only antitank weapons were shoulder-fired RPGs, recoilless rifles, and mines. One can only speculate as to how a light tank will perform in another environment against a heavily armored enemy with antitank weapons that can reach out 3,000-5,000 meters. But as this conjecture is made, and it must be made, those who are planning for the next war must consider past, factual experience. I view the proven record of the light tank in combat as miserable. If asked, I would project the same conclusion for the light tanks for any war in the future, partcularly against a heavily armored force, well-equipped with modern antitank weapons.

ROBERT S. McGOWAN
Colonel, USA (Ret)
UA NATO, Brussels

COMMANDER'S HATCH

MG Louis C. Wagner, Jr.
Commandant
U.S Army Armor School

The Armor NCO Advanced Course

I believe the Armor Noncommissioned Officer Advanced Course (ANCOC), conducted at Fort Knox, is the pinnacle of the education and professional development of the Army and Marine Armor enlisted leader. During 1981, 468 students are scheduled to attend this course, which prepares selected tank commanders and scout section leaders to be platoon sergeants and to perform as acting platoon leaders when necessary. An outline of the course is shown in the "Forging the Thunderbolt" article in this issue.

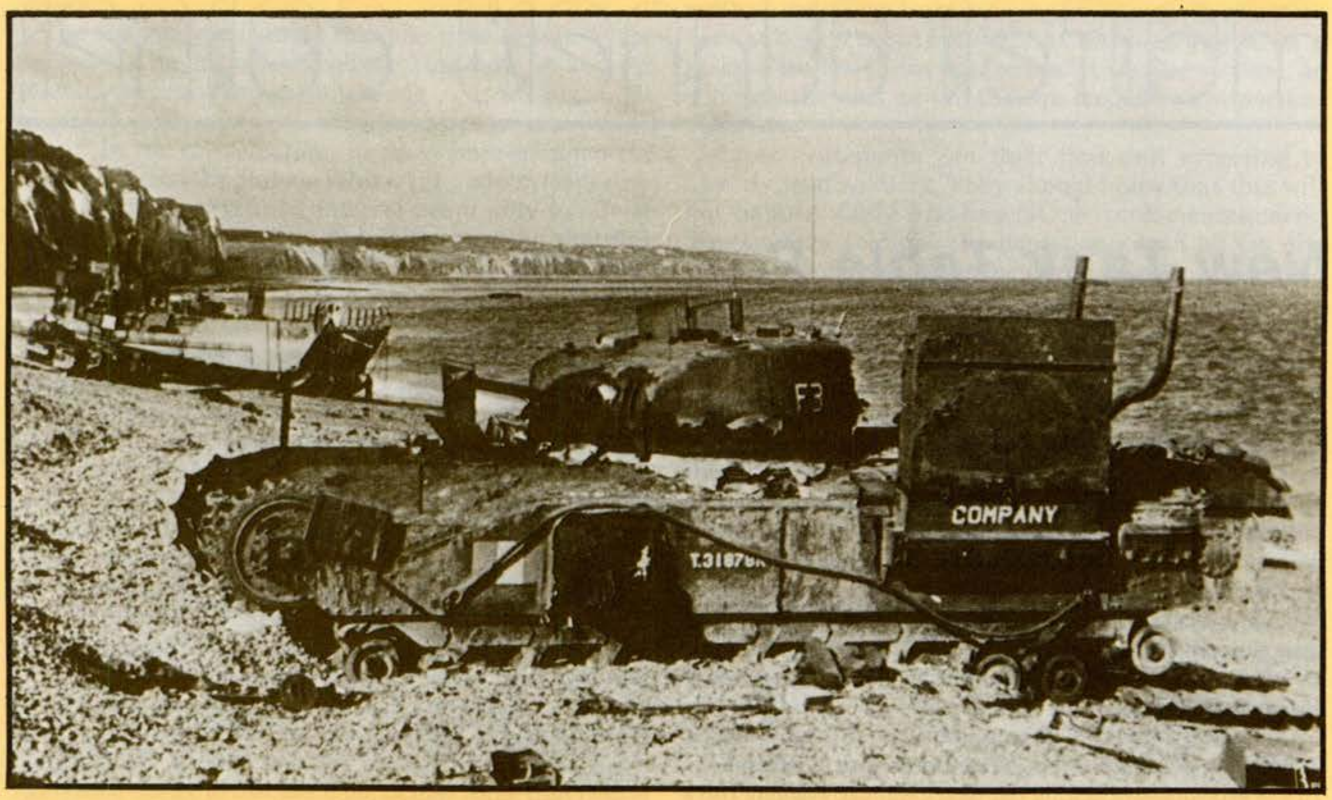
Each ANCOC class now consists entirely of either MOS 19E (Armor) or 19D (Cavalry). They receive training in common subjects with Scout- or Armor-specific training tailored to the appropriate class. The ANCOC course has been kept current to reflect the dynamic changes that have taken place in the Army and the Armor Community in the last few years. The length of the course for the 19E has been increased from 8 to 11 weeks, and the 19D course from 8 to 12 weeks. (The 19D now receives 209 hours of gunnery-related instruction compared to 97 hours for the 19E.) The additional week for 19D instruction was prompted by the replacement of the *Sheridan M-551* with the main battle tank in the Cavalry units.

I want the ANCOC graduate prepared to "hit the ground running." The practical experience he has gained through an average of 10 years of service is greatly enhanced by this course which challenges the student to think, plan, and act in terms of a platoon. The student is given an appreciation for the factors bearing on his unit's performance, the support available to him, and his responsibility to the unit.

The Weapons Department conducts 97 hours of tank gunnery training for the 19E and 209 hours for the 19D. The 19E receives primarily refresher training, firing Tables VP and IXB, while the 19D course is essentially the same as the Armor Officer Basic, requiring the 19D to fire Tables VI, VII, VP, and IXB. Each ANCOC class receives training in special gunnery techniques and advanced gunnery.

All tankers and cavalrymen love to shoot. That is what Armor soldiers believe we do best, and that is as it should be. Therefore, ammunition constraints are a mixed blessing for the Weapons Department, causing the school to concentrate on "training to shoot," rather than "shooting to train." Training management, subcaliber firing, advanced gunnery, and special gunnery techniques from the Master Gunner Course are recent additions to the weapons instruction for the ANCOC classes. I am going to monitor this advanced-level instruction closely, with more to follow if this proves to be as successful as I hope.

The Command, Staff & Doctrine Department presents 208 hours of instruction to ANCOC Armor students and 210 hours to ANCOC Cavalry students. This course of instruction covers a wide spectrum of subjects including: Leadership (Combat and Garrison); Combat Support and Combat Service Support Operations; The Battalion Training Management System; Nuclear, Biological, and Chemical Operations; The Enlisted Personnel Management System; The Army Supply System; and Platoon Tactical Operations. All of this training is integrated into and reinforced by a mounted tactical training exercise lasting 4 days and 3 nights. Tank and Cavalry platoons are formed from the students of each course and operate under realistic, stressful field conditions. Students must demonstrate proficiency in all areas, but especially in leadership, tactics, maintenance, land navigation, NBC operations (individual, crew, and platoon), and tactical communications. Leadership positions are rotated frequently with each student acting as a platoon leader or platoon sergeant several times. During the entire exercise, the instructor-to-student ratio is 1:4 The instructors are experienced,



The Dieppe Raid

A Failure that Led to Success
by Robert P. Arnoldt

When France fell to the German *Blitzkrieg* in June 1940, the world looked for the *Wehrmacht* to complete its conquest of Western Europe by invading and subduing Great Britain. The long-touted invasion, however, never took place. The threat gradually passed from the probable to the possible, and then to just a threat. Hitler's attention had turned partially away from Britain and its stubborn resistance, and had refocused on the vast expanses of Soviet Russia.

England, with the Royal Navy and her unique location protecting her from the *Wehrmacht*, became a forward outpost for the survivors of Hitler's European victory, and a base for Allied strategy to harass and eventually reconquer Europe.

But, after the debacle at Dunkirk, the British had precious little in the way of equipment or battle-worthy ground units to press the Germans and dislodge them from their hold on the Continent. Immediately after Dunkirk, on June 8, 1940 (26 months before Dieppe), the Armored Division and 15 Infantry Divisions. Of these formations, 2 had done no divisional training, 5 had done very little training, and the remaining 9 had reached a "fair" standard of training. The average strength of the divisions in question was 11,000 men, or just over half of their operational table of organization.

If it had not been for the skill and courage of the RAF, the blind stubbornness of Goering, and the lack of foresight displayed by Hitler, there would have been no such forward outpost for initial raids.

As the threat of invasion lessened, the Allies looked for ways to strike back at the Germans, while strength for the return to the Continent was built around the survivors of Dunkirk.

Part of the initial strategy adopted centered on the Allied intent to conduct both small- and large-scale raids on German-occupied territories during the interim between the fall of France and the opening of a second front. These operations were managed by the Com- from volunteers drawn from the United Kingdom, most of the conquered European nations and the United States. The raids were directed against various targets on the long coast from Norway through southern France.

The port of Dieppe was eventually chosen for one of these raid sites because it offered a variety of objectives: a radar station (to be studied and then destroyed); a large number of landing craft (to be captured or sunk); a good opportunity to render the port of Dieppe itself useless; and opportunities to destroy local industries that were being used by the German occupation troops. But, most importantly, the raid would provide the Allied General Staffs with very important and, indeed essential information concerning German defenses in the West.[1]

While other raid sites offered opportunities for destruction of specific facilities (such as the attacks on St. Nazaire or Bruneval), or interdiction of traffic or communication (such as Spitzchosen for different considerations such as stated above. But perhaps the most important reason for choosing the port of Dieppe was that, apart from the disastrous landing at Gallipoli in 1915, the Allies had very little experience in amphibious landings under fire and techniques involved in landing large bodies of men on enemy-occupied shores. If many thousands of men and arms were to be landed when the second front was launched the following year or the year after, experience must be gained the hard way by mounting commando-type raids. Another factor was the very unsettled weather in the English Channel, which is notorious for its sudden gales and storms. A major amphibious landing on the open beaches was considered impossible, due to the difficulties of landing an army in the short space of time before the occupying forces had had time to recover and gather strength sufficient to throw the invaders back into the sea. Logistics operations at that time demanded that a major seaport be captured intact to enable large ships to be unloaded quickly of men and arms, using dockside cranes and transportation equipment.[2]

This "major seaport" thesis was discarded by the Allied High Command after Dieppe, and proved to be a wise move that led to the open-beach landing so successfully carried off on June 6, 1944. The D-Day landings were supported by multiple section *Mulberry* floating piers towed from England and placed to provide a way for supplies, personnel, and armor to be brought into the beachheads without the need for an established port with dockside equipment, etc.

The original Dieppe operation, codenamed *Rutter*, was scheduled for execution on June 21, and again on July 8, 1942, but was scrubbed due to weather and tide conditions.

The original plan was a very ambitious undertaking that called for flanking attacks to be mounted at either side of the town and harbor. A frontal attack was to be avoided at all costs, mainly because of the topography of the area, where the town and main beach are dominated by leadlands to either side on the east and west. A battalion of Royal Marines, backed by a battalion of the new *Churchill* tanks, would land at Quiberville, some 7 miles to the west of the town of Dieppe. Once ashore, they would attempt to overrun the western headlands dominating the town, which had been armed with powerful gun batteries that dominated the main beach. At the same time, two battalions of troops would land at the village of Pourville, nearer to the town of Dieppe, but also to its west. Another two battalions would land to the east of Dieppe at the small village of Puys. Their task would be to quickly overcome the German gun batteries on the eastern headland dominating the main beach and then advance through the rear of the town of Dieppe toward the main beach. The troops at Pourville would adopt a similar maneuver and make for the main beach of Dieppe, after destroying the radar station and rear defenses. They would be assisted by the tanks at Quiberville.

After destroying all military installations and objectives, they would be reembarked from the main beach under the protection of the air force. The objectives were to

•Destroy the airfield at Saint Aubin, Dieppe.

•Destroy the radar station, power station, port and rail installations and ammunition and oil dumps.

•Capture or destroy massed landing craft.

•Capture documents from a German headquarters that was believed to be at Arques la Bataille.

•Take prisoners for questioning.

•Destroy a torpedo dump under the east headland.

The Dieppe assault force was assembled, and two preliminary training exercises were held. The first was very bad; the second, a considerable improvement; and approval to proceed with the operation was given. On July 4, all forces embarked and the troops were told they were going to land at Dieppe. A chance German air raid put two of the large infantry landing ships out of action, and on July 7, the raid was cancelled .[3]

On August 17, it was reactivated. The same force was reassembled and sailed the next night.[4] The assault armada comprised 237 vessels and craft. The expedition was to sail in 13 groups at varying speeds from four principal ports in the United Kingdom; Southampton, Portsmouth, Newhaven, and Shoreham. At a selected position out in the channel, all of the ships and landing craft would meet and form up into one convoy. Fifteen minesweepers would lead the way, sweeping a clear channel through an extensive enemy minefield and marking a safe path with dan buoys.

At a point 10 miles from Dieppe, the infantry landing ships would stop to diaembark the troops into smaller assault craft. After forming up, each group would be led in to their respective beaches by motor gunboats or motor launches. Eight *Hunt* class destroyers of a displacement of 1,000 tons and armed with 4-inch guns would supply the sole bombardment for the invasion, and targets ashore would be signalled to each destroyer by special forward observation teams provided with radio transmitters and receivers.[5]

Air support was provided, in the final tally, by a total of 69 Allied squadrons, with a day's total of 2,617 sorties. Allied losses amounted to 106 aircraft shot down, including 88 fighters, 8 bombers, and 10 reconnaissance aircraft. Local air superiority had been achieved by the invaders, but at a cost of 153 killed and wounded. It was the RAF's worst single day's losses during the entire course of World War II.[6]

Command and control plans were much too rigid and prone to break down, and confusion reigned from the start. The operation's commander, Canadian Major General John Hamilton (Ham) Roberts, was truly without the information he so desperately needed to direct his forces ashore.

Communications from the ground units to Roberts on the command ship *Calpe* ranged from inadequate to nonexistent, compounded by enemy deception and the chaos on the beaches. Most of the Beach Master's and Forward Observation Team's radio equipment was destroyed on landing as were at least 50 percent of the tanks' radios.

RAF communications for the air battle were good between the aircraft, the command ship, and the control point in England. But not knowing how his ground forces were faring, Roberts could not use his air support to its greatest effect.[7]

When *Operation Rutter* was reactivated on July 17, 1942, its code-name was changed to *Jubilee* and its format was altered radically to allow the main thrust to be made on the main beach in a frontal assault against the massed guns of the enemy. The tanks would also be landed on the main beach. The beach slope and the size and composition of the large "pebbles," which made up the surface of the beach, made it totally unsuited to tank-tracks and would cause many of the tanks to break or throw their tracks as they advanced out of the landing craft. This situation and the fact that a high seawall provided a virtually impassable barrier into the town from the beaches were problem points given insufficient attention by the planners. The engineers had been ordered to blow the seawall and the tank barriers, which were made of reinforced concrete, 8 feet high, and fitted with firesteps for German infantry; but the murderous fire on the beach would cut down the unprotected engineers before most had reached the seawall or the tank obstacles. No alternate plans had been provided to eliminate the tank barriers.

The plan to land troops on either flank—at Puys to the east and Pourville to the west of Dieppe—remained unchanged. The heavy gun batteries on the headlands overlooking the main beach represented a major threat to any proposed landing and would have to be put out of action prior to the assault on the main beaches.

The Royal Regiment of Canada, aided by the Black Watch, was given the task of landing on the narrow Blue Beach at Puys. A flight of stone steps provided a seemingly easy climb to the cliff top, where they had been ordered to destroy the heavy gun batteries on the east headland before they could fire on the troops scheduled to land on the main beach a mere 30 minutes later. After destroying the heavy guns, the Royals and Black Watch were ordered to advance through the suburbs of Dieppe and head toward the main beach to meet up with their comrades of the Essex Scottish and Royal Hamilton Light Infantry (RHLI) regiments. By this time, those regiments would have landed on the main beach. A perimeter was to be set up around Dieppe to provide defense against German reinforcements.

To the west of Dieppe, the South Saskatchewan Regiment (SSR) was given a similar task. They were to land at Pourville and secure a bridgehead to allow the Queen's Own Cameron Highlanders to move through the attack the gun batteries on the west headland,before advancing through the suburbs of Dieppe to the main beach. There, they would also meet up with their comrades of the RHLI and Essex Scottish—and hopefully, the Calgary Tanks—who were all scheduled to land at 0520, 30 minutes after the flanking attacks. Assisting the main body of troops would be the Royal Canadian Engineers of the 2d, 7th and 11th Field Companies, units of the Signal and Provost Corps, Field Ambulance and Medical units, and the Toronto Scottish, who were to save many lives during the day with their invaluable suppressive fires from the landing barges. The *Regiment Fusilier de Montreal (Fusilier Mont-Royal)* and Royal Marine Commando group "A" would remain off Dieppe acting as a floating reserve. At the successful completion of the operation, tanks and other equipment not easily reembarkable onto landing craft were to be destroyed on the main beach. Wounded, dead, and prisoners were to be picked up, along with the rest of the force, by landing craft that had delivered them to their respective beaches of landing.

Strong objections to the suicidal frontal attack were met with the argument that a very heavy preliminary bombardment by heavy bombers of the RAF (the majority of which was cancelled at the last moment, due to considerations raised as to the safety of French civilians living in the town itself) would do much to cripple the enemy defenses and that, furthermore, the plan would undoubtedly succeed because of the element of surprise. The fact that it was planned to land the Royals (Blue Beach) and the SBR (Green Beach) 30 minutes before the main assault seemed to have been overlooked. By the time the Essex Scottish and the RHLI hit the main beaches (Red and White) at Dieppe, the enemy would have been well-alerted by the attacks being launched only 6 miles away from the town of Dieppe, and every man would be standing by his gun or mortar position.[8]

At the time of the Dieppe operation, landing craft such as those used by the Combined Operations group, had made some progress but were defintely not up to the level of sophistication of the force used in 1944 at Normandy.

At Dieppe, small Assault and Landing Craft Mechanized (LCM) were carried by larger ships and lowered to the water some 10 miles offshore for their run-in. These craft were partially armored and very lightly armed.

The larger Landing Craft, Tank (LCT), were cramped and hard to handle in any but calm waters.

A new type of support landing craft was used for the first time at Dieppe. Called the Beach Protection Craft, Flak, it was a converted LCT armed in one case with two 4-inch guns and in other cases with ten 2-lb. pom-poms. These craft were used for close-in fire support and antiaircraft protection.[9]

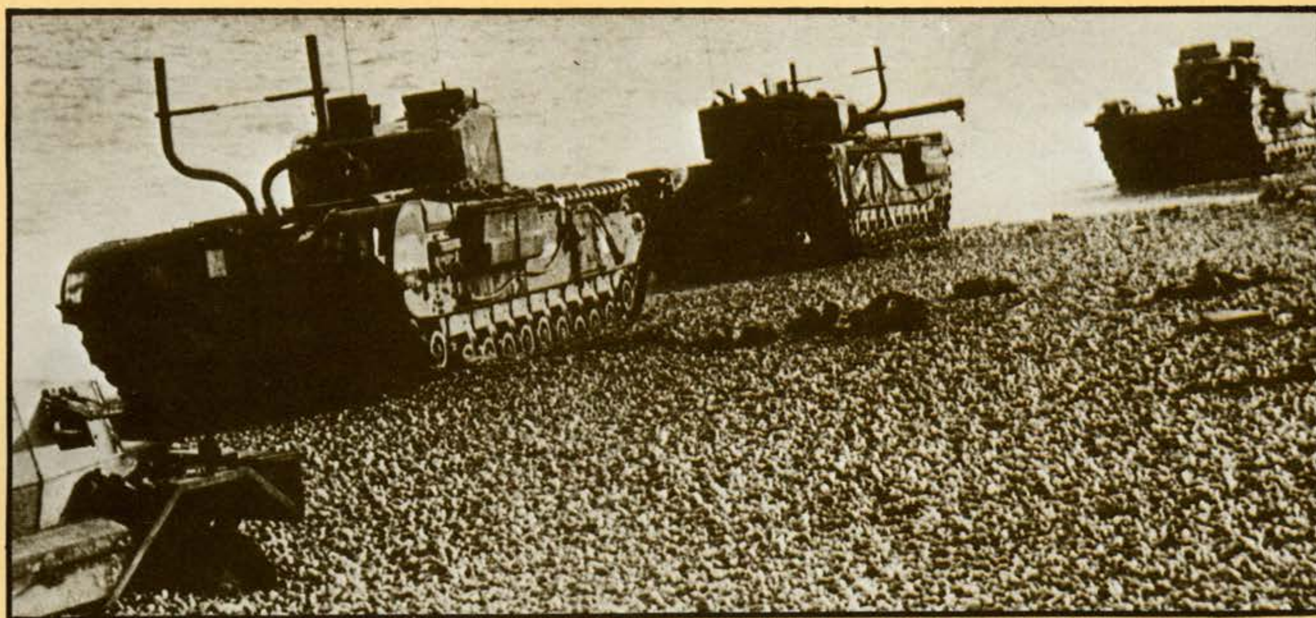
The major actor in the equipment department, however, was not the landing craft, but the tank chosen to equip the Cavalry regiment in their role as an integral part of the main beach landings on Red and White Beaches—the *Churchill*, or *A-22* In fantry Tank Mark IV.

The *Churchill* tank used by the 14th Canadian Army Tank Regiment, or "Calgary Tanks," at Dieppe, had its good points and bad. The vehicle was ill-matched and under-gunned for its specific role during the operation, and the operation suffered accordingly. Most *Churchills* that made it ashore were equipped with 2-pounder and 6-pounder cannon in their turrets, and 3-inch howitzers mounted in the nose that had only limited traverse. These were of small value against German strong points and of no use against the German bunkers and cave redoubts overlooking the beach. One Dieppe veteran, a troop leader who commanded three Mark III vehicles, compared the mounting of the 2-pounder in the turret of the *Churchill* Mark I with "putting a peashooter into the nostril of an elephant."[10]

Pre-landing troop briefings were, according to surviving Canadian participants, extensive in scope but lacking in detail as to German automatic weapon, field gun, and sniper positions in the headlands on both flanks of the main beach, and antitank defenses and the antiship obstacles at both high and low tide.[11] It has been suggested that too much reliance was placed on the prewar tourist information and on aerial photographs taken as little as 36 hours prior to the operation. Additionally, German troop and equipment strength was also underestimated, as was the effect (or lack of an effect) of a minimal naval bombardment and severly limited strategic bombing just before the landing.[12]

"Dieppe was not one battle, but eight separate actions which had only limited effect on each other."[13]

The first action joined was the chance encounter of Flotilla Group 5, carrying No. 3 Commando, with a German coastal convoy bound from Le Harve to



Hulks of Churchill Mark IVs line the Dieppe beach. Photos, pages 12 and 15, Public Archives Canada/PA237054.

Dieppe at 0347. Two messages from British naval headquarters at Portsmouth, warning two hours earlier that the German convoy was in the path of the Flotilla, failed to reach Group 5.

The German convoy escort struck first, scattering the British. Only 7 of 23 landing craft carrying the commandos were able to proceed, with only 20 men landing to attack the battery at Berneval. The commandos in the other six landing craft that reached the French coast were unable to reach their target.

The convoy skirmish, however, had little effect on the action at Berneval. One of the landing craft able to proceed after the convoy battle landed Major Peter Young, 2 other officers, and 17 men at Yellow Beach II below Berneval at 0515. Here, the target was the 2/770th *Huren-Kusten Artillerie Abteilung* which had four 105-mm and three 170-mm coastal defense guns, as well as two 20-mm *Oerlikons* for antitank defense. The battery had 127 men, and there were 114 *Luftwaffe* personnel manning the radar station in the vicinity.

Major Young's small force landed undetected and made their way inland to the Dieppe-Berneval road. A young French boy described the best approach to the battery and led them into Berneval. There, Young cut the telephone lines to Dieppe.

The 20 British commandos then moved to within 200 yards of the battery, neutralized it with sniping for more than 2 hours and reembarked at 0810. The second landing by 6 craft, carrying remnants of No. 3 Commando at Berneval on Yellow Beach I was less successful. They were 25 minutes late and landed in broad daylight, encountering heavy opposition immediately upon landing. The Germans, who outnumbered the small British force, were soon reinforced by three more companies of the antitank battalion of the 302d Division. Of the 120 commandos who got ashore at Yellow Beach I, 82 were captured.

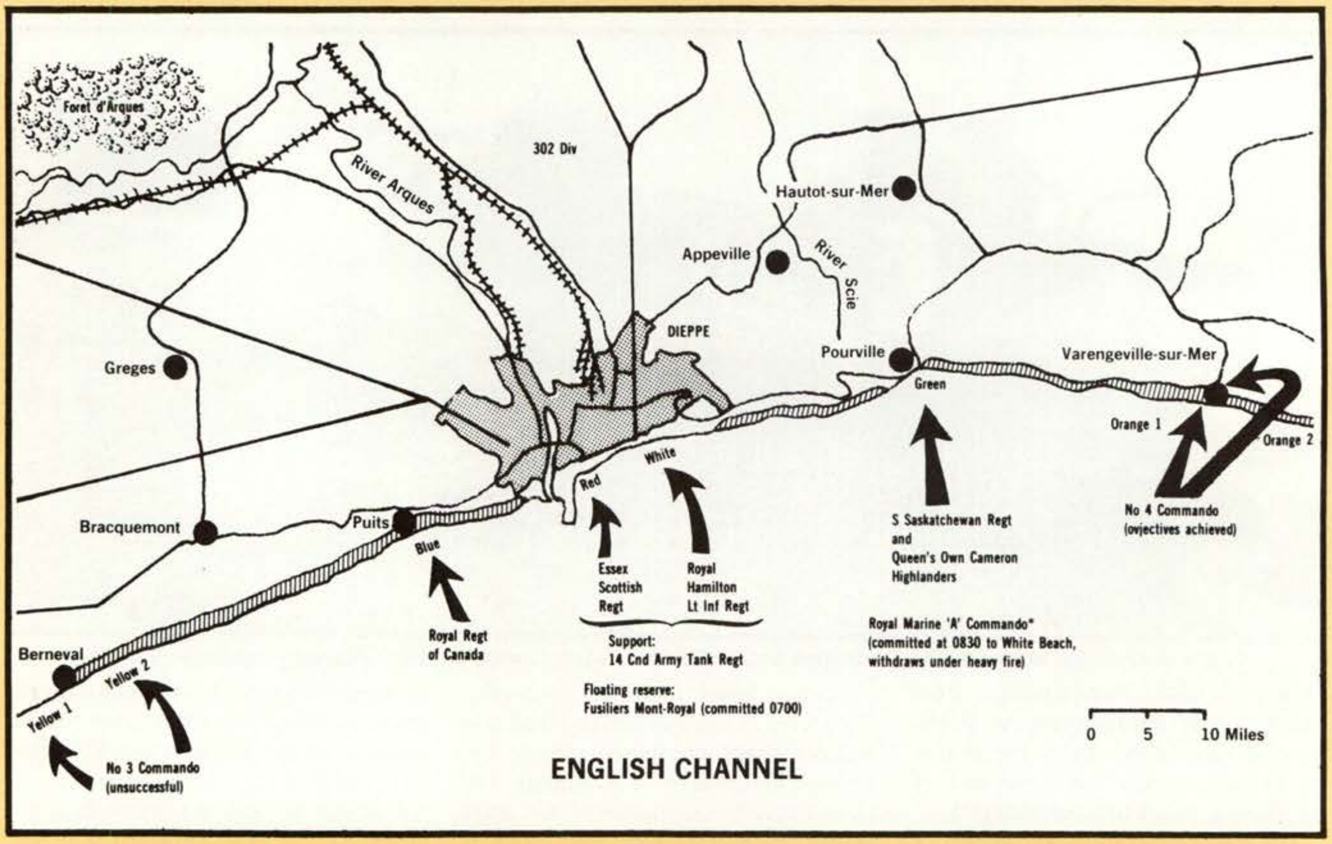
Meanwhile, on the other extreme flank, 5 miles west of Dieppe, No. 4 Commando, under Brigadier Lord S.C.J.P. Lovat, was attacking the heavy German battery, the 813th *Abteilung*, which had six 150-mm guns just behind the village of Varangeville. While everything else about the Dieppe operation may have tragically failed, this attack was a classic in its success, despite the fact that the battery had opened fire on the invasion fleet at 0447, 3 minutes before landing.

No. 4 Commando's attack was made with training-ground precision, and the timing of each individual unit's move was accurate almost to the second. Lord Lovat landed with B troop at 0450 east of the River Saane, lost four men to machineguns, went a mile along the banks of the Saane, and turned east to the Blancmenil le Bas wood alongside the battery. Lieutenant A.S.S. Veasey landed A Troop at Quiberville on Orange Beach II, scaled the cliffs with tubular steel ladders, knocked out two pillboxes, and cut communications. Major Derek Mills-Robert, with F Troop reinforced, landed at Vasterival opposed only by one machinegun. The noise of his bangolore torpedos blowing gaps in the wire along the beach was covered by the roar of the Spitfires attacking the Ailly Lighthouse.

Precisely at 0550, the British mortars opened fire. B Troop attacked from the right flank, and Major Mills-Robert and F Troop from the left flank. An air attack by Spitfires was made simultaneously. It was over in a matter of minutes, aided appreciably by a direct mortar shell hit on piled cordite, which blew up, killing or stunning many Germans. But the hard-driving infantry attack by F Troop administered the *coup de grace* and overran the battery. Four Germans were taken prisoner; the rest were shot or bayoneted. By 0650, the guns were blown up, and the commandos withdrew toward Orange Beach I at Vasterival. By 0900, the unit was on its way back to England. Its casualties totaled 46.

On the German side, it was not until 1000 that the 302d Division headquarters learned that the Varangeville battery had been wiped out.

At Pourville, two miles to the west of Dieppe, the South Saskatchewans Regiment (SSR), commanded by Lieutenant Colonel Charles C.I. Merritt, landed as one wave on Green Beach at 0450, without a shot being fired at it. The plan was to land astride the River Scie, which flows into the sea near the middle of the Pourville beach. Unfortunately, almost all of the landing force was put ashore on the west bank. This meant that A Company, which was charged with seizing the radar station and the high



ground a mile to the east, had to penetrate the village and cross the bridge on the main road to Dieppe. Before it could cross the bridge, however, the German defenders were in action. This was a critical development. The seizure of Le Pollet cliff on the west headlands of Dieppe, and the silencing of the four 105-mm guns of B Battery of the 302d Division artillery, were essential to a successful landing on the main beaches (Red and White) at Dieppe. These two critical steps in the plan were not accomplished.

But even though the SSR was not able to drive eastward and clear the cliff, it did hold Pourville while the Camerons landed and drove inland along the Scie. These two units fared the best of all the Canadian troops in the Dieppe Operation. Of the 523 South Saskatchewans landed, 357 were reembarked, and 268 of the 503 Camerons were taken off. The losses between them still amounted to a staggering 65 percent or 686 out of 1,026, with 151 killed, 266 taken prisoner, and 269 wounded.

At Puys, 1,500 yards to the east of Dieppe, the Royal Regiment of Canada, under the command of Lieutenant Colonel Douglas Catto, made its approach to Blue Beach under murderous fire from fully-alert defenders in unexpected defensive positions. While still well offshore, the landing craft were hit repeatedly and, when those who survived reached the beach, they had no place to go to escape the German guns. A 10-foot seawall, covered with heavy barbed wire (not reported by British intelligence) blocked the head of the beach. On the east cliff, a concrete pillbox was hidden in the front garden of a brick house. The main slit of this pillbox covered the beach and seawall at very short range. A few hundred yards south of Puys, four German howitzers fired 550 rounds at the landing craft during insertion and the withdrawl.

The landing was a complete disaster. Being unable to move inland off the beaches, the Royal Regiment had no chance to accomplish its vital objective of seizing the headlands to the east of Dieppe. Of 554 officers and men who had embarked from England, only 67 returned; 227 were dead on the beach and the rest were prisoners. Only 20 men were able to move inland off the beach. The German defenders lost 2 dead and 9 wounded. At 0835, the German 571st Regiment informed its division headquarters that Puys was firmly in German hands and that the enemy had lost 500 prisoners and dead.

In Dieppe itself, the headquarters of the 571st, with two battalions defending the port, did not order action stations until 0500, after it had heard of the landings at Pourville. The German 302d infantry division went on the alert a minute later.

The frontal attack on Red and White beaches was made by the Royal Hamilton Light Infantry under the command of Lieutenant Colonel Robert R. Labatt on the right (west), landing on White Beach, and the Essex Scottish commanded by Lieutenant Colonel Jasperson on the left (east), landing on the Red Beach. Nine tanks of the 14th Tank Regiment (The Calgary Tanks) were to land with the first wave. The tanks arrived late and the infantry was pinned down before it could get through the wire obstacles and over the seawall.

German riflemen showed exceptional skill in picking off the officers, communications men and engineers, thus effectively hampering command and destroying the attachers' ability to communicate their plight to the command ship or to coordinate an attack; and eliminating any chance of the attackers being able to clear the beach obstacles. German mortar fire was devastating and inflicted severe casualties on the Canadians.

The landing of the tanks, nevertheless, was remarkably successful. All 10 of the LCTs succeeded in getting tanks ashore, and 8 of them landed three apiece. Two tanks were drowned driving off the LCTs into 8 feet of water. Twenty-six tanks reached the beach. Of these, 15 crossed the seawall and reached the promenade. Here, the tanks were stopped. With all of the engineers either pinned down or killed by the withering German fire, there was no way to remove the heavy concrete roadblocks barring all streets into the town.[14]

Other problems plagued the Calgary Tanks as their landing and attempt to move inland continued. These included not only German opposition and radio failure, but also a possible design failure in the tracks of the *Churchills* and the composition of the beaches designated for the landing. In addition to a moderately steep beach slope (1 in 4), the physical make-up of the main assault landing areas was a combination of large, loosely set pebbles from 3 to 6 inches in diameter interspersed with sand at low tide. [15] None of the *Churchills* ashore during the fighting were destroyed by German fire, but all of those that gained the beach and pressed inland over the 2-foot seawall eventually lost one or both tracks to the gravel or to German antitank defensive measures. This, of course, reduced them to the limited role of pillbox until ammunition ran out.

The infantry on the main beaches of Dieppe had little chance. Resistance was much stiffer than had been expected. The tanks that were able to get into action were unable to neutralize or destroy the German gun positions along the beach or in the flanking headlands. There was no artillery support and the guns of the supporting ships were too small to be effective. The infantry paid. D Company of the RHLI was almost wiped out on landing. Between 30 and 45 percent of the Essex Scottish were dead or woulded by 0545.

There was some limited penetration of the town by the infantry. The Casino was captured and there was street fighting in the area around it. But this slight success only led to a compounding of the catastrophe. At 0610, the command ship, *Calpe*, received a message. "Essex Scots across the beaches and in the houses." At 0640, General Roberts decided to land the main body of his floating reserve, and, at 0700, a battalion of Les Fusiliers Mont-Royal under the command of Lieutenant Colonel Menard headed for Dieppe in 26 unarmored landing craft. German artillery had this small fleet under direct fire for 10 minutes as it approached Red and White Beaches. The force suffered casualties before landing, and, on reaching the beaches, suffered the same fate as the first assault wave.

Major General Roberts was unaware throughout the action of the extent of the disaster, especially on the main beaches at Dieppe, where he committed his reserve. At 0817, an entry in *Calpe's* log reads, "Have control of White Beach." Roberts thereupon instructed the Royal Marine Commandos under Lieutenant Colonel Phillips—the last of the floating reserve—to transfer to armored landing craft and land on White Beach to support the Essex Scottish. When Colonel Phillips in the lead landing craft emerged from the smoke screen and saw the disaster on the beaches, he stood up to signal the landing craft to turn back. Colonel Phillips was killed almost instantly, but he had saved most of his command.

The Allied naval losses were comparatively light. One destroyer, the *Berkeley*, was lost during the evacuation, hit by German bombs being jettisoned so the aircraft could escape British fighters. Five of the LCT's and 28 lesser craft were sunk. There were 550 casualties among naval personnel with 75 killed and 269 missing. Naval gunners brought down 29 bombers and fighters—including 5 friendlies!

German ground losses totalled 591 casualties, with the principal defending unit, the 302d Infantry Division, having 5 officers and 116 men killed, 6 officers and 195 men wounded, and eleven missing. The *Kriegsmarine* lost 78 killed or missing and had 27 wounded, while the *Luftwaffe* had 105 killed or missing and 58 wounded. [16]

The withdrawl from the main beaches was set to begin at 1100. The recovery of the two Commando groups, the South Saskatchewans and the Camerons, was already underway or completed prior to that time.

At 1100, a curtain of smoke was laid between the headlands by *Bostons* of 411 Squadron, RAF. The job was carried out with great difficulty in the face of the heaviest fire from an enemy unsubdued and still vigorous. The Hamiltons moved back to the sea shore from the Casino under the leadership of Captain J. M. Currie and Major H. F. Lazier. Detachments of the RHLI and of the Fusiliers Mont-Royal held the Casino until the last, providing covering fire for their comrades. While the reembarkation was in progress, the crews of the *Churchills* were methodically destroying their vehicles.

By 1220, most of the men who had fought their way back to the main beaches had been taken away by the crews of the landing craft, who, says the official report, "showed complete disregard of danger in their efforts to take off the troops."

Throughout the day, and especially during the period of reembarkation, the work of the medical officers and orderlies with the Royal Canadian Army Medical Corps was of the highest order. The number of wounded was high, medical supplies ran short on the beach, and large dressings were much in demand. Most of the medical personnel were killed or captured in the course of their duties.

At approximately 1250, the naval force commander, Captain J. Hughes-Hallett, decided to make one further effort to take more men off. "Now Dieppe is shrouded in a pall of smoke, fog and haze," says the log of Lieutenant R.H.M. Boyle, Royal Navy Reserve, who was serving on the *Calpe*. "Even in the bit of land you could see, there are things smoking everywhere. We hope to go in again and fetch more men off still there...(We) receive terrific fire from the beach, but we fire back with our forward guns."

By then (1250), any further evacuation was impossible. the *Calpe* had closed to within 9 cables (approximately 1 mile) of the beach, when she came under machinegun fire from the German posts on the Dieppe breakwater. No sign of troops or landing craft, save derelicts, could be seen, and the *Calpe* returned to the cover of the smoke. Captain Hughes-Hallett was engaged in signaling to the *Locust*, which, being of more shallow draft might possibly have been able to approach nearer the beach, when General Roberts, the military force commander, received a last signal from shore at 1308. It came from Brigadier William Southam's (Brigade Commander for the South Saskatchewans, Fusiliers Mont-Royal, and the Camerons) headquarters, saying he was compelled to surrender.[17]

The return to England was mostly uneventful, thanks to the RAF, for the cover maintained was still intense. Despite weather which had become overcast, the air battle went on with hardly-diminished fury.

The expedition's surviving ships returned to the ports from which they

Dieppe's failures led to successes like this one at Salerno. (Official British photo)

sailed, some of the vessels not berthing until past midnight. The cost in lives on the Allied side was high. Of the 5,000 Canadian troops involved in the operation, 3,372 were either killed, wounded or missing (captured). This included 593 officers and other ranks killed or died of wounds, 2,188 captured, and 591 wounded who were brought back to England.[18]

Analysis and conclusions. Let us first examine the effects that the Dieppe operation had on the Germans.

Colonel-General Kurt Zeitzer, the Chief of Staff to Field Marshal Gerd von Rundstedt, Commander-West (which included Dieppe and the entire Atlantic Wall), called the operation an invasion attempt, and gloated over how easy it had been to stop this supposed invasion on the beaches at and near Dieppe.[19] Hitler liked to hear this kind of news, and apparently believed Zeitzer, and some others, who did not really know what the facts were. One result of this false optimism on the part of Hitler was the decision to put great emphasis on the use of fixed fortifications along the Atlantic coast and the downplaying of the importance of a mobile reserve,[20] even though the official German after-action report stated the importance of the mobile reserve used by the 302d Infantry Division during the Dieppe Operation.[21]

On the positive side for the Germans, it was recognized by General Erwin Rommel, who assumed command of the Atlantic Coast defenses in November 1943, that beach obstacles and better camouflage against aerial reconnaissance were to be given top priority by German troops from Denmark to the Mediterranean French coast. Copies of photographs found on dead Canadians brought this point home to Rommel and von Runstedt.[22] The importance of beach obstacles was made very evident by the success experienced by the majority of the landing craft in getting ashore, using smoke as a cover, and inserting the Canadian troops and tanks.[23] The landing craft themselves, many of which were examined after capture by the Germans, proved most valuable for the future design and placement of obstacles along the Atlantic Coast during the remaining 22 months before D-Day.[24]

Another improvement made by Rommel was the inclusion of separate coastal artillery batteries, such as those at Varangeville and Berneval, within an extended defensive perimeter around fortified ports like Dieppe. This action was taken to eliminate, as much as possible, commando operations aimed at silencing key coastal batteries prior to, or during, Dieppe-like assaults.[25] No one in the German general staff, not even Rommel, suspected there would be no more attempts on fortified ports.

In a more tactical vein, the fact that no German antitank gun was able to penetrate the armor of any *Churchill* tank during the entire engagement, and that no tank crewman was killed or wounded while inside a tank,[26] was not overlooked by the British, who stressed better, more carefully distributed armor on later *Churchill* marks. The Germans, however, did not even make mention of these facts in their after-action report, dated 25 August 1942.[21] This official oversight on the part of the Germans was only one of many miscalculations and omissions relating to the Dieppe Operation, and one must only wonder at how something so obvious could have been overlooked.

The Soviets, their backs to the wall from Leningrad to the Caspian Sea, benefited indirectly from the Canadian's sacrifice, in that German troop strength in the West was increased from 35 infantry and *panzer* divisions immediately after Dieppe to 52 infantry and *panzer* divisions as of November 1942. The difference was made up mostly of German units moved from the Eastern front to the West to bolster the defenses along the Atlantic Wall.[27]

On the Allied side, there is no question but that valuable information was secured that could not have been obtained without fighting.

Most of the payoff for Dieppe was not collected until June 6, 1944, on the Normandy beaches. How many lives may have been saved in Normandy will become apparent as we see what was learned. Lord Louis Mountbatten said that for every soldier who died at Dieppe, 10 were saved on D-Day.[28]

The lessons learned included the following:

• It was unwise to launch a direct assault on a port. The resistance was too difficult to overcome without destroying all the port facilities, which were needed intact. Further, the direct attack on a port made the plan of battle too rigid and prevented that flexibility essential to overcoming unexpected obstacles, such as clearing the headlands at Dieppe. The Dieppe experience indicated the necessity of achieving a deep penetration quickly with the objective of seizing a port from inland. This was well executed in Normandy nearly 2 years later when the Allies landed on open beaches, much to the surprise of the Germans, cut the peninsula, and took the port of Cherbourg from the rear.

• The disaster on the beaches made it apparent that overwhelming fire support was an absolute necessity, with close fire support in the initial stages of the landing.

• At Dieppe, the force commander was literally a spectator with the battle beyond his control. Compounding the difficulties already created by faulty intelligence, General Roberts was inadequately informed about the situation on the beaches, as communications failed or he received false information. As a result, he sent his reserves (Fusiliers Mont-Royal and the Royal Marine Commandos) into action when they could do nothing to affect the course of the battle. Roberts did not have exclusive control over all forces employed, and perhaps even more serious, he was given a plan to implement over which he had no influence. He should have been asked to participate in the advance planning. All of these errors were corrected before General Eisenhower sent his forces ashore on D-Day.

• Tactical lessons that emerged from Dieppe that were invaluable in the planning and execution of operations at Normandy included:

—The failure of communications was one of the most damaging. The leaders on the command ship *Calpe* could not successfully direct a battle when they had no information on its progress.

—The need for armored landing craft emerged even more clearly after the appalling losses suffered by Les Fusiliers in the unprotected vessels.

—The value of covering smoke was emphasized.

—The engineers' casualties prevented them from destroying obstacles that blocked the landing craft (to some degree) and the tanks and exposed them to destruction, and underlined the need to protect these specialists in the assault wave.

—It was obvious that the infantry must have tank protection from the moment of landing and that the antitank guns defending the beaches must be destroyed in the preliminary bombardment. Out of this knowledge emerged such specialized vehicles as the *Sherman* and *Churchill* "Crabs," the amphibious *Sherman* Duplex Drive (DD), the *Churchill* "AVRE," the *Sherman* and *Churchill* "Bobbins" (Carpet Layers), and the *Churchill* "Crocodile" (flamethrower-equipped). These were just a small sampling of the sophisticated armored fighting vehicles fielded at Normandy.

• Dieppe brought major new organizational concepts for amphibious assaults. The handling of assault landings became a specialized aspect of naval training. The two "dry runs" for Dieppe had obviously been inadequate to iron out all the difficulties that would arise in coordinating such a sizeable force.

• There was a lack of knowledge of the German order of battle below the regimental level—knowledge that was important to the assault forces.

• There appeared to be overreliance on aerial photography as being capable of revealing all that should be known about the German defenses. This, of course, is one of the classic recurrent failures in intelligence—overreliance on one source or collection system.[29]

It must be emphasized that our knowledge of Dieppe only underlines the fact that landings on hostile shores have changed little insofar as the principles of planning and execution are concerned—only the distances to that hostile shore, the ships for transporting the force, and the weapons and equipment used, have changed. Success or failure of amphibious operations is still determined by the effectiveness of training, and the spirit, dedication, and determination of the men who go over the beach.

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Soviet Armor—Past and Present

by Joseph R. Berniece and Paul A. Hoven

Examining briefly the major components of the Soviet tank design concept, we find that the Soviets have been credited, since the design of the *T-34*, with the most effective combination of gun, armor, and motive power within a very efficient ballistically-shaped hull, and with a simple but effective suspension. In many cases, their designs have been considered among the foremost in the world.

Recognizing that a tank had to survive the enemy fire in order to perform the function of breaking through the enemy lines, the Soviets designed all of their tanks so that the external hull armor could be upgraded to meet whatever threat they were fighting. Due to technology restrictions at the beginning of World War II, Soviet medium tanks could not carry the armor they considered necessary for defeating the common enemy antitank rounds. But the Soviets managed, through the manipulation of the slope of the armor, to improve considerably the defensive capabilities of what armor could be applied to the medium tank, while mobility was given priority as a substitute for the lesser amount of armor. They did however, increase the armor on their "heavy" series of tanks, even at the cost of mobility. This was accepted in order to provide the vehicle necessary to defeat any antitank weapon at that time in the field. While we will not concern ourselves further with the development of the heavy tanks, it is important to note that the design development of the current Soviet semi-spherical turrets was a direct development of the heavy tank line (JS-III) and was adopted in the first major postwar tank which saw the combination of the medium tank chassis with the heavy tank gun.

The Soviets also developed the art of appearing on the battlefield with a bigger gun than that of any other country.

Soviet Armor Design—Genius? It appears, from historical research, that the Soviets have tended to benefit considerably more than any other country from such concepts as sloped armor, universal components, standardized design concept, and fully integrated production facilities to place their theoretical engineering designs into practice. The following are a few of these factors and the possible effect they have had on Soviet tank design.

They have a marked tendency to design from the "outside-in" to develop the most powerful armored fighting vehicle possible within the lowest silhouette, both in terms of offensive and defensive capabilities. This, of course, is opposed to the Western view of designing from the "inside-out" in terms of crew comfort and vehicle "fightability." But, since the two design concepts, as represented by their production models,both seem capable of destroying the opposite, it would appear that the concepts which make the difference must lie deeper.

Starting with a tank engine designed and developed from before World War II, and applied up to the present, more than 40 years of continuous development has gone into the critical area of motive power supplied by the diesel engine. Supply of parts and training for service support has been greatly simplified through the Soviet system of commonality of production components, which has led to simplification of the training aspects.

Next, study a suspension which has remained virtually identical in all respects to the first suspension seen on the *T-34*. This again provides for commonality of parts, as in the case of road wheels, drive wheels, possibly even track links, and the capability to interchange components from the original *T-34* up to and including the *T-62* of today.

Finally, evaluate a Soviet designed-hull, which in the case of the *T-62* of today is considered to be among the finest in the world, if not the very best. In this case, research, engineering design, and testing results learned from previous tank hull developments have been continuously optimized.

Hypothesis—Constant Modification vs. New Design. Apparently, far from a complex formula for the design for a "new" tank, the Soviets have tended to simply "repackage" a tank in their efforts to mount a heavier gun to "win the next war," without sacrificing mobility in the process. This repackage concept is most important. Concerned constantly, at the highest levels, about the current strategic arms force in the world at any given time, the Soviets have managed to maintain the maximum number of deployable tanks at any given time through the expedient of accepting into production a "staged" series of design modifications. Due to this simple but effective system, design error corrections and modifications may be instituted at virtually any point on the assembly line from day one and thereafter, and are considerably supported by the commonality of parts referred to earlier. The results of this process cannot be underestimated. *At no point have they been forced to "wait 10 years" for a "new" tank, or even a more significant model of a current tank.* This may in fact be supported simply by the production figures alone. The *T-34* and the *T-54* respectively underwent both thorough redesign and major variants modifications (numbering as many as 10 major "variants" in the latter), and before ultimately developing into the *T-62*, the *T-54/55* series had seen the completion, according to some sources, of over 100,000 tanks.

Soviet Armor Production--Less than Genius. As is usually the case, in attempts to place laboratory technology into a factory setting, the Soviets have been less than fully successful at producing what might be considered an automotively and fuctionally superior tank. A short review of some of the flaws of the *T-62,* as noted by observers to date, may prove illustrative.

Suspension--Even though the Christie suspension provides for a "high speed" vehicle, tanks so equipped have a tendency to throw tracks at high speed, especially in turns and evasive maneuvers.

Engine--As a result of bolting the engine directly to the floor

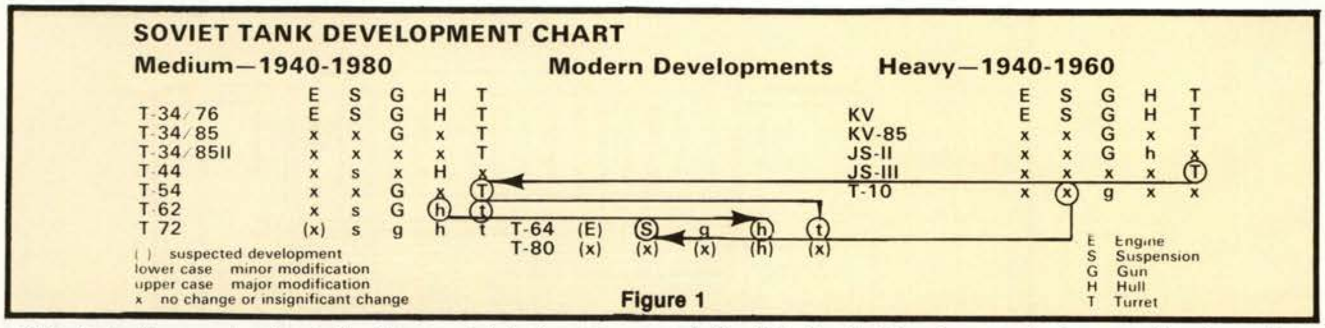

Figure 1

of the tank, the crew is often left with complaints about touring fatigue. This apparently is a result of the steel seats for the crew being bolted to that same floor. Furthermore, it is reported that the Czechoslovakians tear out the engines from each Soviet Tank they receive because they find that after only a mere 25 hours running time appreciable amounts of magnesium aluminum shavings have collected in the engine.

Transmissions--Russian transmissions have never been extremely well designed. In World War II, the Soviets were noted for distributing hammers to the drivers of the *T-34s* for the purpose of persuading the transmissions to move into high gear. More recently, observers at the May Day parades have noted the "whine" from the gearbox of the *T-62s* spiffed up for the parade. Knowing that such a noise indicates, at least potentially, a certain lack of polish, and definite diminution of horsepower, one must wonder about the capability of the bulk of the combat-ready tanks for driving to the front.

External fuel storage--Due to the small size of the Soviet tanks, it was found necessary to mount external fuel cells to provide the capability for reasonable combat operational range. This is not particularly beneficial, but using diesel fuel does reduce the hazards of fire, which might otherwise be associated with this type of arrangement.

Armor penetration--In the aftermath of the Arab-Israeli Wars, Warsaw Pact observers declared that *T-62s* were death traps because they burst into flame when hit on a certain part of the glacis plate or turret. Hits in these areas detonated ammunition and fuel stored in the nose of the tank through impact or penetration. And even the shock of glancing hits on the turret detonated ammunition stowed in an upright position around the inside of the turret wall.

Reloading mechanism—A major problem in the *T-62* is found because the main gun must be returned to battery for reloading by the automatic loading/ejection system. Although equipped with a mechanism that automatically returns the gun to the original line-of-sight and elevation before entering the reloading cycle, the gun cannot be retrained on a new target until after the reloading cycle is complete. This results in the loss of critical time for target engagements.

Shell ejector malfunction—Ejected shell cases sometimes "hang-up" due to the breech and ejection port being misaligned. This malfunction tends to send the spent shell casing flying toward the gunner who, more often than not, is beaned as a result.

Turret traverse—Traverse is slow, or at least slower than any Western tank.

These few points, while not exhaustive, definitely leave the analyst with the impression that the Soviets are not contemplating an end to research and design development of their tanks. But what are their current projects and where do they stand in terms of current project development?

Western Intelligence—Analysis of the Current State of Soviet Tank Development. In any situation where analysis of information and data is dependent upon a certain amount of guesswork, error is certain to enter the final result. While not due to lack of ability or study, it often is the case when the evaluation is made based upon situations and concepts currently affecting the researcher as a result of his own society's values and prejudices. In the case of military analysis, where "secrets" are the *status quo*, it is only reasonable to assume an even greater number of misconceptions will work their way into a subjective (or even objective) evaluation of the material and equipment of the opposing forces, such as the Western habit of numbering "new" tanks instead of new models of old tanks. Apparently, this has often been the situation in the past and remains a problem today.

For example, the *T-62* was rated as possessing a 700-horsepower (hp) engine before an example fell into Western hands. Now, it has been determined that the same vehicle only possesses a 580-hp engine identical to that in the *T-55*, a tank developed 20 years ago. What has occurred here is what we believe may be a case of a *Western* appraisal of what a *Western* country would do to upgrade the performance of an engine. However, the Soviets, would probably be most happy just to get their engine oil ports machined properly and their transmissions corrected. In the latter event alone, as much as 50 hp could conceivably be recovered. In terms of the overall appraisal of Soviet intentions then, we must evaluate what the *Soviets* intended to gain from additional development of their tanks and how they intended to go about this problem, while weeding out potential Western misappreciations of the development effort.

Surfacing in the 1970's, as the *T-64/72* (the actual nomenclature at that time as yet undetermined, now accepted as the *T-64*) was revealed in the Western press for the first time, we found the Soviets breaking their own tank design "rules." Assuming we accept the possibility of a new engine (which we will discuss later), we find the additional development of a new hull, a new suspension, and a "new" gun. (It appears that this gun, a 125-mm semi-smoothbore, is simply an upscaled version of the current 115-mm gun mounted on the *T-62* that may also have been equipped with an up-scaled version of the *BMP* auto-loader.) Perhaps this is not of great consequence to Western designers, since they are used to designing "from scratch" as required, but it is most unorthodox for the Soviets, who never changed more than one system at a time in their tank design history (figure 1). Even more interesting, and more confusing, was the appearance a short time later of what was potentially a second "new" tank, which had also never been the case with the Soviets. This tank, later listed as the *T-72,* was totally unexpected and caused no end of problems to most analysts who noted a great number of similarities between the two tanks. Accepting evidence of the existence of these two vehicles, we must now determine what

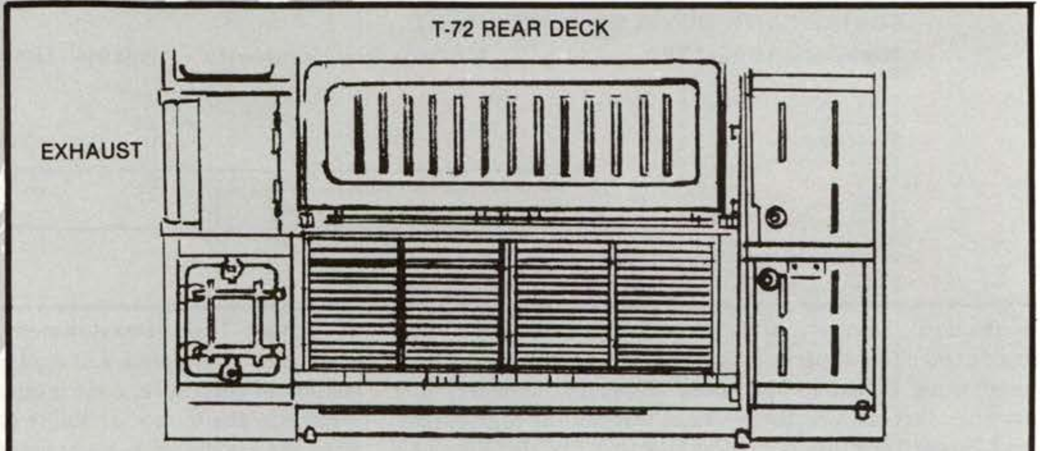

Figure 2

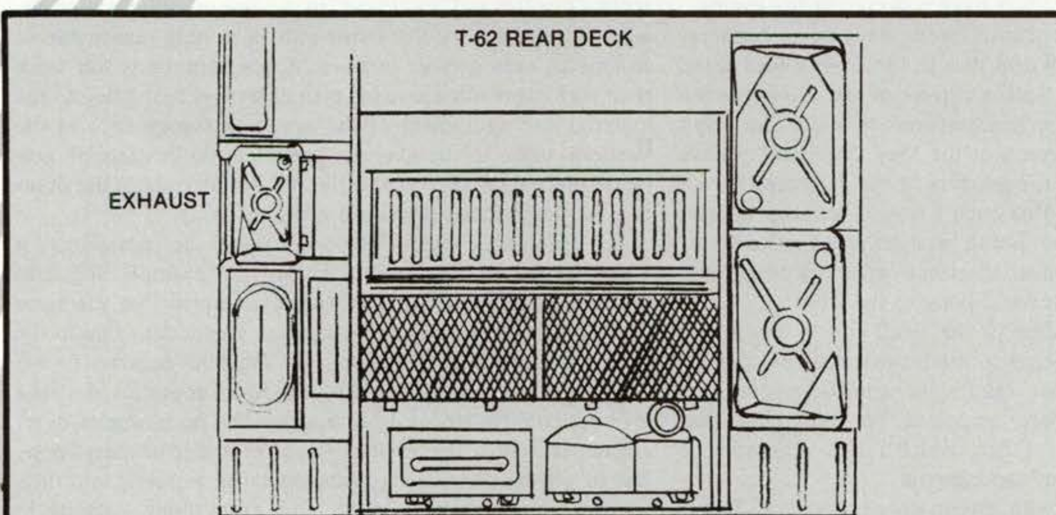

Figure 3

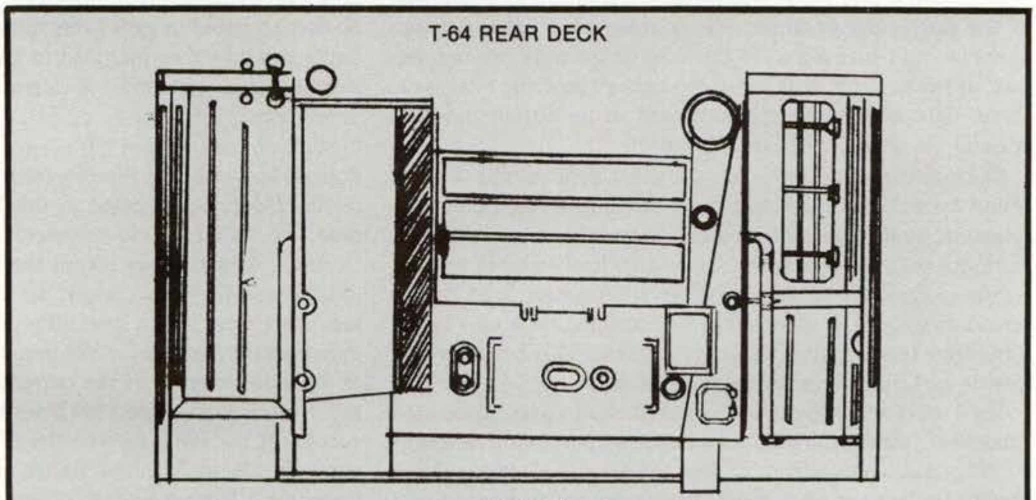

Figure 4

the significance of this apparent change in Soviet tank development doctrine means, as well as asking the question: What are the "indicators" that will allow us to evaluate *two* "new" Soviet tanks, namely the *T-64* and the *T-72*, and where do they fit into the Soviet plan?

By analysis of all available unclassified pnotographs, it appears that, based upon rear deck and exhaust systems, the *T-72* is powered by the same *V-2* (V-12) engine as that in the *T-34/T-62* series (figure 2 and 3). This engine, at 40 years, would appear to have reached the end of its useful modification life, according to most engine specialists and engineers, and at 580 hp, it will probably be impossible to "squeeze" additional power increases out of the engine. Even if it is possible to provide better manufactured or modified engines, it will still be virtually out of the question to "design in" an additional 170 hp to meet the specifications for the 750-hp engine indicated in the current Army statistics. But what about the *T-64*?

The *T-64's* engine will develop 750 hp. When the configuration of the *T-64's* rear deck (figure 4) is considered, it is not inconceivable that the *T-64* may actually have a "new" engine, even in the definition of the Western tank designers. Perhaps, as with the *M-1*, the *T-64* has a turbine engine (one was tested in a tank), new, and just being developed. Further, it is not impossible that this engine is experiencing "teething problems." Further, the suspension of the two tanks is entirely different. The *T-72* shows a suspension remarkably similar to the *T-62* and indeed the entire *T-34/T-62* line, while only sporting what appears to be the addition of three return rollers as an afterthought for a "tighter" track. The Soviets even went to the extent of indicating to the visiting French military representatives in 1977 that the drive wheels and tracks were interchangeable with those of the *T-62M,* a late variant of that tank. The suspension of the *T-64*, however, is composed of six new, smaller road wheels, with a significant gap between the road wheels and the return rollers to provide for what appears to be the same kind of modified *Vickers* suspension used by Western tanks. Again, it appears that the *T-64* is an entirely "new" tank.

In terms of weight, the Soviet tanks have been maintained at the remarkably low and common weight of about 40 tons. The difference between the *T-55* and the *T-62* is about 1½ tons, while the difference between the *T-62* and the *T-72* is even smaller at about 1 ton. This again is indicative of the design similarity of the *T-62* and the *T-72,* and most reasonable,when considering the current railroad and aircraft loading-weight restrictions. Here also, the width of the tank hulls is important, especially for aircraft transport, and, in this case, all three tanks compare favorably.

Yet, with all the data we have, we seem to have great difficulty in determining the various factors associated with the *T-64*. If it is the equivalent of the *T-72*, these should be quite easy to come by, considering the ease with which information on the *T-72* has been obtained lately, not the least of which was an invitation to the French to look it over. So what is the value of the *T-72* and the *T-64* to the Soviets?

Soviet Armor Production—Towards Perfection. Let us assume, for the moment, that the *T-72* is to be the modification platform for the *T-62*. Perhaps, even, the final design modification of the entire *T-34/T-62* family. What might the corrections entail?

Suspension-By adding three rollers, a partial correction should be instituted to the major problem inherent in all Soviet medium tanks since the *T-34*. They should stop shedding their tracks with such alacrity.

Engine—Probably refined, possibly with a turbo-charger, but most probably just better production quality to increase potential horsepower to actual horsepower.

Transmission—According to Western observers of the most recent May Day Parade, the transmissions in the *T-72s* they saw seemed to be much quieter than those of the *T-62s*.

External fuel storage—Indications are that external fuel has been increased from 285 liters on the *T-62* to 400 liters. This may account in large measure for the characteristic "arrow" shape of the upper hull-sides as a result of the simple expedient of enlarging the size of the external fuel cells to cover the length of the hull. Operational range should at least remain the same, if not increase.

Armor upgrading—Taking their lessons from the Arab-Israeli conflicts, the Soviets have increased the angle of incidence of incoming antitank rounds and missiles fired at the front of the tank. It was indicated earlier in the Western press that NATO 105-mm tank rounds had great difficulty in penetrating the *T-62's* frontal armor and that, as a result, it would probably be virtually impossible to penetrate the frontal armor of the *T-64* as it appeared to be designed. The Soviets would likely desire to make such modifications in the design of the *T-72*. Further, the Soviets may have increased the previously indifferent quality of their armor castings, also providing for a more difficult "kill." The turret, it might be noted, is suspiciously similar to the turret of the entire *T-54/55* and *T-62* families.

Gun—Employing a 125-mm semi-smoothbore, similar in type to the 115-mm gun of the *T-62*, the Soviets will again have met their desire to remain ahead of the Western allies in the main tube caliber. Additionally, according to the sketchy reports, the 125-mm gun will be the new mainstay of the Soviet tank forces. By the introduction of the weapon on the *T-72* and on field mounts, the Soviets place ammunition into the supply lines, regardless of any other considerations for the design of the tank.

Sights—As has been indicated in the Western press, the Soviets are currently considering and/or upgrading their *T-55s* and *T-62s* with laser sights. It would follow, and seems to be the case, that the same sights are to be applied to the *T-72* and any future tanks.

Hull—While indications are that the *T-72* hull is 1 foot longer than the *T-62*, it is important to note that it may, in part be due to the manner in which the measurements were taken. The fenders of the *T-72* are noted to project farther than those of the *T-62*, which may conceivably provide for the discrepancy in lengths. Further, it may be that the "gill armor" shown for the first time on the *T-64* and *T-72* may be added to the *T-62* as well, either as a final or an intermediate solution for the defense of the tracks from antitank rounds.

Production lines—Assuming the above to be reasonably accurate, it would indicate that the assembly production of road wheels, engines, transmissions, drive wheels, return rollers, and tracks will be interchangeable with all previous *T-62s*. This is most important to Soviet production methods, since the Soviet dynamic components are designed to be replaced, as opposed to being upgraded or rebuilt during overhaul. And, since the Soviet centralized production system apparently does not function through a contractual system of many small companies supplying one large center, they must keep "in-house" production lines in their factories running to maintain supplies. To switch models completely, then, would require the total withdrawl of those parts from the supply system. Therefore, it is only logical to assume that the standardization of "throwaway" components will be met whenever and wherever possible. This is particularly important in view of the Soviet declaration that the *T-62* was to be withdrawn from production. In any other case, it would indicate the loss of replacement capability for all of the countries which had Soviet *T-62s* but no means to provide replacement parts.

Chobham Armor for the T-72? A great deal of speculation is currently being vocalized concerning both the capabilities of Chobham armor (the special British-developed defensive armor apparently capable of defeating even the most powerful of current rounds) and whether or not the Soviets intend to introduce it to their tanks.

Chobham armor is a composite consisting of a special material sandwiched between two layers of armor (at this time listed as titanium alloy armor plate by the periodical, *International Defense Review).* The specifically designed purpose is to defeat enemy large-caliber tank rounds and antitank missiles of the high-explosive antitank (HEAT) variety, but it also appears to be effective at stopping the more conventional high-impact tank rounds as well. It appears to require flat surfaces and inner obliquities greater than 50 degrees for employment, at least for the present. As such, from the photos of the vehicles we have seen that are definitely known to be so armored (the British-designed tanks, the Shir Iran version of the *Chieftain,* the Vickers *MK IV Valiant,* and the West German *Leopard II*), all have square turrets, boxlike hull outlines with track "skirts," and what appear to be sections or plates of the armor used to build up both the turret and hull defenses. What are the possibilities that the *T-72,* the tank now accepted as the current Soviet main battle tank, is equipped with Chobham armor?

Hypothesis—No Chobham Armor for the T-72. Since the turret of the *T-72* appears to be comprised of a single ballistically, superbly designed semi-spherical casting, as with all of the preceding *T-54/55/62* series of tanks, it is most reasonable to assume that Chobham armor has *not* been used in the construction for the following reasons:

•There is no means to provide for the spacing required on the turret, since the turret outlines are similar to the *T-62*. The only place such spacing could be acquired would be internally in an already cramped tank.

•There is no point at which the blast against the turret, as it is now designed, could be "vented" away from the rest of the turret not affected by the direct hit. Since it appears to be constructed of a single casting, a strike requiring the replacement of a section of the turret would ultimately require the replacement of the entire turret, which would seem to defeat the purpose for the use of such armor in the first place.

•The turret, as designed, is so ballistically well-shaped that, even without such armor, it will probably be extremely difficult to achieve a penetration of the steel armor in any event.

•There also appears to be no provision for the application of Chobham armor on the hull. Again, the only space available for the application of such armor, assuming it to require the volume indicated by the various versions of allied armored vehicles would be the critically short internal space, already at a premium for both crew space and ammunition storage. If, in fact, the Soviets have opted to employ only limited use of the special armor, then the most reasonable point of application would be the front hull of the tank. But there, due to the slope of the armor, it would appear that such an application might be too expensive for the limited additional protection that might be obtained.

Even if the only application of Chobham armor, at this late date, is to be in the form of track skirts, it would be only reasonable to have made provisions for such application before the ultimate distribution of weight. Chobham armor weighs virtually as much as conventional armor and the British design form of Vickers has already noted that the interior armor of the Chobham-armored tank should be made of aluminum armor to save weight. Therefore, it follows that, at 1 ton heavier than its predecessors, the *T-72* would suffer decreased performance as a result of the addition of Chobham armor skirts at this time.

Finally, the costs for such armor protection are high and it would seem rather improbable that every country now looking to purchase or produce such tanks is also planning to utilize such expensive armor, especially considering that the export versions built in Russia are not equipped with the far less expensive antiradiation plastic shielding. It would appear to us then that the *T-72* is not to be fitted with Chobham armor. But where then do the rumors of a Soviet tank so equipped and constructed come from?

A Possible Conclusion. As we have noted at various points throughout this discussion, the Soviets have been only too willing to put their "new" *T-72* tank on display for the Western military. In fact, they are now providing *T-72s* to independent or neutral countries as well as those of the Warsaw Pact. This is very interesting considering that, to this point, the majority of those Warsaw Pact countries were armed with mostly tanks of the *T-55* series. It is hard to determine whether this may have been strictly for economic reasons, or the result of the Soviets wishing to retain a level of technology one step above that of their Warsaw Pact "allies." We do know, however, that the *T-62* was supplied to many Middle Eastern and African countries which, though further away and less capable of causing unsightly confrontations in Europe, are also quite incapable of supporting the Soviets in a major European war. Yet, they are now also being supplied with the new *T-72*.

Gullible as we are, we find it hard to believe that the *T-72* is the Soviets' "new" tank. How can it be? It is touted by Western military analysts as possessing every conceivable modern advance in technology, yet, it is being handed over to any country that asks for one, while the Soviets retain a tank for their own use that is described as being under development and inferior to their current armor. No amount of Soviet public relations staff turnover could account for such a change in policy. However, if we are correct, the Soviets are under pressure to produce a tank that has been upgraded to perform substantially better than the *T-62* for countries that possess Soviet equipment. This will meet the requirements of Soviet allies and continue the commonality of components and parts.

Hypothesis—The T-72 is the Equivalent of the "M-60A4." We believe the tank referred to as the *T-72*, while indicated as a "new" Soviet tank by Western standards, is the Soviet equivalent of a further modified U.S. Army *M-60* series main battle tank. We are aware that the Soviets are constructing *T-72s* at a rate approximately four times as fast as that of the *T-64* and are supplying them not only to the Warsaw Pact but to the Syrians. This, as has been indicated, could probably have been accomplished if the components for the construction had already been in production prior to the introduction of the *T-72*. We have only one mystery left to unravel—why the *T-64?*

Since we have noted that the *T-64* is constructed in considerably smaller numbers than the *T-72* and has a radically redesigned suspension; may possess an uprated or even a new engine; mounts a 125-mm gun similar, if not identical, to the gun mounted in the *T-72;* and, especially inasmuch as no other country has been invited to view the *T-64,* we believe that it is indeed a "new" tank for the Soviet Army.

Intelligence analysts and observers have noted that a tank, similar in appearance to the *T-72,* but mounting skirts and with a "wider spacing" between road wheels, was noted in winter maneuvers outside Moscow in 1977. Suggesting that this was in fact an upgraded *T-72,* they sought to analyze how

T-72 "WITH SKIRTS"

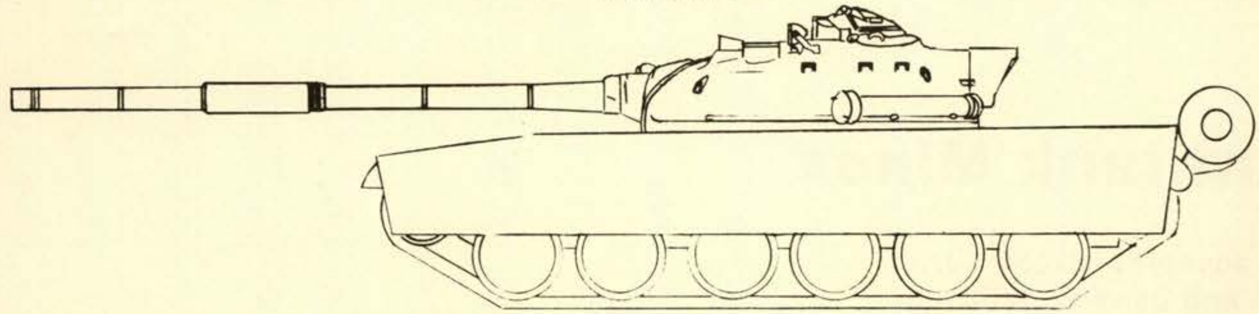

Figure 5

T-64 "WITH SKIRTS"

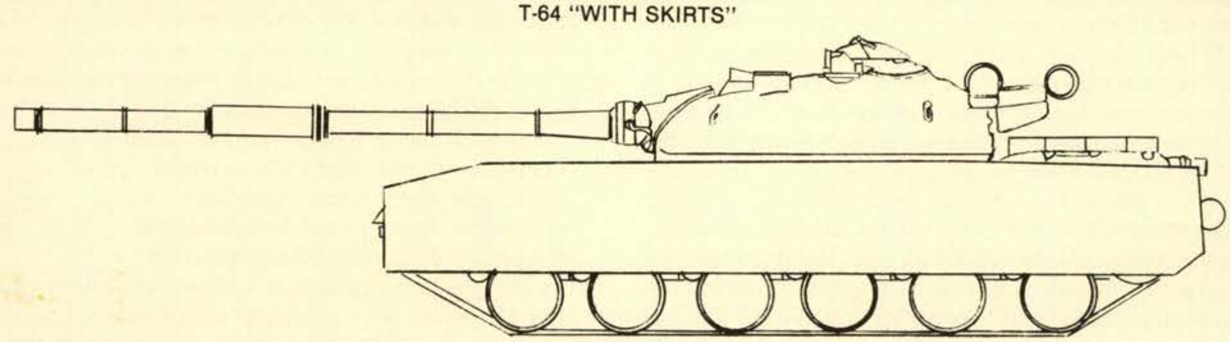

Figure 6

Chobham armor might be applied to a tank such as they had seen and which they called a *T-72*. Remembering that such an upgrading would be more in line with the Western concept of improvement than with the Soviet conception, we believe instead that they saw a *T-64*. If you will note in the accompanying line drawing, observation of a blurry photo of a *T-64,* seen from long range and mounting skirts that would hang down to just over the road wheels, would probably produce the optical illusion that the tank was a "stretched" *T-72* with skirts (figure 5). The illusion would be all the more "real" if the turret was perpendicular to the line of sight, while the hull, perhaps only 5 degrees off alignment with the gun, would appear shorter than in actuality. That would reinforce the impression that the gun was indeed enlarged over the *T-72,* thus providing a second reinforcement that the tank might be a "new" *T-72*. However, the road wheels of the *T-64* are smaller and designed for a "high-speed" or "heavy" suspension (depending upon application) on a hull that is lighter by 3 tons than the *T-72*. Therefore, it seems reasonable that what was actually seen was the *T-64* in prototype configuration mounting the Chobham armor skirts (figure 6). Add the fact that the *T-64* mounts the now-standard 125-mm semi-smoothbore gun, has a turret ballistically superior to any design in the West, and potentially houses a new engine capable of providing the power to drive the vehicle in high-speed combat maneuvers with *BMP* infantry carriers, and only one statement remains to be added.

The tank is already in production by Soviet standards.

Hypothesis—T-80.

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Antitank Mines

by Joseph Backofen, Jr. and Larry W. Williams

This is the sixth in a series of articles on tanks and the technologies of armor penetration, armor, and survivability.

NATO is very much concerned with the possibility of a massive Soviet armored assault to which it may not have sufficient personnel or mechanized equipment to respond. Since the various mechanized or man-portable antitank weapons cannot be pre-positioned in sufficient numbers in all critical areas, it is important to consider their probability of being available where and when they are needed, as much of their effectiveness will ultimately depend on this. The probability of being available in time and location is generally considered under the single heading of "mobility," but this can be of at least three different kinds: strategic, operational, and battlefield.

Strategic mobility amounts to the ability to be transported quickly and easily over long distances. It is, therefore, inversely related to the weight and bulk of the weapon system, as this governs the ease with which it can be transported by ship, rail, road transporter, or aircraft. The portable antitank weapons and mines are clearly the easiest to transport and have, therefore, the highest strategic mobility, with the weapon systems mounted on light ground or air vehicles coming second, and tanks, as the heaviest, being the least mobile in this sense.

Operational mobility is essentially the ability of the weapon system to move rapidly by itself in the zone of operations. It is inherently low in the case of portable weapons which depend for their locomotion on the men who carry them, but who themselves are readily transportable in a variety of ground vehicles or helicopters. In the case of the weapons mounted in ground vehicles, operational mobility is largely a matter of automotive performance of the vehicles. Once deployed, the operational mobility of mines is almost nil. However, before they are deployed, their mobility is that of the vehicle, aircraft or other system (rocket, cruise missile) that will deploy them.[1]

Battlefield mobility is the capability to move about while under the threat of hostile fire. It is related to the weapon system's capability to absorb the enemy's blows once it has been detected and engaged. Light man-portable antitank weapon systems have negligible battlefield mobility. Mines generally differ from all other types of antiarmor ammunition and weapons in that "hits" are provided by enemy actions and, except for the horizontal firing mines, they do not have an "effective range." They are also passive, stationary emplacement weapons once they are deployed and, by design, have no battlefield mobility. Armored vehicles, such as tanks, have high battlefield mobility by virtue of their protective armor. However, this mobility can be rapidly brought to zero by the emplacement of scatterable mines that are lethal to the tank's armor and/or running gear.

The combination of the mine's strategic and operational mobility with low cost makes mine warfare attractive as a means of slowing and ultimately stopping massive armor assaults.[1] In this regard, the usage of mines against tanks has resulted in the following loss statistics:[2-4]

- 16 percent during World War II (average)
- 28 percent during World War II (Italy)
- 70 percent during Korean Conflict
- 85 percent during French Indochina War
- 70 percent during U.S. Vietnam Action.

Even though these percentages were greatly influenced by the way the mines were employed in combat, the smaller percentage for World War II can still be considered significant with regard to stopping an armored assault. If natural obstacles on the avenues of approach are such that tank traffic is as restricted as in the Italian campaign, then even more importance can be placed on mines.

During World War I, German line commanders noted the shortfalls of the early tanks.[5] This resulted in the development of extensive obstacles such as antitank traps, ditches, obstacles, and even an artificial lake.[6] However, the effect of artillery shells and buried explosive charges on tanks did not go unnoticed. This resulted in the local fabrication of antitank mines (traps) from artillery shells, wooden boxes, and either impact levers for initiating the projectile's fuze or modified hand grenade fuzes.[7] By 1918, antitank mines had developed into prepared munitions that were used to augment natural and manmade obstacles.[8,9] In this respect, obstacles acquire a certain "firepower" of their own by the employment of antitank mines which were considered at that time to be one of the major means of stopping and destroying tanks. The previous statistics show that they can still be considered important.

Mine warfare technology is not limited to any one country and can be used against NATO forces just as easily as it can be used against Soviet armored formations. It was noted 20 years ago that "Historically, nobody has employed mines more extensively or with greater skill than the Russians, particularly in relationship to battle-area mobility,"[3] This may have had some effect on the vehicle loss rates encountered in Korea and Vietnam. Therefore, it appears to be appropriate to review the technologies, effective mechanisms, and disruption of antitank mines and boobytraps.

Once deployed, mines are silent, long-lived, passive, stationary, hard to detect, emplacement weapons. Table 1 presents some historical data on the tactical and technical characteristics of some antitank mines. They are generally used to form or augment defensive/offensive barriers in the forward battle area or as ambush weapons against the rear lines of communication and supply.[10] The size, weight, actuation

TABLE 1. PRINCIPLE TACTICAL AND TECHNICAL CHARACTERISTICS OF SOME ANTITANK MINES

Country/ Designation	Fuze Type/ Principle	Explosive Type/ Weight, lb.	Fabrication Material	Weight, lb.	Dimensions, in.			Kill Mechanism	Year Fielded
					Height	Dia./Length	Width		
Belgium									
Type II	--/p	TNT/12.8	Metal	20.00	8.50	10.25	-	B	WWII
B.S.B.	--/p	TNT/7.7	Metal		7.00	10.50	-	B	WWII
PRB-ATK-M3	M30/p	Trialene/13.2	Polyethene	15.00	5.12	9.06	-	B	
Czechoslovakia									
NA-Mi-Ba	--/c	Tritol/5.3	Bakelite		7.80	9.80	-	B	
PT-Mi-Ba[4]	RO-7-11/p, a	TNT/12.0	Phenolic Resin	16.80	4.00	12.80	-	B	1953
PT-Mi-D	RO-1 or RO-7-11 or both/P, F	TNT/13.7	Wood	20.00	5.50	13.00	8.50	B	1951
PT-Mi-K[4,5]	RO-5 or RO-9/p	TNT/11.0	Sheet Metal	15.80	3.90	11.70	-	B	
TQ-Mi	--/c	TNT/11.5	Cardboard	22.00	5.90	11.00	-	B	
Denmark									
M47-1	M47-I, M47-II/p, a	TNT/14.3	Sheet Metal	22.00	3.60	12.40	-	B	
Model 52	4 fuzes/c, a	TNT/18.5	Plastic	23.80	4.90	11.80	-	B	1952
Model 52/53	4 fuzes/c, m	TNT/18.5	Plastic	24.30	5.40	12.80	-	B	
Egypt									
Modified SACI	3 fuzes/p	TNT/15.5	Plastic		8.00	11.00	-	B	
France									
le Pz Mi 407 (f)		Picric Acid/	Metal	14.50	4.50	9.40	5.50	B	WWII
S Pz Mi 420 (f)	M.35 or M.36/p	Picric Acid/	Metal	22.80	4.75	16.20	9.35	B	WWII
Model 1947	M49, M50, M52, /p, c, f, a	TNT/12.0	Bakelite	24.20	4.20	13.20	-	B	1947
Model 1948[6]	M48, M52/p,f,a	TNT or MD[7]/11.5	Sheet Metal	19.80	3.40	12.40	-	B	1948
Plate Charge Models 48, 48-55	-, -, M52/ t,o,f,a	TNT or Picric acid/15.21	Metal		5.30	10.80	-	MS[8]	1948
Model 1951	M50, M52/c,f,a	TNT/14.3	Cast TNT with glass wool	15.40	3.60	11.70	-	B, SC	1951
Models 1953, 1954	-, -, M52/t,o,f,a	-/0.7	Metal	2.00	10.90	2.80	-	SC[9]	1953
HPD Mod FI[4]	-/M	Comp.B/4.4	Plastic	13.20	4.13	11.02	7.28	MS[10]	late 60's
MAH F1	-/O	/14.3	Metal	22.30	19.40	7.50	-	MS[11]	1963
Germany									
Antitank	-/p	-7.5	Wood/Tin	12.00	2.00	12.00	8.00	B	1918
New Model	-/p	Perdite/3.5	Sheet Metal	10.79	2.76	9.84	5.50	B	1918
Tellermine 29	ZDZ29/p	TNT/10.0	Zinc	13.25	2.75	10.00	-	B	pre WWII
Tellermine 35	-/p	TNT/10.6	Aluminum and Steel	19.25	3.50	12.75	-	B	1939
leichte panzermine	-/p	TNT/5.0	Sheet Metal	8.00	5.00	12.00	-	B	pre 1940
Tellermine 35 (Stahl)	-/p	TNT/11.4	Steel	21.20	3.25	12.75	-	B	1943
Tellermine 42	T.Mi.Z.42/p	Amatol/	Sheet Metal	17.20	4.00	12.75	-	B	1943
Tellermine 43 (T.Mi. 43 Pilz)	T.Mi.Z.42/p	Amatol/	Metal	17.20	4.00	12.50	-	B	1943
Riegelmine 43	ZZ.42/p	TNT/17.6	Sheet Metal	20.50	3.50	31.50	3.75	B	1944
Holzmine 42	-/p	Amatol or TNT/11.0	Wood	18.00	4.50	12.25	10.00	B	WWII
Panzerschnell-minen (A,B)	ZZ42 or "Bock" Fuze /p	Pecric acid/ 13.2	Wood	16.00	5.0	20.75	13.00	B	WWII
To Mi A 4531	-/p	Amatol/	Plastic	22.00	5.5	12.50	-	B	1944
Pz Stab Mi 43	-/t		Metal				-	SC	WWII
Hohl-Sprung-Mine 4672	43/I or 43/II/T	Cyclotol/1.57	Metal	20.00	11.25	6.25	-	SC[12]	WWII
East Germany									
PM-60 4	-/c, p	TNT/22.0	Plastic	25.00	5.00	12.00	-	B	1958
West Germany									
DM-11	-/p, f	TNT/14.3	Cast TNT with fiber reinforcement	15.40	3.70	11.80	-	B, SC	13
PZ-Mi-2[14]	-/p	RDX-TNT/11.0	Aluminum	20.2	5.20	12.00	-	SC	
Pandora Bar Mine (AT-1)		-/2.4		3.00		14.20		B	
Hungary									
Nonmetalic Shaped Charge	-/p	TNT/	Cardboard and plywood	12.00	9.30	11.70	-	SC	
Misznay-Schardin			Steel				-	MS[15]	
Israel									
No. 25	-/f	TNT/15.4	Metal	16.00				B	
No. 26	-/p	TNT/15.5	Nonmetallic	19.90				B	
Italy									
Pignone I	-/p	TNT/7.0	Bakelite	12.00	5.13	13.00	-	B	WWII
Pignone II	-/p	TNT/7.0	Bakelite	12.00	5.13	13.00	-	B	WWII
Mod. CS 42/3 (modified 42/2)	Model 42/2/p	TNT/11.0	Wood	15.40	5.65	11.07	9.20	B	
SH 55 (Minelba)	-[16]/p	Comp.B or TNT/12.1	Plastic	16.11	5.10	10.06	-	B	1955
Model "SACI" 54/7	3 ea. AC52/p	TNT/11.0	Plastic	13.70	6.04	10.88	-	B	
		or TNT/19.8	Plastic	22.50	7.41	10.88	-	B	
FD-non-metallic[17]	-/p		Plastic	16.50	5.60	11.00	-	B	
SB-81 (MISAR)[4,17]	-/p	/4.4	Plastic	7.00	3.54	9.13	-	B	1979
SB-MV/T (MISAR)[19]	/?, a	/5.7	Plastic	11.00	3.54	8.66	-	SC[18]	1979
SBP-04 (MISAR)		/8.8		11.00	4.33	9.84	-	B	
SBP-07 (MISAR)		/15.4		18.00	5.12	11.80	-	B	
MATS[17]	-/p	/3.1	Plastic	7.71	3.54	8.66	-	B	
TC/3.6 (TCE/3.6)	-/p, (E)	/8.0	Plastic	15.00	5.70	10.63	-	B	
TC/6 (TCE/6)	-/p, (E)	/13.2	Plastic	21.12	7.28	10.63	-		
VS-HCT	-/S, M	/4.4	Plastic	8.80	4.09	8.74	-	SC[18]	
VS 2.2	-/		Plastic	7.70	4.60	9.69	-	B	
Manta[19]	-/M	/220	Plastic	485.0	14.96	38.58	-	B	1980
Japan									
Type 88	-/p	Picric Acid/2.0	Metal	3.00	1.75	6.75	-	B	1928
Type 93	-/p	Amatol/4.5	Terra Cotta	11.38	4.73	8.60	-	B	1933
Landing Defense Mine[19]	-/p,c		Metal				-	B	WWII
Type 63	-/p	Comp.B/24.2	Plastic	35.00	8.50	12.00	-	B	
Netherlands									
P.W. 2-41	-/p	TNT/5.3	Sheet Metal	9.50	3.50	7.85	-	B	WWII
Type 2, T40[19]	PW-2/p	TNT/9.0	Sheet Metal	13.20	3.50	11.00	-	B	WWII
Model 25 [6]	M29/p	TNT/19.8	Sheet Metal	28.60	5.03	12.00	-	B	
Model 26 [20]	M26/p	TNT/19.8	Molded with glass fibers	19.80	4.44	11.70	-	B	
Poland									
Unknown	-/p	TNT/1.8 to 2.3	Metal	-	-	7.75	-	B	WWII
Antitank, plastic			Plastic	21.00	3.10	12.40	-	-	
Spain									
CETME Mine	-/c, p[21]	TNT/11.5	Bakelite	22.00	6.00	18.00	-	B	
Sweden									
Models 41-47 & 47	-/p[22]	TNT/11.0	Metal		4.90	13.80	-	B	
Models 47 b, c,d	-/p	TNT/12.1	Metal	19.80	3.90	13.50	-	B	
Model 52	M47/p[22]	TNT/16.5	Molded Plywood	19.80	3.00	13.50	-	B	
Model 5	-/p, t	Hexatol/	Glass fiber reinforced explosive	22.00	6.40	13.20	-	B	
Mi-101 (Bofors)	Bofors/p, t	Hexatol/24.5	Glass fiber reinforced explosive	27.50	6.25	12.20	-	B	
Mi-102 (Bofors)	Bofors/p, t	Hexatol/	Glass fiber reinforced explosive	17.60	2.80	12.20	-	B	
Mi-103 (Bofors)	Bofors/p, t	Hexatol/	Glass fiber reinforced explosive	22.00		12.20	-	B	
FFV028[4]	-/M	RDX-TNT/7.7	Metal	16.50	4.33	9.84	-	SC[23]	DEV
Model 6	Unk.								
Switzerland									
Model 37	DKZ.b,DKZ.G/p							B	
Model 42	DKZ42/p							B	
Model 49	DKZ49/p							B	
Turkey									
4 Skg	-/p	TNT/9.9	Zinc	14.30	3.00	10.00	-	B	
Soviet Union									
TM-35	MUV/p, f		Sheet Metal			square		B	1935
TM-38/39	-/p	TNT/7.9	Sheet Metal	11.23	3.15	8.67	8.67	B	pre WWII
YaM-5 (TMD-41)	-/p	Ammonium Nitrate/11.0	Wood	13-15	3.70	19.50	7.40	B	1941
YaM-10	-/p	Amatol/22.0	Wood	26.00	7.80	24.40	8.70	B	WWII
TM-41	MV-5/p	TNT or Amatol/8.4	Sheet Metal	11.90	5.70	9.90	-	B	1941
TMD-B	MV-5/p	-[24]/11-15	Wood	16-20	5.40	12.40	10.90	B	1942
LMG off-rt. Rocket	MUV/p, f	TNT/0.4	Metal	22.00				SC	WWII
TMD-44	Mv/p	TNT/14.8	Wood	21.40	6.22	13.00	13.00	B	WWII
TMB-2	MV-5, ?/p, c	TNT or Amatol/ 11.0	Asphalt-Cardboard	15.40	5.10	10.80	-	B	WWII
TMN-46 (TM-46) 4, 19	MV-5 or MV5K/ p, a	TNT/12.6	Metal	19.20	2.90	11.70	-	B	1952
TM-57	-/p	TNT/15.4	Metal	20.00	4.00	12.00	-	B	
TM-62-M-P	-/a	TNT/	Metal, Plastic					B	
TMK-2								MS	
United Kingdom									
Mark I	-/p	Baratol/4.0	Sheet Metal	7.00	2.30	7.50	-	B	WWII
G.S. Mk. II	No.1, Mk.II/p	TNT/4.0	Sheet Metal	8.50	3.25	7.50	-	B	WWII
G.S. Mk. III	No.2, Mk.III/p	TNT/	Sheet Metal	5.60	5.25	[illegible]	-	B	WWII
G.S. Mk. IV	No.3, Mk. I/p	TNT/8.3	Sheet Metal	12.50	5.00	8.00	-	B	WWII
G.S. Mk. V	No.3, Mk. I/p	TNT/8.3	Sheet Metal	12.50	5.00	8.00	-	B	WWII
E.P. Mk. V	E.P.No.1 or No.2/p	TNT/4.5	Sheet Metal	8.00	2.27	8.00	-	B	WWII
E.P. Mk.VI	No.3, Mk. I/p	TNT/4.5	Sheet Metal	8.00	3.25	8.00	-	B	WWII
No.75 Hawkins	-/c	Ammonal/1.5	Sheet Metal	2.30	0.87	6.80	3.63	B	WWII
Mark VII[6]	No.4, No.5/p	TNT/19.6	Sheet Metal	30.00	5.10	12.80		B	
Bar mine[4]	-/p	/18.5	Plastic	24.00	3.20	47.20	4.3	B	
United States									
M-1/1A1	M1A1, M1A2/p	TNT/6.0	Sheet Metal	10.60	4.00	8.00	-	B	1941
M-4	M4/p	TNT/6.0	Sheet Metal	10.60	4.00	8.00	-	B	1943
M-5	M5/c	TNT or Tetrytol/5.6	Pottery	14.50	5.50	10.00	-	B	1943
M-6,-6A1[6]	M600,M603/c, p	TNT/12.0	Sheet Metal	20.00	3.25	12.50	-	B	1944
M-7,-7/A2	M600,M603/c, p	Tetrytol/3.3	Sheet Metal	4.90	2.50	7.00	4.50	B	WWII
M-15	M608/p	Comp.B/22.0	Sheet Metal	30.0*	4.88	13.13	-	B	Korea
M-19	M606/p	Comp.B/21.0	Plastic	28.00	2.95	13.09	13.09	B	
M-21	M607, M612/t, p	Comp.H6/11.0	Metal	17.3*	4.50	9.00	-	MS	
M-24[25]	M2AT/p	Comp.B/1.9	Metal	18.00	11.50	2.90	14.50	SC[25]	
M-66[25]	-/S, E	Comp.B/1.9	Metal	18.00	11.50	2.90	14.50	SC[25]	
M-56[26]	-/p	Comp.B/3.0	Metal	5.00		rectangular		B	1977
XM-70/73	-/M	PBX/1.3	Metal	5.00				MS	DEV.
XM-75	-/M	RDX-Estane/1.3	Metal	3.70				MS	DEV.
North Vietnam									
MC?A "Min (Chong) Chien XA"	3 ea. C7A/p	TNT/17.4	Metal	19.60	3.30	10.90	-	B	
B-40 Antivehicular	MUV/p, f	RDX-TNT/1.2	Metal	2.70	10.00	3.15	-	SC	
Shaped Charge -100 mm	K-50/p	TNT/3.5	Metal	6.00	3.94	12.20	-	SC	
-150 mm	K-50/p	TNT/8.8	Metal	13.60	5.91	14.40	-	SC	
-200 mm	K-50/p	TNT/16.5	Metal	24.25	7.87	17.00	-	SC	
Yugoslavia									
Metal Pot Mine	-/p	-/5.5	Sheet Metal					B	WWII
TMM[6]	-/p	TNT/	Sheet Metal	19.0	3.94	12.20	-	B	
PT 56	-/p	TNT/12.0		22.0		rectangular		B	
TMA-1	UTMAH/p, F	TNT/12.1	Plastic		4.13	11.90	-	B	
TMA-3	-/p	TNT/	Plastic	14.3	3.10	10.10	-	B	

1. Activation code:

   p = pressure, c = chemical pressure, t = tilt rod, M = magnetic influence, S = seismic, O = offset, mechanical
   f = friction, a = antidisturbance fuzing, E = electronic

2. Conversion factors:

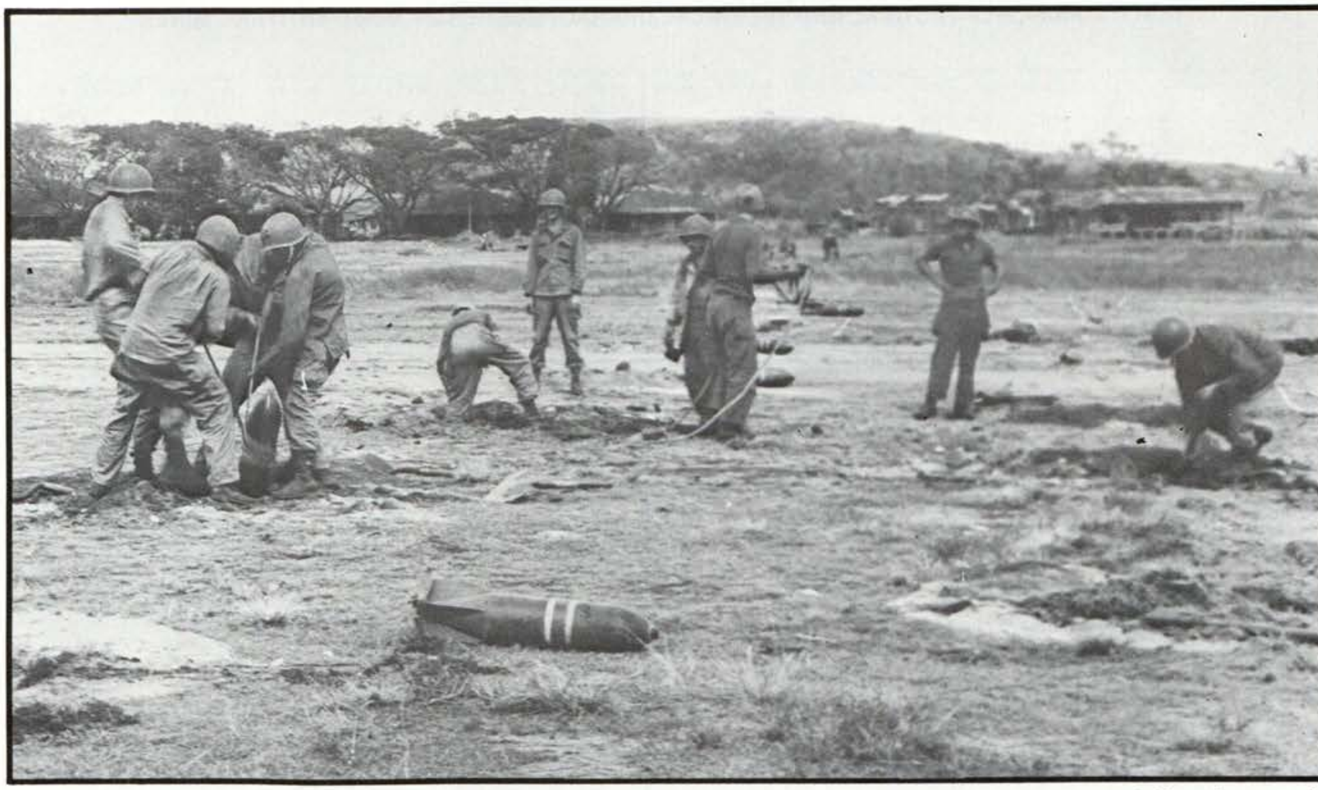
   for lb. to kg. multiply by 0.454
   for in. to cm. multiply by 2.54

3. Kill mechanism code:

   B = blast, MS = Misznay-Schardin, SC = shaped charge

4. Emplaced by mechanical equipment
5. A special pulsed feature has been incorporated into the design of the presure plate.
6. A version of the WWII German Tellermine 43
7. 80 percent picric acid, 20 percent dinitronaphthalene
8. Penetrates 1.9 in. at a distance of 20.0 in.
9. Penetrates 4.0 in. at a distance of 23.0 in. and was developed by using 73 mm diameter rifle grenade warheads in a mine configuration
10. Penetrates 70 mm
11. Penetrates 50 mm at a distance of 80 meters
12. Used a modified Panzerfaust warhead to achieve target penetration cabability
13. Modified French Alsetex mine (Model 1951)
14. Air droppable from a height of 10 meters
15. Penetrates 100 mm at a distance of 20 meters
16. Pneumatic fuze is resistant to overpressure, flails, high explosive breeching and nearby exploding mines
17. Airdroppable mine
18. Penetrates 70 mm of belly armor
19. Used for underwater emplacement on invasion beaches or in rivers and streams
20. There is a fixed anchor mine kit using the model 26 mine for application to fast flowing streams and other bodies of water
21. Hydraulic damped time response
22. Uses a pentagonal pressure spider
23. Can perforate the following steel plate/airgap array: 50 mm at 500 mm + 10 mm at 100 mm + 10 mm at 100 mm
24. Explosive filling may be TNT, Amatol, Dynamon, Ammonite, or Picric Acid
25. Uses 3.5 inch M28A1 rocket which can penetrate 280 mm of armor
26. Scatterable mine

mechanism, and materials from which the mines are fabricated are determined by their tactical development. They may be deliberately hand-emplaced with significant attention to such details as ideal emplacement and camouflage; or, they may even be randomly scattered about by hand, by dropping from aircraft, or by ejection from a rocket or projectile warhead. The tactical requirements generally prescribe the method of emplacement which, in turn, determines the type of mine that



When conventional antitank mines are not available, other ordnance can be used. This minefield of 100-kilo aerial bombs, armed with pressure fuses, was laid on an approach to the Clark Field area of the Philippines by Japanese defenders during World War II.

is employed. Excluding the field fabricated mines/ boobytraps, the present antitank mines fall into three categories: blast, shaped charge, or Misznay-Schardin.

The buried blast mines currently in use contain from 11 to 22 lbs. (5 to 10 kg) of explosive, and some of the lighter buried mines should be doubled (one placed on top of another) to counter a particular armor threat.[3] The explosive weights of the older designs were determined by the amount of explosive needed to cut/destroy the running gear in order to produce a mobility kill, with approximately 6.6 to 11 lbs. (3 to 5 kg) being needed against light- and medium-armored vehicles, and 22 lbs. (such as in the U.S. *M-15*) being required to cut the track of a heavy tank such as the Soviet JS III. The newer series of scatterable blast mines contain from 1.3 to 3.0 lbs (0.6 to 1.4 kg) of explosives but are able to perform the same mission because they are not buried under earth.[11,12]

Blast mines produce damage against armored vehicles by two distinctly different mechanisms.First, an explosive charge in contact with a metal part can cut or break it as a result of the action of the explosion.[13-16] This happens because the rapid change from a solid to a gas (explosion) releases energy so quickly that a very high pressure pushes against the metal part. This high pressure moves through the metal part rapidly in the form of a shock wave that can cause the metal to deform or break if the pressures and reflections from other surfaces are great enough. (Muzzle blast is an example of a "soft" shock wave in air that can cause soft materials, such as bushes, to move and thin plates to deflect.) When an explosive charge is buried under soil, the soil often becomes a buffer that reduces the pressures that are exerted on the track, road wheels, etc. Thus a larger explosive charge must be used if the mine is to be buried and track cutting/destroying action is to be achieved. However, the second "blast" mechanism for causing damage to an armored vehicle is that of using the earth (soil) cover over the mine as a "projectile." In this case, the explosion hurls the soil at a very high velocity like so many very small fragments. Even though the soil may not be able to make holes in the tank's armor or cut a track, the impact of a large mass of soil moving at high velocity can cause the structure to deform.[14-17] (The Vietcong destroyed a bridge at the village of Go Dau Ha in 1970 by detonating a large explosive charge underwater such that the water blew upward and lifted the bridge off its piers.) Soil propelled upward against the belly of an armored vehicle can similarly cause gross deformation and even destruction of the armored structure.

The packaging (i.e. outer wall) of blast mines varies from molded-glass-reinforced TNT (DM-11, Mi-101) through cardboard (TQ-Mi), wood (CS 42/3), and various plastics to metal.[18-23] They are adaptable by various fuzing techniques to airdrop emplacement, air delivery, mechanical emplacement, mechanical delivery, and hand emplacement. As a result of the definition of blast by which these mines cut tracks or stave-in belly armor, they are generally fuzed with a pressure, close-contact, or influence fuze. The pressure and close-contact fuzes usually limit the effect of a so-equipped mine to cutting or damaging the running gear. However, if the fuze can be offset from the mine, they can be arranged so that the explosive charge goes off under the belly of the tank. (In Vietnam, this was a common boobytrap arrangement; wherein split bamboo and copper wire were used as a close-contact switch along the edge of the road; while the battery, detonator, and an explosive charge, such as an artillery shell, were located in the center of the road.) An influence fuze permits the mine to be effective under the "shadow" of the entire vehicle, since it does not require the action of pressure exerted by the track. Thus, it is more likely to be activated by an armored vehicle.

Since blast mines use the high pressure exerted by an explosion to cause damage, and since explosives are generally nonmetallic and nonmagnetic, nonmetallic fuzes were developed so that the mines could not be detected by magnetic mine detectors. In this respect, it has been noted that "There are still very few mine detectors which will detect nonmetallic mines, the most likely type to be found on the battlefield today."[20] The nonmagnetic fuzes can and have been made from plastic materials, as well as from glass vials that contain reactive substances. However, it should be noted that the nonmagnetic material fuzes are of the pressure-activated type and are generally susceptible to overpressure mine-clearance techniques.

Shaped-charge and Misznay-Schardin antitank mines are generally metallic. This is brought about by the fact that they both use shaped-charge technology in order to produce a high-velocity metal penetrator intended to perforate the target's armor and cause internal damage.[3,11,24] However, it should be noted that there are some exceptions. First, Hungary has developed a shaped-charge mine that does not use a metallic liner. Instead, a plywood disc acts as a diaphragm over an unlined explosive cavity.[18] The intent is to use the unlined shaped-charge effect to concentrate the explosive's force into a localized region on the belly of the tank or the running gear. The French mine *Model 1951* and the West German mine *DM-11* have been noted to have a similar shaped-charge effect.[21]

The jet-forming, shaped-charge mines are derivatives of the earlier developed man-portable weapons, such as the *Panzerfaust*. Figure 2 illustrates the World War II German *Hohl-Sprung-Mine 4672,* which used a modification of the *Panzerfaust* warhead, aimed upward toward the belly of the target. The mine was tilt-rod fuzed so that it would be actuated by contact with any part of a target trying to pass over it. The French mines, *Models 1953* and *1954,* were similarly configured and used 73-mm diameter rifle grenades as the explosive charges in order to perforate up to 100 mm of a target's armor at a distance of 580 mm. More recently, during the Vietnam Action, the North Vietnamese used *B-40* or *PG-2* shaped-charge grenade warheads in similar mines that had a pressure-actuated fuze. Similarly, they developed and used 100-, 150-, and 200-mm shaped-charge mines that had explosive charges that were scaled up from the *B-40* warhead.

During World War II, the Germans also used the man-portable Panzerfausts as off-route antitank ambush weapons by means of trip-wire fuzing.[25] The Americans similarly issued information on how to fire the 2.36-inch Bazooka antitank rocket vertically upward out of its shipping container toward the belly of the target by means of an offset pressure switch and battery.[26] And, in contrast to these improvisations, the Soviets developed and used the tripwire-operated *Galitskii Flying Mine (LMG)* during World War II.[4,23] More recently, the U.S. developed the *M-24* and *M-66* off-route mines that both use the 3.5-inch *Super Bazooka* rocket, and have supposedly equipped the *Viper* so that it can be used as an improvised off-route ambush weapon.[27,28]

The technology of the jet-forming shaped charge and how it defeats armor have been previously described in ***ARMOR***, "Shaped Charges Versus Armor."[29] It was noted there that the penetration performance of the charge was dependent upon the precision of manufacture, proximity of target material to the side of the explosive charge, and the material between the warhead and the armor. These are very important points with respect to shaped-charge jet forming mines. First, an open cavity must be allowed for the collapse of the liner and

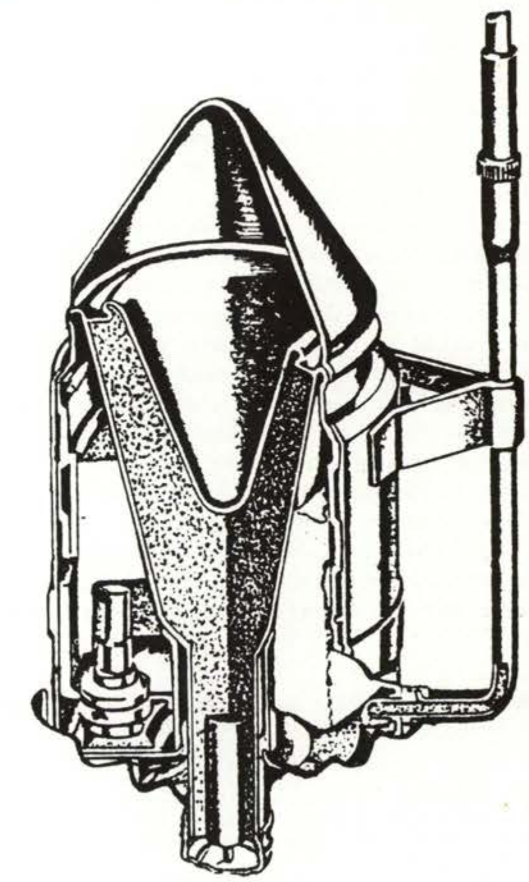


Figure 1

formation of the jet. Second, a variation in the proximity of the soil to the sides of the charge or the density of the soil, if the warhead is buried, will be felt, as if it were a manufacturing imperfection, when the warhead is exploded. This could result in the warhead losing more than half its penetrating capability. Third, an earth cover must either be removed from over the mine's shaped charge before the shaped charge is exploded or the cover will need to be perforated by the jet. If the jet must penetrate an earth cover, it is usually forced to do so at a very short standoff, which means much of the jet would be used up before it could be stretched for deeper target-penetration capability. These three constraints have generally been responsible for both the lack of incorporation of grenade-type charges in buried mines and the adaptation of propelled grenades in off-route mines that attack the target under circumstances more favorable to the jet-forming shaped charge.

Misznay-Schardin mines (plate mines, mass-focus devices, projectile charges or self-forging fragment devices) are a form of shaped charge, wherein a metal plate is projected off the dished surface so that it forms a hypervelocity, penetrating, fragmented slug. These devices can generally be separated from the jet-forming shaped charges by the fact that the latter form both a jet and a separate slug. However, it is possible to vary the metallic liner shape, explosive, and detonation wave shape of a Misznay-Schardin device such that any number of jets and high-velocity projectiles are formed.[24] At the present state-of-the-art, Misznay-Schardin devices can be differentiated from others by meaning those that project the mass with sufficient velocity that it almost all participates in penetration of the target.

Misznay-Schardin devices date back to World War II, when

LTC Misznay of Budapest invented and developed an explosive charge that formed a high-velocity projectile. In July 1944, a German delegation led by Professor Schardin, but including Doctors Thomer and Trinks, observed the operation of this charge.[30] Trinks noted the similarity to the effect that had produced a small projectile from a blasting cap and had resulted in the death of a woman in Baltimore in 1936.[30-31] From this, it was seen that the device could form a high-speed projectile that could rapidly traverse tens of meters, in order to hit and perforate a tank. The French *MAH F1* horizontal-effect, off-route mine that can penetrate 50 mm of armor at a distance of 80 meters is a modern version that has been developed fron the German-improved technology.[21,23]

Trinks had also noted that Misznay's explosive charge also behaved in a manner somewhat similar to his own shallow flat-cone shaped charges. In these latter devices, the liner is flipped inside-out and exploded forward along the axis, so as to form a hollow conical projectile.[11] The designs of buried Misznay-Schardin mines are somewhat closer to this action. Still, the effect is about the same on the target. The advantages of using a large-diameter thin charge to project a plate upward as a focused, high-velocity slug are that the device is less sensitive to soil conditions/materials, and to manufacturing tolerances. However, the soil overburden must still be removed, so it does not interfere with the projection and focusing of the plate mass. This is accomplished for the U.S. *M-21* vertical-effect mine and the Swedish *FFV028* mine by a secondary charge that clears the soil overburden, just before the main charge explodes.[32] Still another advantage over a jet-forming shaped-charge mine is that Misznay-Schardin mines incorporate a greater amount of explosive, thus giving these mines a blast effect that makes their positioning for at least a mobility kill less critical. Due to their characteristics, therefore, they can be found with tilt-rod/pressure, offset, vibration, magnetic-rate, or trip-wire fuzes in buried, unburied, artillery delivered, air-dropped, or off-route applications. In off-route applications, they can be mechanically fuzed, infrared-detection fuzed,[33] or command-detonated, like the antipersonnel *M-18A1* Claymore mine.

The next article in the series will continue the discussion of antitank mines, with emphasis on their fusing and emplacement.

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Training for Maneuver Warfare

by Lieutenant General William R. Richardson
Photos by Major Charles R. Steiner, Jr.

There has rarely been a more important period of peacetime development than that which the Army is now entering. The next 5 years will see the fulfillment of a long-term project for the modernization of the force, a significant shift in our tactical doctrine, and the resolution of training problems associated with organizational and doctrinal changes. All of these developments are of far-reaching significance, but none is more important than that of training.

Even today, training is recognized as the Army's top priority and most pressing problem. In the near future, we will be called on to train a rearmed, reorganized force in new tactics. We must begin immediately to prepare for this challenge. We have not trained up to the level of our weapons systems, nor have we optimized the tactics and techniques using those systems in our current organizations. If this is not remedied at once in anticipation of the future, we will be in real danger of drifting into a training and operational crisis as the decade advances.

The central training problem will not be mechanical. We can assimilate new weapons and new units without great difficulty. The major challenge will be the preparation of leaders from sergeants to generals in the tactical training of the combined arms team. We must train up to the advanced maneuver capability that new equipment will give us and which revised doctrine is already emphasizing.

Maneuver has been a neglected topic in the past decade. The Army has become firepower-oriented and defensive-minded to a dangerously exaggerated and unrealistic degree. Much of this was due to misapplication of doctrine in FM 100-5 *Operations,* and inappropriate explanation and emphasis in field manuals that flow from that capstone manual.

Military analysts have pictured a contemporary battlefield so lethal that maneuver has come to be viewed by some as unproductive and even rash. Wargamers have devised firepower tables which exalt the disembodied effects of weapons and discount the important intangible elements of speed, surprise, and shock action, even though these have been crucial considerations throughout military history. Civilian critics of this trend have been numerous and perceptive, but few soldiers have challenged these assumptions, and, as a result, our training for battle has come to resemble mathematical rather than tactical exercises in too many cases.

The validity of such an approach to warfare has not been borne out by experience. The events of recent wars have demonstrated that the cold operation of force ratios and the practice of reactive tactics do not usually decide battles. Combat has been intense and deadly, but it has also been fast, mobile, and decisively affected by shock effect. General Guderian's observation has remained accurate that "the engine of a tank is no less a weapon than its gun." In a confused and fast-moving battle atmosphere, victory has been more than a matter of management or a question of the manipulation of firepower coefficients. It has depended instead on a moral and professional superiority which endures the stress of combat and seizes every opportunity to strike at the enemy.

Twenty-five centuries ago, Sun Tzu wrote, "Speed is the essence of war. Take advantage of the enemy's unpreparedness; travel by unexpected routes and strike him where he has taken no precautions." This is no less true today. Patton said the same thing in remarkably similar words, namely, that the psychological shock of the unexpected and the concentration of combat power where it does the most damage to an unprepared enemy is the key to success on the battlefield. Maneuver is the means of obtaining these ends.

Every part of the Army has a role to play in improving our ability to maneuver and in converting our fixation on static warfare to a more balanced view of fire and maneuver. The service schools have the critical task of preparing leaders to train and lead a force capable of maneuver. The schools must also coordinate and publish clear, workable doctrine and supporting training materials. In the case of training materials, multi-echelon standardized "Battle Drills" for various size units have been developed by the 1st Brigade, 4th Mechanized Division, and the Armor School. They provide an excellent means for teaching techniques which are so essential at the NCO and lieutenant level and tying these techniques to tactical tasks at the captain and lieutenant colonel levels.

Troop units have the responsibility of developing and maintaining a maneuver capability for the Army. This comes with constant practice—taking the unit to the field frequently and practicing battle drills, innovative maneuvers, and command and control procedures. Commanders in the field must also contribute to the development of doctrine for maneuver by informing the schools of what works and what needs fixing. The emphasis must be on "hands on" tactical training, during which our soldiers and leaders learn the use of terrain and how it can be a major factor in the fundamentals of fire and maneuver.

The officers, and particularly the commanders, will have to be better tacticians than they are now. J.F.C. Fuller noted after World War I that leaders of modern armies need special preparation: "The more mechanical become the weapons with which we fight," he wrote, "the less mechanical must be the spirit which controls them." The successful leaders of the next war will arrive on the battlefield personally prepared and in command of physically tough, self-confident soldiers whom they have trained realistically for combat. In short, they must have frequently practiced fire and maneuver and thereby enhanced their tactical knowledge through plenty of "in the field" experience—far more than we are getting today.

To attain this emphasis on renewed tactical thinking, the Command and General Staff College is making a concentrated effort to focus its curriculum on the realities of maneuver warfare and the important element of tactical judgment. Historical and theoretical readings which stimulate a more confident and creative approach to tactical operations are being added to the C&GSC course, and the overall approach to field grade officer preparation is being sharpened on tactically significant subjects. Tactical studies are also being extended beyond the familiar arena of the Fulda Gap to other regions of the world, where the indirect approach is being applied against either a sophisticated enemy or insurgents.

"Armor must revitalize the art of maneuver for the rest of the Army and reeducate all elements of the combined arms team on the unpracticed art of offensive operations."

The branch schools similarly need to stress the realities of maneuver-based tactical operations. In the case of the Armor School, the task at hand is remarkably clear: Armor must revitalize the art of maneuver for the rest of the Army and reeducate all elements of the combined arms team on the unpracticed art of offensive operations. In the past, Fort Knox has led the wav in the development of maneuver doctrine, whether that maneuver was based on tanks, light armored vehicles, or helicopters. The Armor School must assume a position of leadership again as we attempt to remedy our shortcomings in maneuver training today.

"All of our officers must be taught to appreciate the need for responsive reaction to the fleeting opportunities that arise in the course of operation, and the devastating effect that such blows have on the enemy."

Company commanders and platoon leaders must be taught *how to* maneuver. There must be practical instruction conducted in the field, not just classroom considerations of the broad terms of travelling, travelling-overwatch and bounding-overwatch techniques. Young officers must learn the fine points of the subject from the use of terrain to team organization, from the employment of formations to the execution of battle drills. They must leave Fort Knox with an advanced understanding of platoon fire control and distribution and of command and control techniques for mounted operations in fluid combat, coupled with a full understanding of how to train their units to perform in such an environment.

Field grade officers—especially those selected for command—must learn how to plan and sustain flexible maneuver operations. They must be able to integrate Field Artillery, Air Defense Artillery, Engineers, Aviation, and logistical support into their plans so that their maneuver operations retain their combined arms character. This will entail considerable efforts to overcome the frame of mind cultivated over the past years' preoccupation with defensive, firepower-oriented operations. It requires such skills as rapid concentration of battalions over multiple routes, attacking through friendly defenses and obstacles, immediate transition from defense to attack, and the modification of fast-moving operations already under way. In short, we must make special efforts to develop confident, competent commanders and staff officers, skilled in tactics through practice after practice. That in itself will be a major task, because we will be training officers who have advanced to the middle grades of the Army without having learned these skills themselves.

All of our officers must be taught to appreciate the need for responsive reaction to the fleeting opportunities that arise in the course of operations and the devastating effect that such blows have on the enemy. Platoons, companies, battalions, and brigades must have the ability to react as rapidly and effectively as the horse cavalry did in the whirling melees of earlier wars. They must develop operational procedures and command techniques that permit such shifts and—just as importantly—they must learn to regard such changes as routine rather than exceptional.

Within the platoons, this means that our troopers must learn to read terrain and maps better than they do now. They must be able to fight and report simultaneously, react violently and effectively to enemy contact, and retain their ability to fight in an environment of sudden change, considerable casualties, and the fatigue of extended operations.

Training to fight must become a way of life in tactical and combat support units. Everything the section, platoon, troop, or company does must relate to its combat mission. Commanders at all levels must protect their subordinates from the detractors that adversely affect tactical training and from demands for time that cannot be justified in terms of preparing the unit to go to war. Any time the connection between a training activity and the combat mission becomes hard to discern, the purpose of the training should be reviewed. Whenever the complexity of a technique makes its use in a fight questionable, the practice should be reconsidered. In particular, "wrong training,"—practices which reinforce techniques that can't work on the battlefield—must be supressed.

The perishable skills and tactical judgement that are the basis of maneuver can only be perfected in realistic field training. Tactical exercises without troops, simulations, and terrain board exercises are useful in sustaining a unit's maneuver capability, but cannot be allowed to replace field training. Commanders must insist that their units conduct unconstrained field training exercises frequently enough to preserve their basic operational capabilities and their sense of what does and doesn't work under field conditions.

"Once tasks, conditions, and standards have been identified and tailored to the unit's unique requirements, the whole training effort must be focused on them."

Unit training programs must begin and end with an analysis of the mission. Mission analysis determines the tasks that a unit must be trained to perform in order to accomplish its operational or ARTEP mission. Training analysis will indicate whether the mission is within the unit's capability or if new techniques might permit accomplishment of the mission in another way. Unit missions vary worldwide and within divisions. If carefully analyzed, they yield the key tasks and the standards that a unit must attain if it is to succeed in its wartime mission.

The 2d Armored Cavalry Regiment's pioneer program in this technique led to the development of a list which begins with alert notification and continues step by step through the maneuver and maneuver support tasks necessary for completion of its operational mission. A battalion at Fort Hood would be concerned initially with the recall of its troops and their movement to the theater of operations and would ultimately progress to combat tasks in its anticipated area of operations.

Mission analysis will result in tasks similar to those described in Army Training Evaluation Programs (ARTEPs) and Soldiers' Manuals. But some tasks will be peculiar to the individual unit, and the conditions and standards can be expected to vary considerably because of differences between units' orders, circumstances, and capabilities.

Once tasks, conditions, and standards have been identified and tailored to the unit's unique requirements, the whole training effort must be focused on them. If a battalion anticipates performing mainly counterattack missions because of its brigade's wartime mission, then, its ARTEP, its tank gunnery, its individual training program, and its supporting units' training programs should emphasize counterattack tasks.

The battalion tank gunnery program, for instance, should emphasize the offensive use of organic and supporting weapons in the tactical context of a counterattack mission. Rather than going through a program that concentrates on individual tanks firing standard tasks on a Table VIII range or even completing a platoon battlerun common to the entire division, the battalion should be evaluated in a specially-designed qualification exercise. It would be natural for such a unit to put most of its emphasis on company-level fire and maneuver rather than on single tank proficiency. The culminating exercise in its gunnery program— the qualification shoot on which tank commanders stake their reputations—should be a full-fledged attack using fire and maneuver.

The exercise might logically begin with the occupation of a company-sized assembly area some distance from the live-fire course and incorporate evaluations of troop-leading procedures; maneuver techniques behind and forward of the line of contact; and key maneuver tasks, such as forward passage of lines through a committed unit, movement techniques while in contact, fighting and reporting, and adjustment of mortar and supporting artillery fire while the live-fire phase of the exercise is under way. Coördination of attack helicopters, close air support, and all the other details of combat should be evaluated, including fire control and distribution and operations in a nuclear, biological, chemical, and electronic warfare environment.

Likewise, all other training should emphasize the tasks associated with the tactical mission. Maneuver exercises and ARTEPs should be conducted on realistically-sized pieces of ground, not in the tight confines of small training areas. All members of the combined arms team should be represented.

"Division and brigade commanders must demand a higher general standard of training and insure its effectiveness by eliminating unnecessary training requirements, and suppressing detractors that degrade the quality of training."

A tank battalion that expects to employ a mechanized infantry company in its operations should habitually train with that company. If a brigade or regiment goes to the field without its accompanying artillery, air defense artillery, engineers, aviation support, or logistical attachments, it is failing to train for the full complexity of the combined arms team in maneuver warfare.

It is also necessary to incorporate unexpected developments or sudden changes of mission into the training exercises of armor units. This sort of confusion characterizes maneuver warfare and the friction associated with moving a unit about a large, violent battlefield on which changes frequently occur in the natural environment of war. Clausewitz addressed the problem over 150 years ago. "Peacetime maneuvers," he

wrote, "are a feeble substitute for the real thing; but even they can give an army an advantage over those whose training is confined to routine, mechanical drill. To plan maneuvers in which some of the elements of friction are involved, maneuvers that will train officers' judgement, common sense, and resolution is far more worthwhile than inexperienced people might think. It is immensely important that no soldier, whatever his rank, should wait for war to expose him to those aspects of active service that amaze and confuse him when he first comes across them . . . . exertion must be practiced."

We must support and encourage those commanders who are conducting effective, mission-oriented maneuver training today. Division and brigade commanders must demand a higher general standard of training and insure its effectiveness by eliminating unnecessary training requirements, and suppressing detractors that degrade the quality of training in the battalions. Senior commanders must also provide critical guidance to their subordinates and test their companies and battalions in realistic exercises. If the colonels and generals are not competent in tactics, and if they do not display their knowledge in teaching their subordinates on a daily basis, they have abdicated both their authority and responsibility. The Army cannot win in a battle without competent and confident senior tactical leaders.

The schools and training centers must do more than provide general instruction and broad theory. They must teach officers and NCOs *how to* train tactically—*how to* maneuver their units over the battlefield. They must also furnish the field with doctrine specific enough to fill an experience void in our junior leaders.

"The schools and training centers must do more than provide general instruction. They must teach officers and NCOs how to train tactically and to maneuver their units over the battlefield."

Much needs to be done to prepare the Army to meet the training challenge of the present and the greater demands of the near future. Training and Doctrine Command will take the lead in the effort, but every element of the Army will have to respond if we are to correct today's shortcomings and make the most of tomorrow's capabilities. Only the initiation of broad changes—the accomplishment of a virtual training revolution—will fill the need. Training *is* priority 1. Let's make that a reality. When done, we will be ready to fight and win.

ARMOR CONFERENCE 1981

Keynote Address

GEN Donn A. Starry
CG, TRADOC

Recently, I was listening to some captains describe for me their busy world—they couldn't get any training done, had high deadline reports, too many distractions, and too little time.

I asked them. "Fellows, what are you trying to get done? What are your goals?" One of them responded, "General, my job as a company commander is simply to try to divine which of the 25 or 30 things I have been given to do is first priority today." He whipped out his notebook; in it was a list of some 27 items. He said, "Now every one of those things listed has been prescribed as number one priority by the battalion, brigade, division, or corps commander. There's no room left for my priorities. My job is to determine which one of those things is first today, because it will be different from what was first yesterday, and different from what will be first tomorrow." By the way, the captain pointed out to me that not one of those 27 items was directly related to training or maintenance!

So in that busy world, not all of what we talk about here appears to have as high a priority as many might think.

I mention this conversation because it is important to keep it in mind as we talk about readiness in the armor force. A major problem for young officers is that they can't get their company-level units ready for combat, because they don't know what the first priority is, and they do not have the time to sort it out.

Certainly, if we are going to be ready for tomorrow and beyond, we must have some framework in which to view the challenges we will face. What kind of world are we getting ready for today, tomorrow, and beyond?

Three things seem to me to represent the challenge—I will cite those, then try to build the rest in that framework.

The first challenge is the Soviet problem. The Soviets, and through them, their surrogates, allies, and followers, will likely continue to gain in military capability relative to the United States and its allies—at least during the next few years.

Second, the growing dependence of many nations on Mideast oil and on critical mineral resources in South Central Africa represents an economic, military, and political vulnerability that will continue to be exploited by the Soviets; it is one which quite likely could precipitate a major world crisis.

Third, the nuclear strategy of the West continues to experience several fundamental dichotomies that will likely be acutely aggravated by adverse trends in the world's military balance and which will, therefore, remain unreconciled for many more years. The difficulty of coping with the nuclear problem simply emphasizes the necessity for an added level of readiness in conventional forces.

Considering the challenges, we must recognize that the battlefield we have traditionally looked on as our primary concern—that one in Western Europe—is expanding to one which, though very much like the European one, could be encountered in other regions of the world. Those regions include South Central Africa, when looking ahead 20 or 25 years.

What are the principal characteristics of that battlefield?

First, it will be dense with large amounts of modern equipment. This is so largely because we confront potential enemies who fundamentally believe that the road to success is in numbers. I would contend, however, that the quantity of weapons systems is far less important than how that quantity is applied. Nearly all of these weapons systems will be of high quality. Here again, I would contend that quality is less important than how quality is used. Whatever the quality or quantity factors may be, battles, particularly at the point where a decision is arrived at, will be very, very intense.

Second, just as the ground battlefield will be dense with large numbers of high quality sytems, so too will be the air over that battlefield. This third dimension of modern war will be dense with high quality air defense and air systems.

Third, in such a potentially complicated and confusing environment, command and control will be ever more important. But here too, just when needed most, command and control will be more difficult because of the electronic warfare environment in which these battles will be fought.

Fourth, the variety of weapons systems on that battlefield will be such that it will be impossible to field any one or even a small number of systems capable of coping with the total threat. Therefore, it will continue to be an all arms battle—a combined arms battle, a ground battle, an air battle—an airland battle.

That will be a very demanding world. If a single word best describes the problem of ensuring combat readiness in armor units, today, tomorrow, and beyond, it is complexity. The reason that remotely-controlled tank ran out here a momemt ago was because, while it represents a considerable complexity, it is really very simple and costs very little. It typifies one of our challenges. We simply must determine how to reduce complexity to managable proportions and somehow put it to use to our advantage. *General Starry opened his address by having a remotely-controlled model tank move from the wing to the center of the stage, fire several simulated rounds at the audience, and retire. Ed.*

There are two approaches to coping with complexity.

One approach says that complexity makes our world one in which it is so difficult to operate that we really can't predict what is going to happen. So we continue using the proven patterns—teach soldiers their individual jobs fairly well, send NCOs to schools in the NCO Educational System, send officers to branch schools and the Command and General Staff College, and try to cope with complexity as we face it.

The second approach says that, because of complexity, we can't take the first approach. Despite complexity, there are things we can do to simplify our problems. But we have to think it out in advance and be better prepared to take the necessary steps to improve our readiness to fight on that battlefield, in spite of and indeed because of its complexity.If we are ever to get the Army, and the Armor Force in particular, ready for today, tomorrow, and beyond, we simply have to figure out how to cope with complexity, and we must do it in advance.

Consider some fundamental notions.

First, the history of battle tells us that small units—battalions, squadrons, companies, troops, batteries—small units, well-trained and well-led are more often than not what wins in battle. This is especially so in battles where one side outnumbers the other. In these cases, the outcome of battle most often defies the measures we have traditionally used to predict battle outcome. The day of the Lanchester equation is done. War seldom turns out that way. War is not a firepower equation. It is, rather, a contest of human wills. Leadership is not a matter of administrative or managerial ability; on the battlefield, leadership is the ability to harness the courage of human beings into concerted action in a most dangerous and complex undertaking.

Second, battle has become a complex problem that can only be controlled by overcoming those complexities. To get anything done in battle, it is necessary to issue orders. Complex situations lead to complex orders. Complex orders are easy to misunderstand. They take time to deliver. The mistake level is always high. Therefore, leaders must learn to identify complex situations in advance, to find logical answers, and to prescribe regular drills that they, their soldiers, and their units can use to cope with those complex situations. They must synchronize those drills because they are and will be combined arms drills that integrate soldier tasks, unit tasks, and all arms tasks.

Third, to win, leaders must think. Thinking takes time; in battle, there is little time to think. We will fight with weapons similar to those of the enemy, we will fight on the same terrain, under the same weather conditions, and in the same climate of uncertainty and fear. The only thing that will make a difference will be the brains of the commander. Therefore, commanders must be trained to think. Think ahead. Think correctly, logically, quickly, precisely, with creativeness and imagination about the complex situations they can expect to encounter.

Fourth, because command and control will be made more difficult in that complex electronic warfare environment, because commanders cannot be everywhere, because critical situations always seem to arise where commanders are not, it is important that noncommissioned officers and soldiers know what must be done. The best way to do this is to drill them to proficiency in battle drills; drills designed to cope with the most likely situations. In this way, they will be capable of doing something about right until the boss can get there.

Fifth, the characteristics of modern weapons are challenging our ability to train up to full systems design capability. The gap between systems capabilities and our ability to realize full system potential has grown to the point where it is necessary to look for some completely different ways of training and assigning soldiers, of organizing for battle, and for conducting battle.

Sixth, technology provides marvelous potential for reducing the problems of individual and collective skill complexity. Simple, inexpensive electronic training devices of all kinds must be used to advantage if we are to reduce to managable portions the complexity revolution that faces us and overcome the high cost of training to readiness proficiency.

That remotely-controlled tank has some great potential. We are not sure what or where it ought to be used, but it is obvious that we have to consider its use. Along that line, we have duplicated the controls of an infantry fighting vehicle (IFV) in an electronic game similar to those in a typical arcade. Walk by one of those arcades sometime. The young people in there are volunteers—they have paid a quarter—or more—to play those games. They are all learning something. In many cases, they are learning something that has a military application. If you put all that together, it tells you something—we ought to use that technology and appeal, and so we are. For not much money, we could put these in units, and, if soldiers learn the right things, it would be cheaper than buying more IFVs or an expensive simulator.

Next, in battle, the unexpected can be expected. In fact, the unexpected will be routine. To face that truth, we must train our officers and men for it—in advance—with drills that are designed to do something, to do it about right, do it quickly, and do it in consonance with the mission of the force—the aim of the battle.

Finally, that complex and dangerous battlefield will be a place suited only to and for the actions of trained commanders who have prepared in advance to cope with situations they are likely to encounter. The age of the amateur hero is gone forever.

Now let us sum up. For nearly a decade, our nation has been unwilling to provide its military forces with either the material resources or the moral stamina necessary to satisfactorily perform the tasks assigned them. Emotionally mesmerized by Vietnam, morally bankrupt by a pseudo-ethic that denied the worth of individual obligation to the nation, or anything else, we have cut away at the sinew of our military strength, hollowed out our intelligence community, embraced the notion that training soldiers for war is too expensive in peacetime, and abandoned conscription in favor of joining whatever cohort we could in what was apparently to be a uniformed job corps.

As for our Army, we have taught several generations of officers that managerial skills, administrative talents, and an unbounded faith in technology were surrogates for leadership; and were indeed more important than a comprehensive understanding of breadth, depth, and scope of the military art, its history, its practice, its precepts, its basic fundamentals, and its enduring values.

The history of the decade just past should be instructive to us—to the nation and to the Army. We have now embarked on a course to set aright many things cited as having gone wrong in those difficult years. While I applaud that, as we all must, I submit to you that we are an impatient people with a very, very short memory. The euphoria which presently envelopes the affirmative side of the more-for-defense debate will soon pale if you and I cannot show what we have done with all that treasure. There is, and always has been, far more that can and must be done by applying some of the notions I have tried to suggest to you that can be had by just spending more money. It is not enough to open the vaults of the bullion depository, if that could be done, to satisfy the apparently insatiable appetites of military folks who keep demanding more of everything, without being very able at accounting for what they have or what they have done with it. There is just no free ride. Readiness, in the context in which it will be addressed in this conference, is a lot more than more dollars. Readiness is a state of mind, a way of life, a determination to do right what must be done regardless of how the dollar debate comes out.

So, on that complex and most dangerous battlefield of the next war, the determined, prompt, correct, and calculated battle actions of trained commanders, soldiers, and units is what will win—commanders trained to train, and trained to lead the soldiers and units entrusted to them; soldiers trained to follow, and trained to fight determinedly and fiercely in units whose survival and success is their life's blood.

So it is that sometime, somewhere, once again, the fate of the nation's aims, goals, programs, ambitions, and perhaps even survival will rest on the determination of a few good soldiers, a few good leaders, and a few good units, trained well in time of peace in order that they might be ready to fight well in time of war.

ARMOR CONFERENCE

Commandant's Report

MG Lewis C. Wagner
Commandant, USAARMS

My comments are organized along the lines of what we are doing in structuring, manning, modernizing, training, and, if need be, mobilizing the force.

Fort Knox plays a key part in all these areas insofar as armor and mechanized forces are concerned.

For several years, we have been studying the Army, particularly the combat divisions, to determine what the most effective organization will be for the 80's and into the 90's. We call this the Division 86 concept. I point out that it is a concept and that it will change as we go along, but it utilizes the equipment we have, and, when we look at the threat we face, Division 86 appears to be the best available force for the job.

A transition plan for implementing the concept is being developed, and here are some of the things being done to make it easier to implement that plan.

We have recommended a command and staff transition course that will address organization, doctrine, tactics, and techniques for employing the force. This course will be short, and will be conducted primarily for those major commands, staffs, and unit representatives who are concerned with reorganizing.

Exportable training packages are being studied and developed. These packages will include lesson plans, audiovisual aids, training extension courses, and training devices that are generated by the Armor School. These packages will provide information and guidance about such items as tables of organization and equipment, doctrine, and how to operate that force when it has been reorganized.

We are also developing transition literature, and it is just that—transition literature, because there is going to be a phase when we are going to have a mix of equipment. We can't organize the force and have the *M-1, M-2, M-3*, and all of those other items of equipment available at the same time. There is going to be a transition period that means we are going to have to learn to operate disimilar types of equipment together. The Armor School is going to put out special texts, coordinating drafts, and so forth, to carry the Armor Force through that transition period until we are fully organized and operating under Division 86.

Furthermore, institutional training at the Armor School will be modified as we look at how Division 86 can be most effective during the transition period. When we get into that, we are going to do it more scientifically than we ever have in the past. We are analyzing how we are really going to fight that first battle, and then looking at the conditions we need to train the force up to, so that we can do a better job in that fight.

As we consider restructuring the force, it is equally important to look at manning that force. As General Starry pointed out, we can have all the sophisticated equipment in the world, and have a new organization, but if we don't man the force with soldiers who understand their jobs, are trained in them, and are capable of performing them well given the opportunity to do so, the force just isn't going to be successful on the battlefield. In the past, we did not consider the individual and his training as we should have. One day, you came to work, and you were reorganized under the ROAD, Pentomic, or some other concept, but you had not been taught how you were going to function in or use that concept. The force fumbled around out there in the divisions, and, eventually, everyone thought they were doing things about right, but no two units were doing them the same way. As individuals moved from one unit to another, they found that they were training differently, and even using different tactics. That is not using a force in the most effective manner. We just cannot afford to do that in Division 86.

In manning the force, we have to recruit individuals who can do the job. Then we have to retain them in the career force so we can train them to a level that will provide the mobilization and combat capability we will need on the day we have to go to war.

Recruiting has been very successful for the Army in fiscal year 1981, particularly in Armor, with approximately 69 percent of the recruits being high school graduates. That percentage has been higher in the past several months, and some training companies have over 80 percent high school graduates in their ranks. That does not mean that a high school graduate is going to be a better soldier than one who is not, but it does mean that we have a better chance of retaining him for at least his first tour, and that means a better chance for training him later to become an NCO, because he has succeeded in something he set out to do and is willing to accept a new challenge.

We now have an overstrength in the lower grades of armor crewmen ranging from 125 percent to 130 percent of those authorized. That does not mean an overstrength in the Armor Force, because the lower-grade soldiers are occupying middle-grade NCO slots where there are shortages. However, we believe that the overstrength and quality of the lower-grade soldiers we have today will provide us the cadre for filling that shortage of middle-grade NCOs.

In another area of manning the force, the Chief of Staff of the Army has directed that the commandants of the various training centers become the titulars head of their respective branches. That involves a lot, and I am not sure yet as to everything it does involve. But it definitely involves one thing that will improve the force. We are working very closely with the Military Personnel Center to devise better means to get the soldiers we need, making sure we provide them with promotion opportunities, and then retain them in service. Eventually, we plan to have a say in what is being done in personnel management of Armor enlisted and officer personnel.

Now for a look at equipping the force. I am not going to talk much about that, because briefings on a majority of the major items of equipment will be presented during the conference. Obviously, though, we are primarily interested in the *M-1 Abrams* tank, *M-2/3* infantry/cavalry fighting vehicles, and the *AH-64* advanced attack helicopter, because they are the vehicles of mounted combat. But they alone cannot do the job. It will be a combined arms battle out there, and unless we get better communications equipment, and improve in other areas, such as resupplying things, we are not going to succeed—no matter how sophisticated our equipment is or how skilled we are in using that equipment. Incidentally, one item of equipment that is of interest to the Armor community will not be covered at the conference. That is the combat vehicle in crewman's clothing system. Over the years, the combat vehicle crewman, whether armor or infantry, has not been very well dressed for his job. We are doing something about that. We have designed a multipiece uniform that includes 8 pieces for summer and 11 for winter. Basically, it includes coveralls, a tanker-type boot, and a short jacket to keep the crewman from getting snagged on projections inside the vehicle. A ballistic vest and insulated boots for winter wear are also part of the system. The coveralls and jackets are scheduled for fielding in Europe in September 1981 and in the continental United States in February 1982. In phase two, the rest of the items will be fielded with the exception of winter gloves and ballistic facepiece. These did not test out very well and are being redesigned.

Many of the Armor Center's resources are expended in the modernization area. New systems have to be procured with a view toward the personnel and training systems as well as the hardware. There is no use in having equipment if you don't know how to use it, and that is what we are working on very hard. But we are not taking a unilateral approach. We work closely with the U.S. Army Infantry School, and very little doctrine is put out in the mechanized infantry or armor community that has not been coordinated with infantrymen.

Other activities at Fort Knox during the past several months have included the testing or evaluation of such things as a reference heading system, a 9-mm submachinegun, a military motorcycle, new types of tank track, the high mobility/agility (HIMAG) vehicle, and the high-survivability test vehicle, lightweight (HSTV-L).

As for the new types of tank track, technology to date has not been able to provide a suitable track. The track that was tested was supposed to double the 1,000-mile life of the track now in use—it lasted 800 miles. So, if anyone knows how to develop a better track, we would like to hear about it.

In the work with the HIMAG and the HSTV-L test beds, we have accumulated much information about what agility, vehicle size, and various types of fire control do for mobility and survivability. We are analyzing that data, and, by this fall, we hope to come up with an answer for the Armor Community as to where we want to go in these particular areas. *(A briefing on the HIMAG and HSTV-L programs appears later in this report of the 1981 Armor Conference.* Ed.)

If structuring the force is considered the skeletal system, and manning and equipping that force is considered the muscular system of the Army, then training has to be the nervous system. Every soldier and civilian in the Army is responsible to some degree for training, and we don't do it very well. We are getting better, but we are not there yet. The function of training is to apply manpower and material within resource constraints to increase the Army's combat potential.

Fort Knox's training obligation is twofold; institutionalized training of Armor enlisted personnel and NCOs, and officers through the grade of captain; and the production of training doctrine and devices to support units training in the field. However, the Armor Center and School are not responsible for conducting that unit training. Nevertheless, unit training is largely dependent on the training literature, techniques, and doctrine developed at Fort Knox.

As for institutional training, emphasis is on training the trainer. It has been proven again and again that a mediocre crew, led by a well-trained, motivated tank commander, will consistently outperform a superb crew that is poorly led. So we have to have trained NCOs to command tanks and scout squads, if we are going to be successful.

We now have a new Advanced Noncommissioned Officers Course.

It is designed primarily to develop platoon sergeants, and we think it will do the job. We are also developing a Basic Noncommissioned Course to train tank commanders and scout squad leaders. If we can do that well, we will make it easier for platoon, company, and battalion commanders to conduct training that will insure combat readiness.

Basic Armor Training has also undergone some changes. We are running a pilot course in system-specific training. In this course, an individual is trained for any one of three positions in the crew of a particular model tank or a cavalry vehicle, rather than specifically as a loader, gunner, or driver.

In discussing individual training, I will say at the outset that we do not have the resources or the time to train a new soldier or officer as completely as we would like. We need about 6 more weeks to put a recruit through basic and individual training and send a well-trained soldier to a unit. We may get a week or so, but not 6 weeks. So the unit is going to have to continue the new soldier's training when he arrives. However, through a series of articles in *ARMOR,* we are telling unit commanders what the soldier has been taught, so that they will know what remains to be taught.

Turning to officer education, I will discuss some changes that are occuring in the Armor Officer Basic (AOB) and Advanced (AOAC) courses. The new second lieutenant attending AOB, is trained almost entirely to be either a tank or armored cavlary platoon leader. AOB students spend a lot of time on training exercises, learning to command and move a platoon over the battlefield. They recieve instruction in leadership, tactics, maintenance, land navigation, NBC operations, and tactical communications. We think these new officers are being well trained, but again, we don't have enough time to train them as well as we would like to.

Time constraints have also forced major changes in AOAC,where we train captains and senior first lieutenants to be company commanders and the battalion or brigade staff officers. Since only about 20 percent of the students have been company commanders, we concentrate on that facet of the course because most graduates are going to company command assignments. We would like to spend more time on staff work, but again, time will not permit it.

Even though the lack of time has brought changes in the curricula of our courses, it has not caused us to relax our standards. In fact, we are making them tougher, and we are putting competition back in. We now select distinguished and honor graduates, and we have established a commandant's list, along with tactics and physical training awards. The students like it, and they are even asking for more competitive challenges.

So much for institutional training; now, let's move to a topic that is dear to the hearts of all tankers—gunnery, and FM 17-12. The series of 17-12 manuals and training circulars you have today are a bit confusing, because there are several models of tanks in service, and they don't all have the same fire control system. So we are working on a new set of system-specific gunnery manuals. There will be a manual for the *M-48A5, M-60A1, M-60A3,* and *M-1,* detailing the gunnery techniques that are peculiar to each of those tanks.

Today, there is a near-zero consistency in the way we operate on tank ranges. There is some consistency in some divisions, but in others, there isn't even consistency among battalions. The Armor Center has to take some of the blame for that, but we are going to do something about correcting it. Among the things that are going into the new manual are a sliding scale for scoring and a section on crew duties. The crew duties are especially important, because gunnery is a crew exercise. If you skip that part, or fail to train the crew properly, or fail to force them to use proper techniques, they will not be able to engage targets with speed and precision. We have to reemphasize precision gunnery, particularly for the *M-1* and *M-60A3* tanks equipped with the laser rangefinder and improved fire controls. There is no way that battlesight gunnery is going to assure a first-round hit.That is not to say that we should do away with it completely, but it is for a specific purpose. It is to be used in close, lethal surprise situations.

Another facet of gunnery that presents a real problem is that of zeroing. If we follow the manual, we will obtain a proper zero and we will get consistent hits, but we will use more ammunition than we can afford. We can't do that! So we have to come up with a better technique. We will do that in the new manual.

No discussion of gunnery training or training in general proceeds very far without becoming involved with the matter of resources. We are going to have to look at simulation, better subcaliber devices, and the like. We are looking at two systems at Fort Knox that are not directly related to gunnery, but rather to maintenance and driver training. The organizational maintenance trainer teaches an individual to troubleshoot without having to have a tank set up with induced errors that are to be found and corrected. It teaches the student to use test diagnostic equipment to locate faults rather than searching for them with the trial and error method that is so commonly used by American mechanics. The other training device under study at the Armor School is a driver trainer that uses a television video system and a computer to give the student the sense of operating a tank over various terrain. The driver trainer is expensive and complicated, and I am going to have to be convinced that we need something that complex before I recommend that it be bought. Yet another sophisticated trainer is being tested at Fort Hood. That one is the unit conduct-of-fire trainer, and it too is complex and expensive. Again, if it doesn't work or doesn't look cost effective, we are not going to buy it just because it is fancy and might do the job.

We need all the help we can get in the area of simulators and training devices. We are working very closely with the U.S. Army Training Support Center and have asked to be the guinea pig for devices that they are considering. We are working hard in this field, and we are going to come up with some training equipment that will enable the commander to train his troops effectively and as inexpensively as possible.

Finally, all that has been said here, and all that is to be done about structuring, manning, equipping, and training the force, will undergo the ultimate test, if we are forced to implement our mobilization plans. Should mobilization be required, we must field a total force of Active and Reserve components that are combat-ready and capable of protecting the nation against any threat—today, tomorrow, and beyond.

ARMOR CONFERENCE

Supporting Tommorrow's Divisions

BG Al Wheeler
DCG, USALC

There are some very basic things we have to consider when structuring to support today's—and tomorrow's division.

We must analyze and know the Soviet threat to combat operations that has grown quantitatively and qualitatively with the introduction of new tanks and other items of self-propelled equipment.

The threat to rear area operations has also increased considerably. Recent information on Soviet special operations forces and increased Soviet reliance on heliborne operations indicate a significant threat to brigade, division, and corps rear areas. This must be reckoned with, if combat service support units are to perform their missions in support of the forward deployed battalions. Therefore, our concern with the threat is twofold—the rear area we support from, and the forward area—or your area—that we support in.

Second, we must know what units make up the division. This includes details of the unique support requirements of each piece of equipment and the personnel who operate that equipment.

Next, we have to know how the division is to be organized and employed, so that we can organize our support units to be responsive. Logisticians must understand tactics, if they are to be responsive.

Further, we have to design our units to be able to provide close-in, dedicated support for the combat units, and area support for the other division units, both in the brigade support area and the division support area.

Finally, we must organize to operate and support the division in peace the same as we plan to do in war. There will be no time to reorganize and change the way we do business when the fighting starts!

There are four priority tasks that we must perform to generate and sustain the division's combat power. These tasks are to arm, fuel, fix, and man the critical weapon systems.

We are vitally concerned that our customer units have the people and equipment they need to do their unit-level support jobs, such as supply, maintenance, transportation, and services and administration.

The point here is that it is not only critical to you at the combat organization level that you structure your units to support yourselves internally, but it is equally important to those of us that extend support to you on the battlefield that your organizations are not deficient in organic support capacity.

In forming the combat service support units of Division 86, we think we have put together a more responsive support organization than you have in the current division. It is based upon how you described your needs and how we understood them.

However, you must also understand that, at the echelons above division, there are severe manpower constraints imposed upon the number, type, and manning levels of combat service support units. Much of the Army's general support (GS) force structure—which includes ammunition, transportation, supply and services, as well as maintenance units—is found in our Reserve Component organizations, less than fully manned Active Army units, and even in units referred to as composition 4, or "Compo 4." A "Compo 4" unit is one that is required but for which no personnel or equipment are authorized.

I want to speak to that erosion of military personnel in logistics positions—especially above the operating units—and its relationship to that catchy but disastrous phrase, "tooth to tail." It seems to me that this erosion has been driven by two principal things: the first involves the "tooth to tail" syndrome; and the second involves "civilianization," which, in itself, may be an outgrowth of the "tooth to tail" part of this equation.

The term, "tooth to tail," is a catchy phrase that has to do with the ratio of combat forces to support forces. Over the years, the term "tail" has come to be almost synonymous with overhead or nice-to-have, peripheral activities, while, at the same time, the word "tooth" has come to mean people in combat units. Somehow, logistics personnel have all come to be classed as "tail"—meaning they are "overhead" and can be easily reduced, or at least share disproportionately in reductions in strength. Nothing could be further from the truth. The fact is that a division cannot fight without its maintenance personnel, its supply personnel, its communications personnel, its medical personnel, its ammunition handlers, and the people needed to keep the support rolling to the front. These logistical elements are not just nice to have: they are essential.

Most people, who use the words, "tooth to tail" don't know what they are talking about, and if you try to argue against it, you are immediately boxed in. No man in his right mind can argue for more "tail." The word itself is pejorative, and you start out with two strikes against you. On the other hand, one might make an argument that, compared to earlier weapons, modern weapons systems require fewer people to operate per destructive equivalent.

For example, the fighter or missile or gun system of today has a much greater combat capability than its predecessors. It can inflict considerably more damage and is considerably more lethal. It is also considerably more complex and more difficult to maintain. In short, we might say that, through the technical sophistication of our weapons, we are putting more combat power in the hands of a given number of combat personnel and that we need more support people for these sophisticated weapons. Just the opposite is occurring; namely, we are constantly reducing the number of support personnel. Since we seem to be boxed in by a catchy phrase, I think we ought not to use that phrase unless the user can clearly define what he is talking about. Catchy phrases neither contribute to our understanding nor assist us in making critical decisions.

In the future, logistical constraints could have a major impact on tactical decisions at battalion, brigade, and division level. Therefore, as with intelligence information from your S-2/G-2, you can no longer afford to allow logistical matters from your S-4/G-4 to be filtered before they are provided to you, the commander. Combat service support input will heavily influence how you plan to fight.

To give you a picture of the support that is back of your battalions, I'd like to discuss some of the organizational changes that are being made under Division 86 and in the Armored Cavalry Regiments. The most significant changes are three brigade support battalions and the absence of a finance company. Finance support for the division will be provided from the corps finance organization. Now, let's look at the subordinate elements of the Division 86 division support command (DISCOM).

The brigade support battalion is organic to the DISCOM and is under the command of the DISCOM commander. It provides direct support (DS) to its assigned brigade and other divisional units operating in that brigade's area. The relationship of the support battalion commander to the brigade commander is the same as the relationship of the DS artillery battalion commander to the brigade commander. That is, he provides direct combat service to the brigade.

Each brigade support battalion will be routinely placed in support of a specific brigade in order to insure continuity and enhance the supporter-to-supported relationships.

Although not a part of Division 86, a support squadron TO&E has been approved for the armored cavalry regiment. When fielded, this will give the ACR an organic direct support capability similar to that now provided divisions and separate brigades.

Next, I would like to discuss a few things that we as logisticians need to have so that we can give you good support. First, we need an adequate number of people with the right skills, training, and experience. Examples of this are the new master mechanics who are being trained to maintain a specific weapon system, such as the new *Abrams M-1* tank, or the new *M-3* cavalry fighting vehicle. We also must have mobility for our people, equipment, and supplies, such as that provided by high mobility, multipurpose wheeled vehicles.

But mobility by itself is not enough. In order to be able to operate and support you at the pace your units operate, and to support forward, we need hardened and protected support vehicles, such as the proposed family of armored combat logistical support vehicles that include the armored, forward area rearm vehicle for ammunition support, the maintenance assistance vehicle for close-in maintenance support, and the medical evacuation vehicle for ground evacuation of the wounded.

In order to tie people and equipment to the task at hand, we need reliable communications to be able to communicate locally with you, to orchestrate support operations between our units in the brigade and division support areas, and with the Corps Support Command units that support us in the division.

We also need dependable data terminals, such as those found in the new decentralized automated service support system, and the appropriate software programs to manage people and materiel.

Another item on our need list is sufficient transportation to move people, supplies, and heavy equipment. The need for trucks with onboard materiel-handling equipment has been articulated by just about everyone that's ever been on a tank ammunition detail or ammunition supply point out-load exercise. Additionally, high consumption rates dictate a need for materials-handling equipment suitable for use in forward areas, such as a rough terrain forklift that is essential to the efficient operation of an ATP.

Now, I would like to address the matter of test, measurement, and diagnostic equipment (TMDE). Development of sophisticated equipment was supposed to have had a positive impact by reducing the reliance of new equipment on the combat service support system and by reducing the training of crews and support personnel. In application, however, the initial impact appears to have been to the contrary—it has, thus far, not simplified, but rather has complicated both repair and the training of repair personnel.

To respond to this dilemma, we are developing TMDE that is designed to reduce the requirement for support personnel and improve their productivity through rapid isolation of the faulty component under test. The principle here is to improve our ability to diagnose and replace a faulty component, and return the weapon system to operation as quickly as possible, while evacuating the component to the rear for repair.

To accomplish this, we are working on a family of automatic test equipment (ATE). Although the Army has, in the past, developed automatic test equipment for some of its low-density missiles and aircraft, the current trend is toward broader application. Frankly, we are not satisfied with a myriad of different connectors, adapters, and suitcase-configured test equipment currently being proposed or developed for use at organizational level.

My presence at the Armor Conference at the invitation of General Wagner is a clear indication of Armor's understanding of the critical role of logistical support and its relationship to success on the modern battlefield. You are the logistician's biggest customer. Consumption rates of fuel, ammunition, parts, and other supplies equal tonnages that equate to how we are organized and equipped.

We will continue our efforts to insure that responsive support is provided on the modern battlefield through the development of logistical concepts that will enable us to face tomorrow's challenges. I welcome your assistance in articulating your needs to the logistics community to provide support when and where it is needed.

ARMOR CONFERENCE

Status of the Advanced Attack Helicopter

MG Edward M. Browne
AAH Project Manager

To set the theme of this presentation, I would like for you to think of the advanced attack helicopter (AAH) as a light aerial tank, because that is what it is. It provides flexible decisive firepower, and the mobility to get it to where it is needed a lot quicker than ground-bound systems, and it isn't just a concept.

Operational Test II (OT II) for the AAH is underway at Fort Hunter-Liggett, CA, with three completely equipped aircraft and a full ground support equipment package. After OT II is completed, the production proposal will go before the Army and Department of Defense System Acquisition Review Councils in November. The production contract award is scheduled for 10 December 1981. The contract will be for 14 aircraft the first year, 78 the second year, peaking to 96 the third year, and continuing at that rate for 3 years, with an additional 60-unit buy in the last year for a total buy of 536 AAHs. The maximum production rate will be 8 per month, and I am a bit distressed with that. I would like to have some more support from the armor community with regard to increasing that rate.

Along that line, we get many inquiries as to the overall cost affordability of the AAH system. The answer is that, on a cost effectiveness analysis basis, the AAH is 3½ to 5 times more effective than the 3-million AH-1S in use today.

As to operational effectiveness, I think that the AAH is going to bring a kind of capability that we have never had before. It is going to cause us to rethink helicopter utilization, and how to integrate it into the battlefield. It will give the commander a true capability to operate around the clock in periods of adverse weather that he has not been able to exploit in the past. The AAH is going to provide the only precision aerial attack capability around the clock in adverse weather.

True, the Air Force's *A-10* is a fine aircraft and can provide a lot of support. But it isn't a night fighter because the pilot's target acquisition capability is limited to what he can see with his unaided eyes. Not so with the AAH, equipped with the target acquisition and designation system (TADS) and flown by a pilot using the pilot night vision system (PNVS).

We have acquired targets with the TADS as far away as 5 kilometers while flying in a driving rain. On one occasion, the aircraft was flown in a moderate snowstorm by a pilot using the PNVS and accompanied by a safety pilot wearing the older night vision goggles. The safety pilot's vision was such that he thought they should be flying under instrument flight rules, while the other pilot could still see the terrain, avoid obstacles, maintain course, and accomplish the mission. This capability provides an added dimension of firepower that enhances the effectiveness of the combined arms team, especially when the AAH is integrated into the total family of fighting vehicles.

Now, let's look at the balanced weapon system that provides the decisive combat power. It is referred to as a balanced system because it is capable of delivering the *Hellfire* missile, the 2.75-inch free flight rocket, or 30-mm automatic cannon fire. The 30-mm chain gun is particularly interesting because it can deliver fire out beyond the range of the TOW missile, and its ammunition will punch through the rolled homogeneous steel armor of the BMP, BTR, and *ZSU-23-4*.

Many aviators will remember that, heretofore, we sort of addressed our 2.75-inch rockets to whom they might concern. We just spewed them out and hoped they hit something. Not any more. We can now fire them from behind a mask, have them fly to a given range, open over a specific point on the ground, and have each of them release nine submunitions. That gives a very lethal capability because we have 76 rockets aboard, and each submunition is capable of penetrating lightly armored vehicles and trucks, as well as disabling a tank if it gets inside the engine compartment.

Now, our primary job is to kill tanks. We do that with the *Hellfire*, and no one is going to walk away from a tank that has been hit by that missile. In a test firing, a *Hellfire* struck a tank, moved it 2 feet in the direction the round was traveling, and its destructive effect punched a hole through the side that was hit, passed completely through the tank, and out the other side, where it dug a 3½-foot hole in the ground.

The things that enable us to put these munitions on target are the PNVS and TADS. The PNVS gives us a tremendous capability for operating under adverse conditions, and we have done some phenomenal things with it. Several other countries and our sister services are considering it for use with their helicopters. The U.S. Coast Guard is examining one for their search and rescue operations, and the Marine Corps is going to use the system with their *CH-53D* special operation helicopters. I have been encouraging the Army to do the latter for about a year, without much success. The one feature of the PNVS that is a marked improvement over the night vision goggle is the capability for flying the aircraft without ever having to look at instruments inside the cockpit. All needed information is displayed on a 1-inch square combining lens mounted on an arm projecting from the helmet so the lens is about three-fourths of an inch from the pilot's dominant eye.

One aspect of the PNVS is physiologically amazing; and even the medical profession doesn't understand it. We have found that after 40 to 50 hours of operating with this device, the other eye begins to move independently, and its gaze wanders around the cockpit from instrument to instrument.

Just as the PNVS device is the key to operating at night and in bad weather, so is the TADS crucial to putting steel on target—day or night. Its primary components are a long-range television, a forward-looking infrared sensor, and a directional optical telescope. Initially, the TADS did not do so well as we expected, but it has been refined and is performing much better. We are sure it will do the job for which it was intended and that it will meet its operational goal.

Many other things contribute to the success of the AAH's balanced weapons system. One of these is a fire control black box that gets its input from the TADS sensors. Other items include penetration aids, survivability equipment, and ballistic protection devices. These are integrated to provide passive and active capabilities that enable us to live and operate in a high-threat environment. The penetration aids include an infrared jammer, a radar jammer, radar warning devices, and flares for decoying missiles.

The light aerial tank and its balanced weapons system that I have been describing is called the *advanced attack helicopter,* but I believe we have a tendency to consider it as a defensive rather than an offensive weapon. I offer you something to think about. I see no reason why we shouldn't plan to go beyond the forward edge of the battle area (FEBA). There are a number of areas back there where we could conduct raids and raise hell in general. I believe that we ought to consider these options instead of just having the AAH setting 3½ to 5 kilometers behind the FEBA, always in a defensive posture. The capability for getting the AAH beyond the FEBA is there. For example, an AAH equipped with two 250-gallon external tanks, armed with eight *Hellfire* missiles, and carrying 500 rounds of 30-mm ammunitions, has a 215-nautical-mile radius of action in a hot day environment.

The next thing I am going to discuss doesn't apply just to the AAH but to the aviation community as a whole. We found out that our nuclear, biological, and chemical (NBC) protective ensemble was inadequate. So, I asked Natick Development Center and the Chemical Corps for help. I also brought in British, German, and U.S. Air Force representatives. Their research and development efforts have produced a new NBC protective mask that will allow us to operate the systems on the AAH. We are also working on the other parts of the NBC protective gear, and we are going to come up with something that really works. When we do, I think the rest of the aviation community will adopt it, along with tankers and others.

Now, let's turn to maintenance and survivability. When people look at all of the sophisticated equipment on the AAH, they always ask how we are going to maintain it. Our answer is that we designed the system to be modular. We don't want anyone at the unit level tinkering with the internal mechanisms of any of these devices. We have built-in test equipment aboard that tracks along with the pilot and copilot as they go through their checklists. As it does, it identifies any faulty module that it encounters. The unit mechanic then simply removes that module, replaces it with a good one, and sends the bad one back to the general support depot.

The PNVS is a good example of the maintainability of the systems in the AAH. It has accumulated 1,100 hours of flight time since December 1979 and has achieved an availability/reliability rating of 97 percent. That is an accomplishment that I think has been unheard of before, and that is with prototype equipment. I believe we will do better than that with production hardware.

Overall, we expect to be able to have this magnificent flying machine at the user's disposal on a 24 hour per day basis.

As for survivability, the AAH was designed to be 95 percent survivable if it were to crash at 42 feet per second straight down. That equates to 30 miles per hour. There is no other helicopter built to those specifications except the *UH-60 Blackhawk*. Other survivability features include triple redundant controls with mechanical linkage that is designed to withstand hits from 12.7 and 23-mm weapons. This is one tough bird, and it should dispell the notion that all helicopters are fragile machines. Heretofore, that might have been partially true, but it is not so for the AAH.

In summary, the AAH is going to give the commander a highly-capable, balanced weapons system that has to be integrated into the scheme of maneuver of a combined arms team that is being equipped with a new family of superior fighting vehicles. The ground commander must be cognizant of this and consciously strive to develop the best tactics, doctrine, and training to enable the AAH to make a maximum contribution to that team.

I would like to make this point in that regard. Take any division on line in Europe, and give them whatever slice of ground you want—nominally, a front of 75 to 100 kilometers and a depth of 150 to 200 kilometers. Then put the attack helicopters in the central laager area of the division's reserve force. Now take a look at how long it would take to get an armor battalion up to a breakthrough at the line. Depending on the weather and other ambient conditions, such as trafficability of the soil, stream crossings enroute, and so forth, it might take 3 to 5 hours to get there with tanks. On the other hand, as many attack helicopters as are available in the division, or even corps, reserve can be there in 15 minutes, each armed with 16 *Hellfire* missiles. Then when on station, they are capable of firing those 16 missiles at 16 separate targets within 1 minute, using onboard laser designators and the designators aboard fire support team or scout helicopters.

That is firepower and flexibility. I submit that we must think about it and use it properly.

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ARMOR CONFERENCE

Status of the Scout Helicopter

COL Robert S. Fairweather
TSM, Scout Helicopter Program

The Army Helicopter Improvement Program (AHIP) is designed to provide the Army with a near-term scout helicopter. The program was born when the advanced scout helicopter (ASH) was determined to be too costly. Subsequently, a review of the ASH program resulted in guidance being given to establish a competitive program for modifying an existing inventory helicopter and equipping it with a mast-mounted sight (MMS). In addition to the MMS, the required operational capabilities (ROC) statement included pilot night vision goggles, navigational doppler, radar warning, and digital message interface. The ROC also specified detection and recognition ranges for the TV and forward-looking infrared target (FLIR) acquisition sensors—3,000 meters for TV during daylight , and 2,000 meters for FLIR at night. Airframe performance requirements include a vertical rate of climb of 450-550 feet per minute (2,000 feet/70 degrees); hover out of ground effect (4,000 feet/95 degrees); a dash airspeed of 100-145 knots; an endurance of 1.9-2.14 hours; agility and stable handling; and space, weight, and power for an air-to-air *Stinger*.

A request for proposal was released in January, and proposals have been received from Bell Helicopter and Hughes Aircraft. A source selection and evaluation board has convened and will provide its recommendations by mid-July. Army and Defense Systems Acquisition Review councils will meet in July and August respectively and will result in a decision to enter full-scale engineering development with the selected contractor. The remaining milestones of the program will lead to an in-operation capability in February 1986.

Once we defined the sensor range and airframe performance requirements, we validated them through hands-on field trials to evaluate operational suitablilty and detectability of the AHIP scout helicopter concept. The detectability tests showed that an OH-58C with an MMS was 30 to 60 percent less detectable than a UH-1 with an MMS. The operational suitability evaluation revealed that the MMS concept is operationally sound, and an OH-58 with an MMS is able to operate better in nap-of-the-earth areas than a UH-1 with an MMS.

The AHIP concept was also evaluated through a cost and operational effectiveness analysis (COEA) that was based on information from the hands-on tests, research of past studies, technical data, and wargames.

In the wargames, the ground forces were supported with different attack team and artillery/scout configurations. First, a base case was played using an attack team of 3 OH-58Cs and 5 AH-1Ss, along with 2 OH-58Cs carrying field artillery aerial observers. Next, the OH-58Cs were replaced with AHIP scouts. Then, in the third game, an AHIP scout and AH-64 configuration was used. The first two games were played at the U.S. Army Aviation Center (USAAVNC) and the TRADOC Systems Analysis Activity (TRASANA). In the game at USAAVNC, the AHIP Scout and AH-1s team showed the following improvements over the base case combinations: targets killed by helicopter—55 percent, helicopter survivability—15 percent, and helicopter exchange ratio—158 percent. The improvements in the game at TRASANA were: targets killed—58 percent, survivability—28 percent, and exchange ratio—178 percent. When the AHIP scout was teamed with the AH-64 in the third game at TRASANA, improvements over the base case were: targets killed—114 percent, survivability—36 percent, and exchange ratio—402 percent. The AHIP scout and the AH-64 contributed about equally to the improvements, and the figures strongly support the compatibility of the AHIP scout with the AH-64.

The real value of the wargame is the determination of how much a new system contributes to overall force effectiveness. By making no change to the force other than replaying the OH-58C with the AHIP scout, the improvement in force effectiveness ranged from 9 to 45 percent. When the AHIP scout was teamed with the AH-64, the increase in effectiveness jumped to 165 percent.

The game also revealed marked improvements in kills by *Copperhead* and *Hellfire* missiles when targets were designated by lasers carried by helicopters rather than by ground laser locator designators. The capability of the AHIP scout to deliver air-to-air *Stingers* made yet another contribution to increasing the effectiveness of the force. Friendly helicopter survivabillity was improved 48 percent, target kills increased by 80 percent, and Hind-D effectiveness was reduced 88 percent.

Overall, the COEA revealed that the AHIP would result in a 44 percent life cycle cost, with most of the increase resulting from the cost of buying the machines. However, when the cost is balanced against the high effectiveness mentioned earlier, it is apparent that for a modest increase in force costs, the AHIP pays large dividends in increasing the overall force effectiveness.

ARMOR CONFERENCE

The Combat Vehicle Technology Program

CPT Joe Jennings
USAARENB

The opening part of this briefing gave the background of the Combat Vehicle Technology Program and described the High Mobility/Agility (HIMAG) vehicle and High Survivability Test Vehicle—Lightweight (HSTV-L) being used in the program. Since that material, including pictures of the vehicles, appeared in the May-June 1980 and May-June 1981 issues of ***ARMOR,*** *it is not repeated here.*

The Combat Vehicle Technology Directorate (CVTD) has been working for almost 4 years on the Armored Combat Vehicle Test (ACVT) Program. During that time, a large and extensive data base has been amassed on the performance of lightweight combat vehicles (LCV). Thus far, only a fraction of the data has been analyzed. However, some significant findings have been made and are reported here.

Most significantly, there is good reason for both the Army and the Marine Corps to be concerned with LCVs. The airlift requirements to move a current full TO&E armor battalion equipped with *M-1s* are probably prohibitive, at least for contingency or rapid-deployment-type missions. On the other hand, a significant reduction in airlift requirements can be achieved with a battalion equipped with LCVs. This is not to say that the LCV would have the same combat power as the main battle tank. In fact, one of the questions that CVTD will answer is whether a force equipped with LCVs can be successful on the battlefield, until it can be augmented by a heavier force equipped with main battle tanks.

Both the HIMAG and HSTV-L underwent firing tests at Aberdeen Proving Grounds. These tests were conducted primarily in the stationary-stationary firing mode, with only some moving-stationary firings conducted for demonstration purposes.

The objective at Aberdeen was to determine how well the medium caliber—antiarmor automatic cannon (MC-AAAC) would perform on an actual vehicle chassis. The tests showed that the cannon could fire a round every 1-1.5 seconds, the telescoped ammunition required for the burst operation of the autoloader was feasible and performed well, the cannon system was as accurate as a contemporary gun system, and the recoil effects of firing an MC-AAAC on a chassis as light as 20 tons were not excessive. These findings are significant, because a burst-fire cannon of this size has never before been fired on so small a platform.

Following the Aberdeen tests, the HIMAG and HSTV-L were brought to Fort Knox, in order to conduct operational tests with soldier and Marine crews at the Wilcox Range facility. This range allows the vehicles to fire on the move in a straight line on either a smooth or rough surface, or while performing an evasive slalom maneuver. The purpose of these firings is to generate a data base for evaluation of the relative utility of three different levels of fire control on both medium and lightweight high-mobility chassis.

The first level, in which the gunner manually tracks the target, is a state-of-the-art fire control with an automatic linear lead computer and laser rangefinder. The next level adds an automatically-computed angular rate to the basic state-of-the-art fire control system. In rate-aided tracking, the computer determines the correct tracking rate for the gun, based upon gunner tracking rate inputs, the firing vehicle's velocity, and the range to the target. The third level, autotrack, completely automates the tracking and gun-laying procedure. The gunner has only to acquire the target and then lock on the computer to the target's thermal or visual signature. The fire control then automatically lays the gun and continuously tracks the target. The gunner may fire at anytime.

The preliminary conclusions from the Fort Knox testing are based primarily on an analysis of the HIMAG live firing. The HSTV-L has not completed its firing. These results are somewhat surprising. They show that, at slow speed, in straight-line motion, there was no discrimination between the three levels of fire control. But, at higher speed, the manual system performed better than rate-aided or autotrack.

Surprisingly, the autotrack system displayed significantly slower firing times than either the manual or rate-aided systems. This is because the gunner has to perform additional tasks to initiate lock-on. The system also often loses lock after firing, due to obscuration. As expected, a burst of 3 rounds improved the probability of hit (PH) for a given trigger pull; however, we have not yet completed our analysis, which will determine whether the improvement in PH is significant enough to offset the increased ammunition expenditure.

The 75-mm MC-AAAC is the only gun that CVTD has in hardware form at this time. However, two other possible weapons systems are being considered. One is the 90-mm MC-AAAC, essentially an up-gunned version of the 75-mm, and the other is the 105-mm *M-68* cannon, now mounted on both the *M-60* and *M-1* tanks.

The performances of the 90-mm and 105-mm MC-AAAC are practically the same, because both guns fire essentially the same projectile, and the 90-mm MC-AAAC has a 300-cubic-inch chamber volume that allows it to attain a very high muzzle velocity. The performance of the 75-mm MC-AAAC is significantly below that of the other 2 rounds across the frontal 30 degrees of the target, but, around to the side, the performance of the 3 cannons become somewhat the same.

Against a tougher target, the performances of the 90-mm and 105-mm MC-AAAC are drawn closer to the performance of the 75-mm, and all 3 rounds have trouble defeating the tougher target across the frontal 30-degree arc.

CVTD is also evaluating the performance of 24 conceptual vehicles that vary in size, weight, type of armament, level of mobility, and level of fire control sophistication.

The concept vehicles are being studied to determine the feasibility of mounting the various new technology components on vehicle systems that must be light and small enough for strategic transportability, and to evaluate the battlefield utility of lightweight vehicles utilizing the technologies examined in the testbed vehicles.

One concept vehicle, the ACVT-75, weighs 16 tons, mounts a 75-mm MC-AAAC externally, and has a 3-man crew. This vehicle is representative of one that could meet the requirements of either the Marine Corps' mobile protected weapon system (MPWS) or the Army's mobile protected gun (MPG), and it is being evaluated in the operational role of both those systems.

Another concept vehicle, the ACVT-90, weighs approximately 22 tons, mounts a 90-mm MC-AAAC externally, also has a 3-man crew, and has space in the rear for additional ammunition storage or additional crewmen or scouts. This vehicle was designed to use the powertrain components of the Infantry/Cavalry Fighting Vehicle (IFV/CFV) family of vehicles, but the hull has been redesigned to allow the vehicle to fit aboard the *C-130* and *C-141* aircraft. This vehicle is being examined in the role of an MPG and as a follow-on to the CFV. A spinoff from the ACVT-90, the ACVT-90H has a larger powerplant that achieves a 38:1 power ratio.

The evaluation of the concept vehicles included an analysis of their cross-country mobility in German terrain, in comparison with that of HIMAG and the *M-1* and *M-60* main battle tanks. The results reveal that the concept vehicles and HIMAG can achieve increases in mobility over the *M-1* that range from 3.67 percent for the ACVT-75 to 26.15 percent for the ACVT-90H. All the vehicles show dramatically increased mobility when compared with the *M-60*. In a Mideast environment, however, the same relationships do not hold. ACVT-90H performs only 2.81 percent better than the *M-1*, but HIMAG continues to perform better than the *M-1* by 15.02 percent, because of its higher horsepower and smoother ride. On the other hand, the ACVT-90H, with its 38:1 horsepower-to-ton ratio, is hampered by its poor riding characteristics, as is the ACVT-75.

Numerous other performance estimates are being made for the concept vehicles. Combined with the data derived from HIMAG and HSTV-L and other tests, there is a great amount of information available. It is CVTD's responsibility to evaluate and analyze this information and make a recommendation concerning future use of LCVs. The results of these evaluations and analyses, thus far, include the following:

• Perhaps most significant has been the demonstration of the technical feasibility of medium-caliber antiarmor automatic cannons, and the fact that they can be fired accurately from a chassis as light as 20 tons, in both single shot and burst fire.

• The MPG studies demonstrate that lightweight combat vehicles do have tactical utility, at least in certain scenarios.

• An extensive data base has been gathered to permit the evaluation of the performance of various components of new LCVs and the trade-offs involved with their uses.

• The Marine Corps' MPWS and the Army's MPG have been identified as the most promising operational concepts.

• The possibility of an LCV being used as a follow-on to the CFV or IFV, in order to expand the buy, is being investigated.

• Data is continuing to be amassed that can be used in the future to support cost and operational effectiveness analysis (COEAs) and full-scale development programs, if such a decision is made this fall.

Five issues remain to be resolved in the ACVT study: 90-mm weapon system lethality, the mobility/agility payoff, analysis of fire control versus rate-of-fire, determining additional uses for MPGs, and self-defense air-defense capabilities for LCVs. The following actions are underway, or will be taken, to address these issues:

• A program is underway to develop a 90-mm MC-AAAC prototype and a 90-mm telescoping round. Test firings are scheduled this summer to evaluate the round's lethality.

• Sufficient data is now available and an analysis of mobility/agility payoff will be made.

An analysis of fire control versus rate-of-fire will be conducted by CVTD, in conjunction with the Army Materiel Readiness Systems Analysis Agency and the Ballistic Research Laboratories.

Additional uses for an MPG or MPWS will be sought in order to expand the buy of LCVs and realize cost benefits.

The HSTV-L will be used to conduct dry-fire exercises to investigate the self-defense air-defense capability of an MC-AAAC and mounted on an LCV.

CVTD anticipates having answers to all these issues for briefing the Army Chief of Staff on the ACVT program in August-September of this year.

More Armor Conference presentations will appear in the September-October issue. Ed.

Armor Update Conference

6-8 October 1981 Fort Knox, KY

The Armor Center has scheduled an Armor Update Conference to be held at Fort Knox on Tuesday, Wednesday, and Thursday, 6-8 October 1981. The purpose is to update Armor Service School instructors, Noncommissioned Officers Academy instructors, Reserve Component unit officers and advisors, Active Component staffs and Active Component unit commanders. The conference will cover current developments in doctrine, tactics, training and materiel. It also will provide a forum for the exchange of ideas and identification of problems requiring resolution by the Armor Community and Armor Center. A message to major commands will provide specific information for attendees. The last update conference was held in 1979.

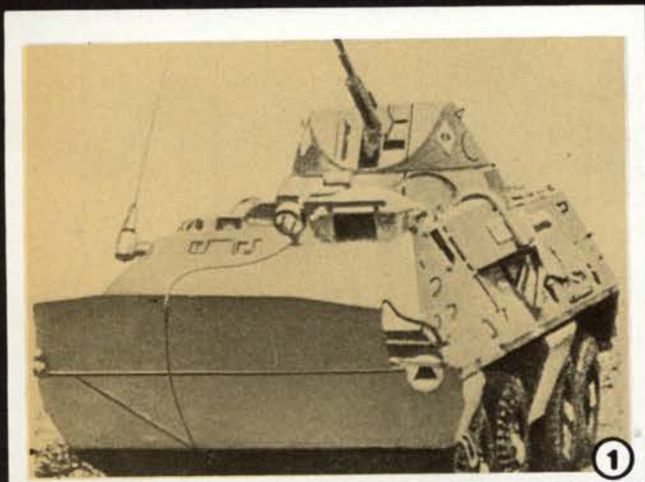
Correction

The scores shown for the U.S. in the Canadian Army Trophy Match on page 75 should read 35,187.

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 74)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KAREN RANDALL

North Vietnam Armor Operations: The Lessons of 1972 and 1975

by Lieutenant K.N. Stacey
Royal Australian Armor Corps

May 1975 saw the successful conclusion of the Vietnam People's Army's (VPA) general offensive against the Republic of Vietnam (RVN). Since this time a number of articles have appeared in Vietnamese publications analysing various aspects of this operation.[1] One of these, written by Colonel Dao Van Xuan, is titled "In the Spring 1975 General Offensive and Uprising—Tank-Armored Troops in Strategic Group Offensives."[2] In it, the author discusses the strategic and tactical employment of the VPA's armoured forces, highlighting specific points and outlining the lessons to be drawn from the offensive. Colonel Xuan's article provides an opportunity to compare the VPA's experience of armoured operations in the 1975 Offensive, and the 1972 Spring Offensive, when armoured fighting vehicles (AFVs) first appeared on the battlefield in large numbers.[3] In 1972, VPA armoured forces had been employed with only mixed success. Building on this experience, VPA commanders involved in the 1975 Offensive were careful to use their AFV resources to maximum advantage. In doing so, they greatly aided the VPA's chances of victory.

Background to the 1972 Spring Offensive. In response to the RVN's relatively successful "Pacification" and "Vietnamization" programmes and the consolidation of President Thieu's leadership, the Lao Dong (Workers') Party decided to revert to large unit warfare in December 1970.[4] According to Porter, "the Lao Dong Party's strategy for ending the war had always assumed that a military and diplomatic stalemate could be broken by a decisive victory,"[5] and, what was of greatest importance was the timing and targets for such a main force offensive. Throughout 1971, increased Soviet and Chinese military aid flowed into the Democratic Republic of Vietnam (DRV). This build-up of aid was the result of agreements signed between the DRV and the Soviet Union in August and December of 1971.[6] Negotiations with China in February 1971 concerning supplementary military aid[7] were reflected in a doubling of Chinese shipments into Haiphong.[8] Significant also was the nature of this assistance. As well as small scale items, such as ammunition and rifles which had been provided previously, large numbers of heavy mortars and artillery, armoured vehicles, and trucks also began arriving. During this period, VPA divisions, which had been operating in the RVN, were withdrawn from combat to undergo training and re-equipment with the newly arrived aid.[9]

The reasons for mounting the offensive in 1972 were that United States ground forces had largely been withdrawn from the RVN, and hence, the VPA could concentrate their efforts on destroying RVN Army (ARVN) main force units. Also, with President Nixon committed to extricating the United States from Vietnam, a successful attack on the RVN would apply further pressure for a negotiated settlement if he wanted to be re-elected in 1972. At this time, the antiwar movement still remained as a significant lobby group in American domestic politics. The "Pacification" and "Vietnamization" programmes were designed to show that the RVN regime could administer and defend its sovereign territory. If the VPA could achieve success on the battlefield, the effectiveness of these programmes would be shown as limited, and the credibility of

the RVN regime would be further undermined. If the offensive resulted in the capture of territory, Communist prestige would be enhanced, and the basis laid for the establishment of an alternative government to the one in Saigon. On the eve of the 1972 Offensive, the VPA had 13 divisions, equipped with approximately 1,200 AFVs poised to strike against the ARVN forces.[10]

Lessons of the 1972 Offensive. General Giap, the VPA's Commander-in-Chief, opened the offensive on three fronts, with the main initial thrust across the northern Demilitarized Zone (DMZ) The VPA advance in this area began on March 30, spearheaded by 100 AFVs.[11] Inaccurate intelligence assessments[12] meant that ARVN anti-armour defences were inadequate in trying to stem the progress of the VPA armoured columns. The surprise appearance of AFVs on the battlefield clearly demonstrated the devasting psychological effect they can have on an unprepared enemy and was a decisive factor leading to the ARVN's 3d Division disorganized withdrawal. Once the ARVN forces overcame this initial shock, they were able to employ successfully anti-armour weapons and their own armoured forces against the VPA. The ARVN's subsequent achievements in destroying the enemy AFVs were also assisted by the VPA's inept handling of its vehicles.

VPA forces operating on the other two fronts, in the RVN province of Kontum and Binh Long, also employed AFVs to spearhead their advance.[13] The VPA's use of armoured forces in attempting to capture the provincial capital of An Loc clearly illustrated weaknesses in tactical coordination and cooperation. Lack of effective artillery support, combined with an absence of accompanying infantry, meant armoured vehicles became easy prey to the anti-armour weapons of the ARVN forces.[14] Although recently returned from training in the Soviet Union,[15] VPA tank crews fared badly in tank versus tank engagements and also in general battlefield deployment. According to observers, VPA armoured units persisted in advancing along roads when cross-country movement would have been safer, and in proceeding slowly and indecisively when speed and initiative were called for.[16]

Initially, the VPA offensive had been favoured by rain and low cloud cover, which restricted the use of allied air power. When the bad weather lifted, RVN Air Force and USAF planes were able to fly missions in support of defending ARVN forces. Ground-attack aircraft, bombers like the *B-52,* and helicopter gunships were responsible for destroying many enemy AFVs on all three fronts. This situation emphasized the essential requirement for active and passive air defence measures if AFVs were to operate on a battlefield where their forces did not have the benefit of air cover.

For the VPA, the conventional, mid-intensity warfare they were being called on to conduct was a new experience. Commanders lacked the background to organize large-scale, combined-arms operations, and this deficiency was reflected in high vehicle and manpower casualties. The fact that the three fronts on which the VPA forces were fighting did not directly support each other aided ARVN attempts to contain the VPA drives. On the northern front, the VPA advance lost its initial momentum due to an inability of the logistic system to maintain supplies.[17] As far as the individual VPA soldiers involved in armour operations were concerned, one commentator described the situation in the following terms—"hesitant uncoordinated fumbling with some well-maintained Soviet vehicles showed once again that successful armour employment is totally dependent on aggressive spirit and technical skill on the part of the tank crews."[18]

By the middle of May, the tide had turned against the VPA offensive, and many of the units on the three fronts were being withdrawn for refurbishment. By the end of July, the VPA had, in combined operations, sustained some 60,000 troop casualties and lost 250 AFVs. Balanced against these losses was the, what later proved to be invaluable, experience gained at all levels in planning and conducting operations involving large numbers of troops from different arms. Also, the VPA had succeeded in forcing the RVN to commit all of its main force units to stemming the Communist advance. This allowed Communist guerilla groups freedom to operate in the countryside, and establish control over a further 1,400 villages in the RVN.[19] The first large-scale use of AFVs by the VPA graphically illustrated to commanders the possible pitfalls associated with their employment. The lightning success of the 1975 Spring Offensive in many ways demonstrated how well the VPA had applied the lessons learned 3 years previously.

Background to the 1975 Spring Offensive. At the 21st plenum of the Lao Dong Party's Central Committee held in October 1973, it had been decided that the DRV must "maintain a course of strategic offensive and give active guidance to advance the revolution in the South."[20] This decision led to a reorganization of the VPA order of battle along the lines of four independent army corps, with associated mobile commands.[21] A reequipment programme was also started, and, according to the VPA field commander General Van Tien Dung, "large numbers of tanks, armoured cars, rockets, long-range artillery and antiaircraft guns were sent South."[22] Such an effort was possible, by 1974, the old "Ho Chi Minh Trail" through Laos and Cambodia had largely been superceded by a new network of paved roads extending from the DMZ between the Vietnams down through the Central Highlands.[23] In conjunction with this, General Dung describes the construction of "a 5,000 kilometer-long oil pipeline which ran from Quang Tri through the Central Highlands on to Loc Ninh."[24] In this way, vehicles using the new road system could be conveniently refuelled.

The effectiveness of the VPA's reorganization and planning was demonstrated in December 1974, when main force units joined with regional forces in opening a campaign to gain control of Phuoc Long Province. The combined infantry and armour assault on the provincial capital, Phuoc Binh, quickly led to its capture by the VPA. One observer stated that "militarily, the attack revealed the reforms that had been instituted"[25] in the VPA, and emphasized that the VPA "now placed greater (importance) on the shock value of armour and artillery closely supported by infantry."[26] The improved coordination evident in the attack resulted from the integration of armour and sapper groups into the VPA divisional formations.[27] Encouraged by this success, DRV leaders resolved to conduct an all-out strategic offensive to liberate the RVN in 1975-1976.[28]

Lessons of the 1975 Spring Offensive. In planning the use of armoured forces in the campaigns of 1975, VPA commanders gave much thought to the lessons learned in 1972. They approached the problem of maximizing benefit from limited resources by concentrating armoured forces, as described by Colonel Xuan, "in the most appropriate and rational way."[29] This meant deciding on what were to be the most decisive battles and those which would have the greatest influence on the prevailing strategic situation. By amassing armoured forces for these critical engagements, and, as Xuan says, "dealing thundering blows in the important strategic directions,"[30] great benefit was to be gained. Consistent with this, AFVs were not used in the diversionary actions of the "Tay Nguyen (Central Highlands) Campaign" but concentrated for the major assault on Ban Me Thout. Similarly, in the "Ho Chi Minh Campaign," AFVs were allocated specifically to spearhead the advance on Saigon.

The VPA identified two key methods of successfully employing armoured forces—"sudden assault" and "deep advance."[31] The notion of "sudden assault" implied overwhelming of enemy resistance by a quick attack. In this way, the shock effect created by AFVs was utilized to throw the enemy off balance. This technique was used against population centres such as Xuan Loc, Bien Hoa, Hoc Mon, and ultimately Saigon. A successful "sudden assault" opened the way for an effective "deep advance," or pursuit. The vulnerability of a withdrawing enemy meant pursuing VPA forces were able to inflict heavy casualties on ARVN units. Also, the "deep advance" movement referred to the actions carried out in the use of the "blooming lotus" tactic.[32] The employment of armoured forces facilitated the rapid capture of key objectives such as command and control centres inside a town or city's defensive perimeter. The VPA used this tactic to great effect, and, according to Colonel Xuan, "the role of deep advance attack was considered the decisive blow responsible for the lightning victory of the campaign."[33]

The VPA commanders also recognized how their armour had suffered when they became detached from infantry troops in several of the 1972 battles. Consequently, they were determined to maintain tight attack formations with each component mutually supporting the other. Also, these formations needed to be strong enough so that enemy infantry and tanks could not stop their advance or divide them.[34] In working closely with infantry units, armoured forces provided support by destroying enemy fortifications and obstacle systems. In deciding on the employment and tactics of a combined-arms group though, VPA commanders also considered how the characteristics of AFVs could best be utilized. Points in their consideration, as Colonel Xuan recounts, were "the need to

attack hard and quickly, to have extremely bold offensive action, and importantly not to stop in front of enemy troops during an attack."[35]

In order to maintain the momentum of their advance, VPA commanders used the technique of "leap-frogging" units. When enemy resistance was encountered, the leading units deployed for a quick attack, while following units bypassed the enemy location to continue the advance. This was the case in the attack on the Thu Duc Officers' School outside of Saigon. While it was in progress, other VPA units pressed on to attack and seized the Saigon Bridge.[36]

The speed at which the VPA was able to maintain its advance, combined with a lack of planning on the part of the ARVN forces, denied the latter any opportunity for regroupment and consolidation. The ability of the VPA to sustain its progress came from a disciplined and well-organized logistics system based on more than 10,000 vehicles.[37] To fully capitalize on the opportunities created by successful infantry and armour attacks, VPA troops needed the ability to move at the same speed as the leading armoured vehicles. Where previously VPA divisions had moved on foot, in this offensive the available resources made it possible to mount them in trucks for rapid redeployment. Captured enemy vehicles and even touring cars[38] were used when VPA transport was not readily available. The VPA also made greater use of armoured personnel carriers for both transporting troops and close accompaniment of tanks during assaults. By these various means, VPA advance units were able to cover an average of 50 to 60 kilometres in a 24-hour period.[39]

During the 1972 Offensive, the VPA was forced to restrict its operations because of logistic backup problems.[40] In the "Tay Nguyen" and "Ho Chi Minh" campaigns of 1975, armoured vehicle mobility and combat efficiency were maintained by a complex, yet effective resupply system. The construction of the oil pipeline to Loc Ninh must have greatly increased the ability of AFVs to operate for protracted periods in southern RVN provinces. To facilitate the distribution of fuel, each advance column had attached to it "units in charge of transporting fuel...to assure timely supplies."[41] Similar units were also responsible for ammunition resupply and vehicle servicing. As well, VPA forces made use of captured fuel stocks. The speed of their advance meant that on many occasions withdrawing ARVN troops did not have time to destroy depots or immobilize vehicles. In the case of the latter, VPA troops used enemy AFVs to boost the strength of their own forces.[42]

The level of competence displayed by VPA commanders during the 1975 Spring Offensive was a great improvement on the situation that had existed in 1972. The VPA established within combined-arms groups a command situation whereby the senior infantry officer was in charge, except where AFVs were fulfilling the major attack task—then, the armour officer was in command. According to Xuan, in both cases, "the infantry commander and the tank-armoured force commander had to maintain a close relationship."[43] Training also stressed that, to carry out an effective tactical appreciation, commanders needed to be in a position where they could observe changes on the battlefield. The implementation of any plan required commanders to have firm control over all forces under their command. Leadership training conducted by Communist armed forces has often been criticised for its stifling of individual initiative, which has led to an inability of commanders to cope with unexpected situations. The impression gained from Colonel Xuan's article is that the VPA approach to the carrying out of command tasks was to encourage flexibility and creativity in all combat situations. This was to apply particularly to officers in command of "deep advance" columns. The successful bypassing of ARVN defensive locations to strike at centres of command and control depended on the personal initiative of individual commanders.

In commenting on the 1972 Offensive, General Dung mentions the significant role of United States support in limiting VPA operational successes.[44] With 600 fighter-bombers based on four aircraft carriers in the Gulf of Tonkin and 100 B-52s based in Thailand, as well as approximately 180 RVNAF aircraft operating against them, any weaknesses in the VPA antiaircraft defences were reflected in troop and vehicle losses. By 1975, the factors prevailing on both sides had altered significantly. While the RVNAF had been strengthened to some 1,600 aircraft of all types, the ARVN could no longer count on United States air support. For their part, the VPA had been supplied with more advanced antiaircraft weaponry by the Soviet Union.[46] Also, the integration of antiaircraft regiments into advance columns and an emphasis on mobile defensive measures meant the VPA was able to establish a protective umbrella over most troop concentrations. This greatly reduced the incidence of AFV casualties from either tactical bombing or close air support missions.

In 1972, the lack of inter-arm coordination by the VPA, particularly in assaults, had cost them dearly. In overcoming this deficiency, VPA planners stressed the requirement for preparation prior to combat. Flowing from this was the establishment of standard operating procedures designed to facilitate quick understanding between cooperating units. As a further aid to commanders, advance columns had attached to them reconnaissance troops composed of infantry, artillery, and engineer elements.[47] These troops served a liaison function between the advance column commander and their own branch commander. In organizing communications, it was considered important, according to Xuan, to properly combine "the signal networks among all units and services...particularly to fully use the solid signal network of tanks and armoured vehicles to assure uninterrupted signal and liaison contacts.[48] To aid cooperation and coordination, advance columns also organized a unit of liaison officers equipped with mobile vans, which (were) constantly dispatched to the advance line to directly assess the situation."[49] To these sources of information was also added the intelligence that became available from units operating behind the ARVN's lines of resistance. The effectiveness of all these measures was demonstrated in the speed with which the VPA offensive was brought to a conclusion.

Colonel Xuan's article indicates that the VPA had learned, as a result of their experiences in 1972, that if they ignored the basic considerations of AFV employment, high casualties would result. In regarding the full experience of VPA armoured operations, no startling new techniques or innovations appear. What does come out, though, are many valuable and pertinent lessons demonstrating how armoured forces can be successfully employed. The reasons for the VPA's effective use of armoured vehicles bear close resemblance to the major principles stressed in the training doctrines of most Western armies. What the VPA achieved was to adapt these tenets to the unique conditions of the Vietnamese situation. Outside of the Arab-Israeli conflict, the present-day student of armoured warfare has had very little opportunity to observe AFVs in actual combat situations. Examination of the VPA's armoured operations provides a chance to broaden this experience. Throughout the course of the war in Indochina, many questioned the viability and effectiveness of armoured vehicles in the region. As one author comments, "But everyone knows you can't use armour in a place like Vietnam!" This cry was heard so often through the mid-60s that it came to be accepted almost as an article of faith.[50] The VPA clearly demonstrated that armoured forces did have an important part to play in deciding the final outcome of the conflict. It would be hoped that these lessons are not lost on future planners of combat operations in the Southeast Asian region.

Footnotes

1 Senior Colonel Doan Ba Khanh: "The Advances Made in the Combat Operations of the People's Navy in the General Offensive and Uprising of the Spring of 1975." *Tap Chi Quan Doi Nhan Dan*, Hanoi, No. 11, Nov 1976: pp. 71-77, U.S. JPRS. *Translations on Vietnam*, No. 1906, 28 Mar 1977.
Colonel Pham Quong: "In the General Offensive and Uprising of the Spring of 1975: Some Experiences in Assuring the Mobility of the Military Engineering Forces." *Tap Chi Quan Doi Nhan Dan*, Hanoi, No. 12, Dec 1976, pp. 65-71, U.S. JPRS. *Translations on Vietnam*, No. 1920, 28 Apr 1977.
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4 I. Ward, "North Vietnam's Blitzkrieg," 1. Why Giap did it: report from Saigon in *Conflict Studies*, Oct 1972, No. 27, p. 1.

5 G. Porter, *A Peace Denied—The United States, Vietnam, and the Paris Agreements* (Indiana Univ. Press, Bloomington, 1975), p. 103.

6 *Pravda* (Moscow) 19 Aug 1971 in *USSR and Third World*, Vol 1, No. 8. *Pravda* (Moscow) 31 Dec 1971 in *USSR and Third World*, Vol 2, No. 1.

7 *New China News Agency* (Peking) 15 Feb 1971 in *USSR and Third World*, Vol 1, No. 1.

8 *The Sunday Times* (London) 28 Feb 1971 in *USSR and Third World*, Vol. 1, No. 2.

9 According to the author, there was not a single Communist main force division in South Vietnam by the end of 1971. Porter, *op cit.*, p. 104.

10 Estimates vary as to specific quantities but certainly the VPA had in the region of 600-800 *T-54/T-59* tanks, as well as some 400-500 *T-34* tanks, *PT-76* light tanks, *BTR-40* armoured cars, *BTR-50* (PK) armoured personnel carriers (APCs), *K-63* APCs, and *ZSU-57-2* Self-Propelled Anti-Aircraft Guns. See R. Thompson, "The War in Vietnam Reflections on Counter-Insurgency Operations" in *RUSI Journal*, Vol. 118, 1973, No. 3, p. 21; c.f. *Military Balance 1971-1972* (London), p. 50.

11 *Keesing's Contemporary Archives*, July 1-8, p. 25336.

12 "The complete failure to give warning of a possible tank threat stands as a telling indictment of allied intelligence work at this time." Ward, *op. cit.*, p. 1.

13 *Keesing's Contemporary Archives*, July 1-8, 1972, pp. 25336-25337.

14 See W.F. Ulmer, "Notes on Enemy Armor at An Loc" in *Armor*, Jan-Feb 1973, pp. 14-20.

15 "Prisoner interrogations have established that *at least 3,000 North Vietnamese tank crewmen participating in the offensive had only four to five months earlier graduated from the Russian armoured school at Odessa.*" Ward, *op. cit.*, p. 5.

16 Halloran, *op. cit.*, p. 19.

17 Ward, *op. cit.*, p. 4.

18 Ulmer; *op. cit.*, p. 15.

19 Porter, *op. cit.*, p. 104.

20 Dung, *op. cit.*, p. 10.

21 *Ibid.*, p. 13.

22 *Loc. cit.*

23 *Strategic Survey 1974* (London), p. 88; c.f. Dung, *op. cit.*, p. 15.

24 Dung, *op. cit.*, p. 74.

25 P. Burnard, "The Battle for Phuoc Long," *Pacific Defence Reporter*, Apr 1975, p. 23.

26 *Loc. cit.*

27 *Loc. cit.*, "Inf divs normally total 8,000-10,000 men, incl 3 inf regts, 1 tk bn, 1 arty regt, and support elements." *Military Balance 1975-1976* (London), p. 60.

28 Dung, *op. cit.*, p. 22.

29 Xuan, *op. cit.*, p. 58.

30 *Ibid.* p. 59.

31 *Loc. cit.*

32 "The image of the 'blooming lotus' describes the way the style of attack began in the center of the town, then gradually opened out into the outlying areas like a flowering bud slowly opening its petals." Dung, *op. cit.*, pp. 31-32.

33 Xuan, *op. cit.*, p. 59.

34 *Ibid.*, p. 61.

35 *Loc. cit.*

36 *Ibid.*, p. 62.

37 Dung, *op. cit.*, p. 39.

38 *Ibid.*, p. 227.

39 Xuan *op. cit.*, p. 62.

40 Dung, *op. cit.*, p. 90; c.f. Ward, *op. cit.*, p. 4.

41 Xuan, *op. cit.*, p. 66.

42 General Dung makes mention of the fact that, in the advance column, American *M-113* APCs, as well as *M-48* and *M-41* tanks, began to make their appearance. Dung, *op. cit.*, p. 142; c.f. Xuan, *op. cit.*, p. 66.

43 Xuan, *op. cit.*, p. 63.

44 Dung, *op. cit.*, p. 90.

45 *Keesing's Contemporary Archives*, July 1-8, 1972, p. 25338.

46 The Soviet Union had supplied the VPA with the *ZSU-23-4* self-propelled antiaircraft gun. This AFV is equipped with four, radar controlled, heavy machineguns, and is considered by Western authorities to be highly effective in its designated role.

47 Xuan, *op. cit.*, p. 64.

48 *Ibid.*, pp. 64-65.

49 *Ibid.*, p. 65.

50 Colonel R.R. Battreall, "Ky Binh Vietnam-Muon Nam," *Armor*, Jul-Aug 1974, p. 8.

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An Airmechanized Force for the 90s

by Brigadier Richard Simpkin

Not long ago, Dick Ogorkiewicz suggested in your pages that the British *MBT-80* was likely to be the last conventional tank to be developed, at least in the West. Now, to the relief of many, that project too has gone to the wall. Given the success of the high-mobility-agility (HIMAG) program, the fact that the HIMAG test vehicle is made up largely of proven subsystems, and the way the Germans are already getting 1,850 hp DIN (German Industrial Standard) from a compact diesel, there is little doubt that high mobility and agility are at last on the way. Broadly speaking, we can expect that in the nineties the operational mobility of the main maneuver force will be better than doubled and its battlefield mobility tripled. This adds up to a whole new ballgame, which I explored in my latest book, *Antitank 90—An Airmechanized Response to the Soviet Beyond* (Oxford and New York, Brassey's/Pergamon Press, Autumn 1981). Here, I want to single out and address two specific and related issues: the preparation of defended localities, and the use of helicopters in independent operations within the main mechanized battle—hence the term, "airmechanized."

First though, we need to remind ourselves what mechanized forces are about. Between the Wars, one of the reasons the Germans got the answer just about right and most everybody else got it wrong was that they started by saying not "Here is a tank. How can we use it?" but "How could we use a relatively small force with much better mobility than the bulk of the army?" The mobility of the *Panzertruppen* was an order of magnitude higher than that of the rest of the *Wehermacht,* marching on its feet and still partly backed by horse-drawn transport. Since WW II, the advanced armies have had at their disposal three levels of ground mobility—the boot, the track, and the cross-country wheel (or light track). Given a nominal mobility of 40-50 kph for the main force, armored cavalry and like vehicles could offer around 75 kph—the classical 50 percent margin said to be required for recon and command elements.

HIMAG puts the mobility of the main force up to this level, eliminating the margin. If we go chasing after cross-country armored vehicles with usable speeds of around 120 kph, we hit more than a whole nest of technical problems. Even with *Abrams,* HIMAG, and the high speed test vehicle/light (HSTV/L), experience is beginning to suggest that we hit the limits of human response because the results of reading the ground wrong become rather dramatic. To get a margin at all, let alone a 50 percent one, it becomes better and cheaper—probably even in fuel—to get off the ground than to try to cross unprepared surfaces. So the ultramobile elements have to get off the ground. *Rotor is to track as track is to boot.*

But before we start thinking "airmechanized," we need to consider what HIMAG mobility does to the ground maneuver battle, especially to the mechanized defense. Evidently, however little NATO may like it, the dimensions of the battlefield will grow. The Soviets in the advance already like to give themselves 30-35 km of thinking space at battalion level. As their speed and this depth increase, so does the area of real estate swept by the advancing commander's short-term options. Sure, the equally-mobile defender can react physically in the same relative time. But he has a much larger number of localities he may have to defend; and a considerably larger chance of getting the answer wrong and being flanked. This two-horned problem is, I guess, the thought underlying this article.

Instant Preparation

As military technology advances, defense comes to be increasingly about the extreme concentration of firepower in time and space and less about "strong ground" *per se.* Some theorists—and they are mainly Germans—have been claiming for years that ultrahigh mobility negates the military value of ground. Sure, we need to get away from the notion of pouring boiling oil from castle walls or rolling stones from a hilltop; even from the fact that high ground is strong because attacking uphill on foot is slower and more tiring. Nonetheless; apart from its political, strategic, or logistic worth, ground still has significant *tactical* value. Certain terrain characteristics are necessary to provide the positions of fire and observation, and the fields of fire required for a maximum concentration of firepower; to canalize the enemy so that he presents an optimum target; and to maximize the snafu in the follow-up that a bloody nose will cause him.

As long as ground has tactical value, the notion of improving it by preparation has to be a valid and realistic one, despite the way the number of alternate positions grows with battlefield dimensions. Yet, as a proponent of maneuver, I have always felt there to be three grave drawbacks to preparing ground in advance. One, a virtual certainty in the NATO center, is that the opposition will find out; even if he is unable or does not choose to go a different way, he can measure and time his punch accordingly. The others concern the defending commander's commitment to use a position he has prepared—and here I am thinking mainly of the highest level of tactical command, say brigade, or on the tactical/operational borderline, say division. Physically, the materiel used in preparation is irrecoverable; with the logistic problems imposed on NATO by financial restrictions, this is no negligible matter in itself. Likewise, the expenditure of human effort is likely to reduce the potential of the defense in some way or other.

Far more important, though, is the commander's psychological commitment to ground he has chosen and prepared. A commander conducting a tactical defense always needs to watch his troops' confidence in him and their morale. He might see preparing several alternate positions and then going somewhere quite different again as a loss of face. Anyway, he is going to be drawn toward a position just because he has chosen it, even if it is less than ideal for the actual course of operations. Field-Marshal Montgomery's principle of balance is highly relevant here. By definition, the attacker has "the initiative"; the defender's initiative lies in keeping his options open. Contrariwise abandonment of all preparation would confine the defending commander to a small number of positions of extreme natural strength, thus imposing another intolerable constraint on him.

So a highly mobile force operating in defense needs *instant preparation*. By this, I mean a degree and form of preparation that suffices to close the gap between the natural strength of the ground and the backup the defender's firepower requires from it; and that can be completed between the defender's occupation of the position and the enemy's arrival. Evidently, the key lies in the *scatterable minelets* laid by helicopters (and thrown out of IFVs) on occupation, and put down by artillery in front of the enemy just as he arrives. I have no space to deploy the arguments fully here, but rather a thorough analysis of the whole antiarmor spectrum convinced me of two things:

- The place to use minelets is *right in* the main tactical battle, covered by fire; not on their own in an economy of force role.
- Within the tactical battle, minelets are a much more effective form of submunition than bomblets, because they need to coincide with the target only in space, not in time as well.

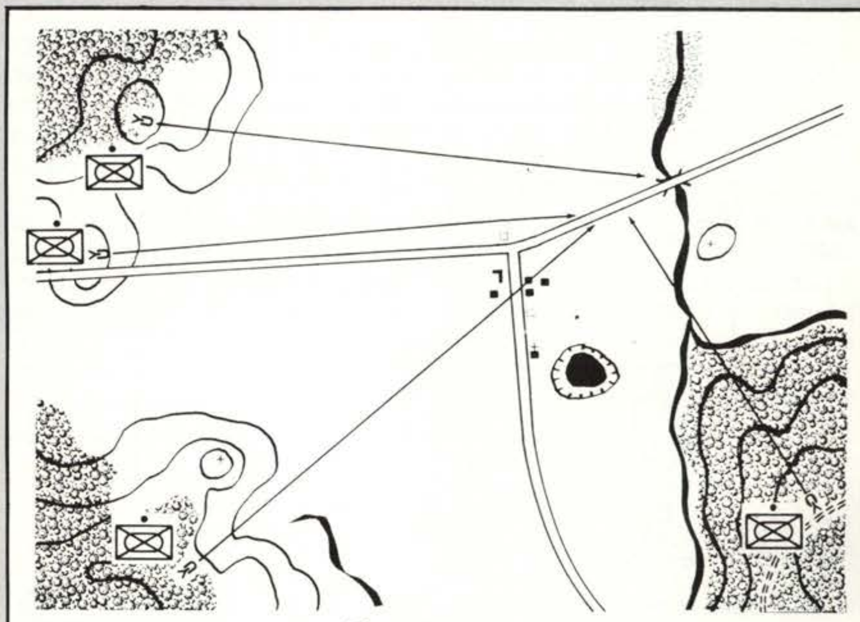


Figure 1

Maximizing Firepower

Naturally, this gap in defensive strength can and should be closed from both ends. For many well-known and self-evident reasons, only a limited number of direct-fire antiarmor weapons can reasonably be sited so as to fire on the same point or immediate area. The use of minelets and other neutralizing techniques in this area enhances the value of these direct-fire weapon systems by gaining them time. Since attack helicopters operate in a wholly mobile manner even in defense, these too can thicken up the concentration of fire in time and space without cluttering the battlefield. But if we are going to talk about "maximum concentration of firepower in time and space," we have to bring fire to bear from outside the direct fire zone.

Copperhead exemplifies this principle, but, with firing *Copperhead* and minelet carrier shells superimposed on its conventional missions—along with the importance of counterbattery fires in keeping the defense mobile before and after the crunch—the close-support tube artillery is going to be just a shade busy. Once again, I cannot deploy the full arguments here. But I suggest that, now that the state of the art permits, there is a need to unclutter the direct fire zone and exploit the principle of massing fire by making the primary chemical energy surface-to-surface antiarmor weapon system an indirect fire one. Some ballpark figuring suggests that this system should be a missile that it may use laser target-marking (like *Copperhead*) initially but should ultimately have terminal guidance by active homing; that this system could be deployed on a family of vehicles based on the British *CVR(T)* or the US *Lance* launcher (*M-667*); and that it would then be heliportable at the *Chinook* level. To provide the complementary minelet capability and limited general support, mortars could be similarly mounted, provided that the mortar (like the piece of an SP artillery gun) is located above armor.

Helicopters in the Defense

The need for dedicated antiarmor artillery units in support of the mechanized maneuver force and the feasibility of making these readily heliportable provide at once the link between the two parts of this article and the key to independent helicopter operations in the defense—the concept I called "airmechanization." In the early days of the U.S. Air Cavalry, there was much talk of independent helicopter operations, mainly offensive and under the head of "vertical envelopment." I may not be fully in touch, or I may read the wrong periodicals! But I have the impression that, since then, a number of very understandable pressures, not least the state of the art and the scale of the antiarmor threat itself, have combined to make attack helicopters very much a part of the combined arms team.

Back in the sixties, a school of thought in the *Bundeswehr* favored the concept of "flying tanks," but that baby took two smart taps on the nose shortly after birth. One was the proposed use of cheap machines with limited performance and low-grade pilots, a notion that continues to contradict some of the fundamentals of rotary-wing technology and techniques. The other was the disclosure to the Federal Republic of Germany (FRG) of Chobham armor; along with complementary German work, this hung a considerably larger

The New French Army—Part II

by Colonel Arnaud P. Loubens

The first half of this article (*ARMOR,* Sep-Oct 1980) described the objectives of the reorganization of the new French Army and presented a detailed description of the mission, organization, and employment of the French armored division. This half of the article will deal with the French Army corps, infantry division, and the corps and divisional cavalry squadrons.

The 1977 reorganization of the French Army created smaller, "square," combined arms divisions but established a larger corps formation to coordinate and direct their employment and to support them (figure 1).

The army corps' command, control, and communication assets include 1 rear and 2 forward command post elements, and a direct air support center, a combat signal battalion provides dedicated communication support for the corps headquarters elements.

Combat support of the divisions is provided primarily by an artillery brigade, two engineer battalions, and a chemical battalion. Other support elements such as army aviation and air defense units are consolidated at corps level.

The corps also has a considerable intelligence collection and analysis capability, with the collection effort being carried out by two armored cavalry squadrons, two electronic warfare companies, and aerial surveillance and reconnaissance means.

One of the main responsibilities of the corps commander is the control of tactical nuclear weapons, including the *Pluton* missile, should they be employed. These French weapons could only be used by French forces on orders of the President of the Republic of France and their use would be coordinated with other theater forces employing tactical nuclear weapons.

In combat, the corps area would include a frontage of about 100 kilometers with a depth of 120 to 150 kilometers.

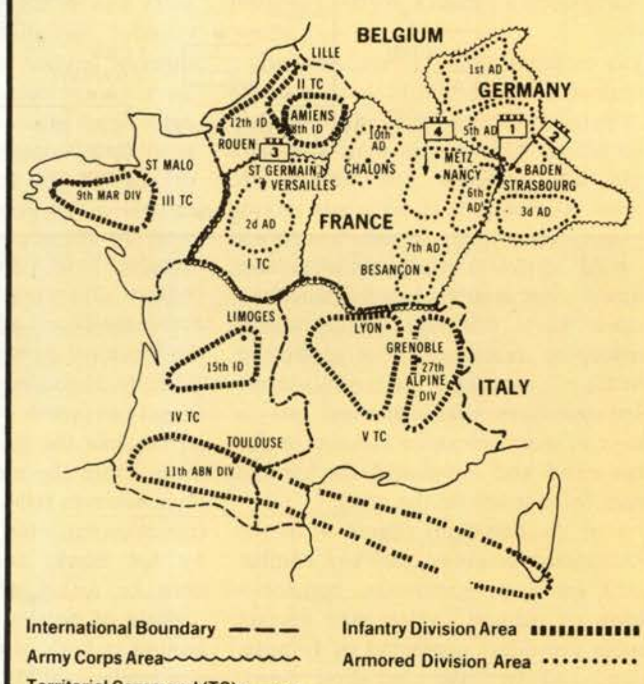
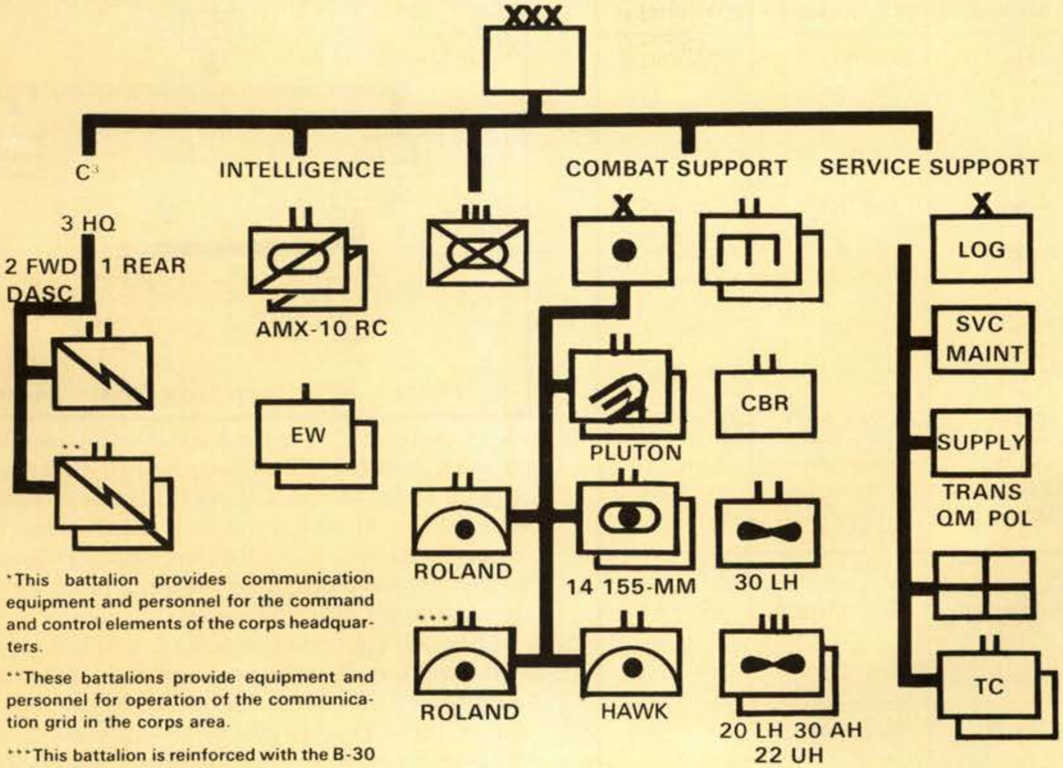


Figure 2.

In peacetime, the three corps commanders are also military region commanders (also called territorial commanders) and in wartime the corps are subordinate to the 1st French Army Headquarters, Strasbourg. A corps headquarters has the capability for command and control of air-ground maneuver forces of from 3 to 5 divisions, and during an emergency or full mobilization, the corps would probably be reinforced by general or territorial reserve formations.



*This battalion provides communication equipment and personnel for the command and control elements of the corps headquarters.

**These battalions provide equipment and personnel for operation of the communication grid in the corps area.

***This battalion is reinforced with the B-30 twin 30-mm antiaircraft gun.

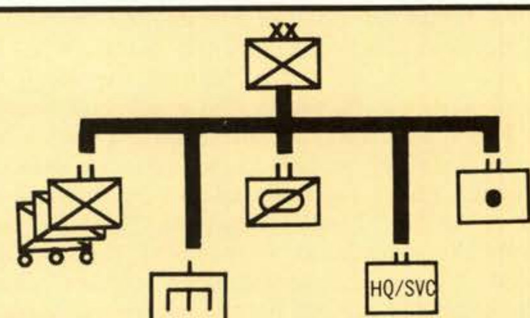
ACA .... Army Corps Artillery
DASC .... Direct Air Support Center
EW .... Electronic Warfare
TA .... Target Acquisition
TC .... Traffic Control—1 for Army Corps area and 1 for division supply lines

	Army Corps Troops	Logistical Brigade	+ 3 Divisions	or + 4 Divisions	Total
Strength	21,000	14,000	24,000	40,000	60,000 75,000
Vehicles	6,200	3,600	3,600	6,000	13,400 15,800

Figure 1. French Army Corps

The French infantry division. The French active ground forces have seven infantry divisions (ID) located throughout the Republic as shown in figure 2. Four of these divisions are organized for the usual roles and missions assigned to infantry divisions. The other three are specialized. The 8th ID at Amiens and the 12th ID at Rouen are stationed in the area of the 2d Military Region which has its headquarters at Lille. In the event of war, these divisions would probably become elements of III Corps which has its headquarters at Saint-Germain near Paris during peacetime. The 14th ID at Lyon and 15th ID at Limoges are stationed in the areas of the 5th Military Region at Lyon and 4th Military Region at Bordeaux respectively. The 14th and 15th IDs are employed for internal security reinforcement missions, but are available for any other task that might be assigned.

The organization of the "standard" infantry division is shown in figure 3. Like the new armored division, the current French ID is smaller than it was before the modernization of the army began, and it is square in that it has four combat maneuver elements—three infantry battalions and one cavalry squadron—giving it the advantages of geater efficiency in training, in tactics, and in supply and maintenance support.



Strength
7,000

Vehicles
420 VAB
36 AMX-10 RC

Weapons
72 Milan
58 20-mm AA Cannon
24 155-mm BF-50 Howitzers
18 120-mm Mortars
12 VAB-mounted HOT

Figure 3. French Army Infantry Division

Infantry battalions are the main subordinate elements of the infantry division, and, as in the armored division, there are no intervening brigade headquarters. Each infantry battalion, in turn, is made up of a headquarters and service company, four maneuver companies, and a combat support company.

The infantry maneuver companies are made up of

	9th Marine	11th Airborne	27th Alpine
Orgn	1 Div Hq	1 Div Hq + 1 Abn Grp Hq	1 Div Hq + 2 Hq
	4 Infantry Bn	6 Inf Bn	6 Inf Bn
	1 Cav Sqdn	1 Cav Sqdn	1 Cav Sqdn
	1 Arty Bn	1 Arty Bn (mort)	1 Arty Bn (mort)
	1 Engr Co	1 Engr Bn	1 Engr Co
	1 Hq/Svc Bn	1 Hq/Svc Bn	1 Hq/Svc Bn
	16 Inf Co	24 Inf Co	24 Inf Co
Manvr Elm	3 AML Trp (50 Panhard) 56 *Milan*	2 AML Trp (32 Panhard) 16 Recon Tm 154 *Milan*	3 AML Trp (50 Panhard) 84 *Milan*
Combat Support	24 120-mm mort 18 105-mm how	54 120-mm mort	60 120-mm mort
Service Support	Hq/Svc Bn	Hq/Svc Bn	Hq/Svc Bn
Strength	7,600 44 hel 1,400 veh	12,000 1 Army Avn Bn (attached) 2,200 veh	9,000 10 hel 1,700 veh

Figure 4. Specialized Infantry Divisions

three platoons with four squads each—this is in contrast to the armored company which has 4 platoons of three tanks each. Combat support companies have two antitank platoons equipped with the *Milan* missile, one scout mounted in jeeps, which are to be replaced by the *Peugot PL-4,* and one 120-mm mortar platoon.

Total strength of a French infantry battalion is 1,240 and it is equipped with 228 vehicles including the *Vehicle de L'Avant Blinde* (VAB) or forward combat vehicle. The VAB is a true infantry fighting vehicle and carries an infantry squad made up of 1 NCO, 1 sharpshooter, and 4 two-man teams. These teams are referred to in the French Army as "binoms" and implement the concept for overcoming the fear and uncertainty that is engendered when soldiers operate alone for extended periods on the modern battlefield. Under the binom concept, basic missions are accomplished by 2 men who live, train, and fight together. The VAB also has a crew of two—the driver and the gunner for the 20-mm automatic cannon.

Tactically, the four standard French infantry divisions are organized and equipped to operate in heavily wooden areas, broken terrain, and urban areas.

Specialized infantry divisions. Three of the French Army's infantry divisions (figure 4) are, as their names imply, organized for special missions and operations in difficult terrain and different environments. These divisions are the 9th Marine at Saint Malo, 11th Airborne at Toulouse, and 27th Alpine at Grenoble. In peacetime, the 9th Marine and 11th Airborne are

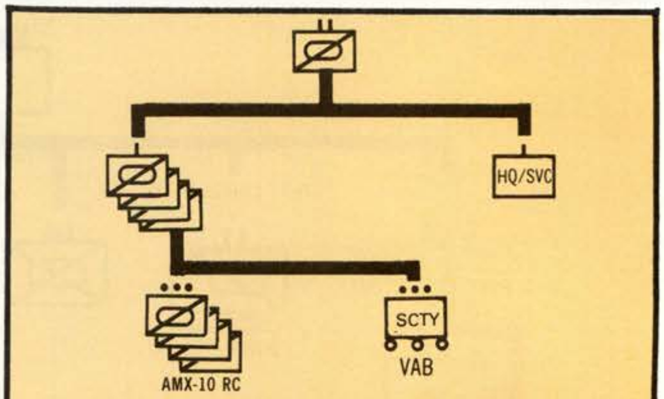


Figure 5. Army Corps Light Cavalry Squadron.

components of the French Rapid Deployment Force, and some of their battalions are manned entirely by career personnel. In wartime, these divisions or some of their elements could be employed in the Central Battle. For example, an airborne battalion, armed principally with guided missiles, might be used to reinforce an armored division in an antitank role.

Although organized, equipped, and trained for operation in mountainous terrain and under adverse weather conditions, the 27th Alpine Division also has the capability to execute other combat missions.

These divisions are highly specialized insofar as their missions are concerned, but they have some very important things in common—*esprit* and professionalism. All three division commanders take advantage of their unique missions, equipment, stationing, and unit histories to motivate their personnel—and they do so with great success. Each year, 17,000 young civilians participate in special part-time training courses to qualify for the "Pre-Military Paratrooper Qualification Certificate." Some of those who earn the certificate are fortunate enough to become members of the 11th Airborne Division during their year of active service.

Even if he is not happy with having to report for one year of active duty, the 18 to 22-year-old civilian who joins the 159th Alpine Infantry Regiment at Briancon learns very quickly to appreciate his invigorating surroundings and to enjoy the challenging training. He becomes a good soldier—fit to fight not only in rugged alpine terrain, but anywhere else the regiment might be committed.

In addition to the seven divisions just discussed, the French Army has 14 reserve infantry divisions available for mobilization in wartime. These reserve units are organized along the same lines as the active force but are equipped with older vehicles and weapons—trucks in lieu of VABs and the *AML Panhard* in lieu of the *AMX-10 RC,* etc.

Light armored cavalry. It seems fitting for this study of the new French Army's major units in the pages of *ARMOR* to conclude with a discussion of Cavalry, and its missions that have endured down through the years and will remain the same on future battlefields—reconnaissance, security, and economy-of-force.

There are three types of cavalry units in the French Army: the armored division scout troop, infantry division light armored cavalry squadron (ID LAC), and army corps light cavalry squadron (AC LAC). Since the

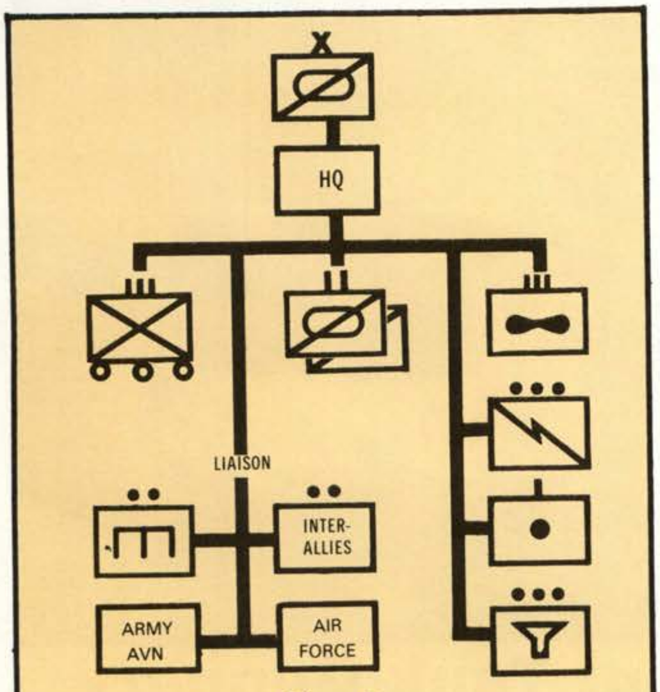


Figure 6.

armored division's scout troops were described in Part I of this article, only the ID and AC squadrons will be discussed here.

Each army corps has two cavalry squadrons that operate under the direct control of the corps commander (figure 5). These squadrons make maximum use of the capabilities of the wheeled *AMX-10 RC* and VAB armored vehicles to provide long-range security to the front and flanks of the corps and to collect vital enemy information. Both vehicles have excellent amphibious and cross-country mobility, effective night-driving systems, and long operating ranges—800 kilometers for the *AMX-10 RC* and 1,000 kilometers for the VAB. The 105-mm main gun of the *AMX-10 RC,* firing a fin-stabilized shaped-charge round, provides an effective antitank capability out to a range of 2,000 meters during daylight. At night, the low light level television sight, while not as effective as a thermal sight, permits accurate engagement out to 1,000 meters.

When employed in a security role, particularly as an advanced guard, the AC cavalry squadrons are often reinforced by an infantry regiment; combat support units, all of which are mounted in wheeled vehicles, and aviation elements (figure 6).

As a screening force, each AC cavalry squadron has the capability to deploy 16 platoon-sized reconnaissance teams to provide either mobile or fixed security. By employing one team on each axis, the squadron can cover a frontage of 40 to 50 kilometers in average West European terrain.

Generally speaking, the ID armored cavalry squadron has the same characteristics as the corps squadron, but there are some significant differences. Some squadrons are equipped with the *AMX-10 RC* and VAB with a *Mephisto* missile launcher, while others still use the venerable, inexpensive *AML Panhard.* Those squadrons having the *AMX-10 RC* and VAB/*Mephisto* have an antitank capability that is enhanced by the *VAB/Mephisto's* HOT missiles. These missiles are launched from 4 retractable ramps that can be traversed through 360 degrees. The HOT is effective out to 4,000 meters. The VAB/*Mephisto* carries a total of 8 missiles.

The *AML Panhard* is still an effective reconnaissance vehicle but its armament lacks the punch of the *AMX-10 RC.* Some *AML Panhards* are armed with a breech-loading 60-mm mortar and others with a 90-mm gun having a kill probability up to 1,000 meters. Unfortunately, the *AML Panhard* has no night-fire control system and is poorly armored.

Since the infantry division may operate independently, under the control of the commander of a military region, or be integrated into an army corps outside its normal area, it deals with various types of enemy units. The infantry division may face a force that has been infiltrated into a rear area; airborne commandos, who are well armed but fighting without support; battalion-sized task forces that have bypassed friendly defenses; or firmly entrenched troops that must be dislodged to open the way through an urban area.

Therefore, the effectiveness of the infantry division, and sometimes the survivability of its elements, is dependent on its cavalry squadron's ability to obtain and disseminate information and to operate with a flexibility that is tempered with caution. If the squadron encounters an armored or mechanized force of superior strength, it makes a thorough reconnaissance and, if possible, destroys some of the enemy's armored vehicles with antitank ambushes. If the force is small, the squadron destroys it through aggressive action.

Close cooperation with division elements, quick and accurate fire support, and swift evaluation and reaction to difficult situations, are required of the infantry division cavalry squadron just as with the corps' squadron. Equipment changes, as do the organization and the enemy; but cavalry's mission never changes, nor does the nerve, boldness, and dash with which cavalry accomplishes that mission.

With that observation, it is time to conclude this article about the new French Army that has evolved from the 1977-1982 reorganization plan. As the plan nears completion, France's ground forces will continue to improve their capabilities through the 1980's. If the need should arise, the French Army could increase NATO's strength in the Central Region by 30 percent—a fact worth noting.

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Reserve Component Tank Gunnery

by Major Roger J. Arango

Total force is no longer a concept. It is the Total Force policy that integrates the Active, Guard and Reserve forces into a homogenous unit[1].

For many armor people, the immediate effect of the Total Force policy is either duty with Reserve Components or association with Reserve Component units through affiliation programs, participation on mobile training teams, or as evaluators. Duty assignments with Reserve Components may include assignments to higher level staffs in the Continental United States Armies or Readiness and Mobilization Regions, branch assistance teams of Readiness Groups, or as advisors to brigade-, battalion-, or squadron-sized units. Thus, it is important for Active Component armor people to understand some of the constraints under which Reserve Component armor units operate.

U.S. Army Forces Command regulations establish premobilization training objectives. The first priority is the unit gunnery program—specifically, crew qualification on Tank Table VII.[2] Certain units may go beyond qualification on Table VII, but these are exceptions. Reserve Component armor units have a total of twenty-four 8-hour training days (forty-eight 4-hour periods known as Unit Training Assemblies—UTAs) during inactive duty training (weekend drills) and 14 days during annual training (summer camp) to accomplish their training objective. It would appear that 38 training days are more than sufficient to qualify crews through Table VII.

The 38 days available for training armor units are not devoted entirely to tank gunnery. First, with few exceptions, Reserve Component armor units are in the National Guard rather than the Army Reserve. Federal missions notwithstanding, the Guard remains a state military force with a variety ot important civil protection missions—missions requiring guardsmen to undergo specific training. Second, guardsmen must also undergo the required training in common combat tasks such as annual weapons qualification, physical training, and the like. Third, units also train toward ARTEP standards. Because of time and space considerations, such ARTEP training normally takes place during annual training. Finally, there are one-time training requirements that arise in nearly every training year that further reduce the time available for gunnery: Battalion Training Management System, junior leader training, and organizational effectiveness are some examples. When these training requirements are subtracted from the original 38 days, the available training days shrink to 30.

The location of range facilities available to units further reduces available training time. On the one hand, increased use of scaled ranges on armory grounds has increased the opportunity to fire Tables I through IV at home station. On the other hand, not every armory has a mini-range. Moreover, with some armories located in urban areas, it is impossible to construct adequate facilities. Thus, some elements of the battalion will be required to travel to an adequate range to shoot the preliminary tables. Guardsmen are paid on a 4-hour basis for the weekend drills with travel time coming out of the UTA. The end result is more lost training time. Up to 25 percent of a given period can be used for travel to equipment sites.

Firing Table V, normally accomplished during weekend drills, is an even more time-consuming requirement. Few armories have sufficient facilities for a moving tank range. Units must travel to an equipment site to draw tanks and use a range facility.[3] In addition to travel time to and from the home station armory, time must be allotted to enable crews to draw, inventory, maintain, and turn in the equipment used during the weekend range firing. All of this time comes out of the 16 hours of the weekend. Up to 8 hours can be spent traveling to the site, traveling to the range itself, and drawing and turning in equipment. A Multiple Unit Training Assembly (MUTA-4) usually nets 5 or 6 hours of actual gunnery. In sum, the time and space factors will further reduce available training days to 28.

There are also a variety of personnel problems that affect the unit's gunnery program. Personal experience with Reserve Component tankers convinces me that they are intelligent, eager to learn their jobs, and motivated by the same considerations applicable to their Active Army counterparts; i.e., they respond positively to good leadership. The basic problem the Reserve Component soldier faces, however, is the learning decay that occurs between drills. Tankers are in the turret for no more than 2 to 3 hours on a weekend gunnery drill. They will not see the tank again for at least a month or sometimes more, depending on the unit's schedule. They will forget a part of what they previously learned. The actual learning loss will depend largely on the crew's level of experience. It is nearly always necessary to repeat some part of the previous gunnery training, however. Again, this retraining comes out of the rapidly dwindling available days.

Reserve Component units have the same problems as their Active Army counterparts in such areas as personnel turbulence, strength, and MOS qualification. Low strength makes it difficult for units to operate ranges at peak efficiency. Low strength usually means that range support personnel are also not being trained in their own MOSs. Personnel turbulence makes it difficult to stabilize a crew throughout the training year and forces the unit to continue to schedule makeup firing. Finally, MOS qualification procedures used in the National Guard allow the awarding of an MOS based on longevity rather than actual task testing. Generally, a tanker can be awarded the MOS by being in the unit for 3 months and attending a summer camp. He may also be awarded the MOS by serving 6 months in the job. All of these personnel issues tend to affect training and lengthen training time required.

The personnel problems discussed above may be exacerbated by occasional reorganizations of units that occur throughout the National Guard. A tank battalion today may have been an infantry battalion several years ago. The people, however, remain the same, and they retain their rank. The problems are acute for the unit's leadership. Officers and noncommissioned officers now find themselves leading a unit of a branch in which they have received little formal training. Their level of branch experience is simply not commensurate with their rank. More significantly, they may lack the detailed skills necessary for organizing gunnery programs and operating tank gun ranges. The problem of limited training time is already acute. During a weekend drill, the unit simply cannot afford to have anything go wrong during range operations. Unfortunately, when the unit's leaders lack detailed knowledge of the tank gun range operations, problems are more likely to arise which, in turn, result in more lost time.

When the unit arrives at its annual training site, it still cannot make use of the entire 14 days.[4] Nearly 2 days are required to draw, inventory, maintain, and turn in equipment. One day is required for administrative details such as pay, unit awards, retirement ceremonies, and the like. Finally, the unit has a two day "R and R" weekend. If a unit can get 9 training days during the annual training period, they are doing well. As indicated above, however, the entire time is not devoted exclusively to gunnery. Annual training is about the only time the unit has to devote to ARTEP training. Thus, the unit usually takes 5 days for gunnery.

A recapitulation of training time would probably show that of the 38 days the unit started with at the beginning of the year, the actual number of days devoted to *all* MOS training is closer to 20, and the time actually spent in firing tank tables is closer to 10. Returning to the original question, now considering available training time: Are 10 nonconsecutive training days a year sufficient to take a crew through Table VII with a reasonable expectation of qualifying them?

The situations described above do not apply equally to all Reserve Component armor units, nor should they be regarded in any sense as an apology. Rather, they are described for the consideration of those Active Component armor personnel who will be associated with Reserve Component armor units as an integral element of the Total Force policy. The following suggestions may prove helpful for Active Component tankers assigned some form of Reserve Component duty:

- Be aware that many Reserve Component tankers face severe training constraints.
- Do not assume that because a person commands a tank he is as fully qualified as someone in your unit in the same position. Take the time to evaluate the people you are assisting.
- Always apply sound leadership principles, taking particular care not to embarrass people.
- If a crew is having trouble, check the most obvious source of the problem first; e.g., proper switches on or cables plugged in.
- If a crew is not familiar with a task, teach them the *proper* procedures using the Technical Manual or Soldier's Manual.
- Determine what type of equipment the unit has before you arrive at the training site. Many Active Component tankers have not worked with *M-48As* and *M-60* tanks. The differences between these tanks and the *M-60A1* can be distracting.
- Be alert to potential bottlenecks in the range operation. With the minimum training time available to Reserve Component tankers, delays in range operations cannot be tolerated.
- Finally, do not be condescending in your attitude or permit standards to be violated. Reserve Component tankers expect to fire the same tables to the same standards as their Active Component counterparts. Reserve Component tankers will respond to the challenge.

Footnotes

[1] James R. Schlesinger, quoted in DA Pamphlet 135-3, Foreward.

[2] The actual tables fired depends on the unit's ARTEP level. See ARTEP 71-2 and FM 17-12, pp. 20-2 and 20-3.

[3] See DA Pamphlet 135-3 for descriptions of the various types of equipment sites.

[4] Actually, there are 15 days for annual training, with one day programmed for travel.

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What's Next for the Tank?

by Clifford D. Bradley

After more than 40 years of dominating the battlefield as the centerpiece of land combat forces, the current configuration of the tank is coming under intense study, and emerging technologies and competing systems pose new threats to the tank's ability to effectively fulfill its traditional role.

As one examines the tank in the role it plays in the combined arms, land-warfare, close-combat forces, there can be no doubt that mobile, protected firepower will be an important and perhaps indispensable part of land combat for the foreseeable future, and probably forever. In the aggressive assault role, a tank-like vehicle with a high level of mobility and protection has no equal for awesome, highly-effective mounted firepower.

Accepting that there is a need for a tank or tank-like vehicle to accomplish the assault role, the question then becomes: What is the optimum vehicle configuration to perform the future mobile, protected firepower mission? Of all factors that combine to determine the future tank shape; such as internal volume, cost, manpower, weapon and automotive technologies, tactics, etc., perhaps no single factor is as important as the antitank threats to tank survivability. Rapid threat progress growing out of the technological advancements in offensive firepower related to detecting, hitting, and penetrating armor create survivability problems, difficult for the tank to respond to in a timely manner, and threaten the tank's ability to perform its role as the "bully of the battlefield." The impact of such advancements on future tank design is a certainty and may significantly affect the configuration. It is hoped the following discussion will help to clarify the challenge ahead for the tank developer.

Firepower vs. Armor Protection

Those charged with the design and development of future tanks must monitor and be closely involved on a continuing basis with two competing technologies. These technologies are antitank firepower and tank armor. Any serious imbalance between the two, even for a short period, can significantly alter the tank role and therefore impact on battlefield tactics.

During the past 40 years, the turreted tank, generally conceded to have evolved from the Soviet *T-34*, has been the configurational choice by all countries (Sweden is now reassessing their S-tank) to accomplish the tank role. Over this extended period, the turreted tank configuration has provided tank developers with an interesting example of the growth and maturation of a weapon system, and the factors that influence it. Generally during this period, defense has reacted to offense, mainly because of the relative ease of introducing armament, ammunition, or fire control improvements compared with meaningful armor upgrading. This means that the selected armor level for a given tank design was based on the projected threat for some future time period, and as weapon technology progressed, the armor became less and less effective. Then, at some level of vulnerability, a new tank design must be initiated with heavier armor. This, in turn, usually calls for upgrading the engine, transmission, track, and suspension. Firepower technology has had an additional advantage, inasmuch as armor designers have to consider kinetic energy and shaped-charge munitions in their designs. Both of these warheads provided widely varying challenges, due to the mechanisms by which they act to defeat armor. While this one-upmanship between armor and firepower has had the effect of increasing the size, weight, and cost of tanks, there was no real organized serious user or developer resistance to this trend because the increase was gradual and capable of being absorbed or accepted in cost-effectiveness terms. The delicate imbalances in armor versus penetration were gradual and not of such proportions as to cause a major concern over the trend, or to cause Army planners to seriously question the future cost effectiveness or suitability of the turreted tank as the optimum configuration for the role of mobile protected firepower in the assault role of land combat. However, in recent years, there have been two major upsets created by the firepower element in this delicate balance. Let's take a look at them.

The Antitank Guided Missile

The first of the two major imbalances between firepower and armor occured in the late 1950's and early 1960's, with the marriage of the shaped-charge warhead and guided missiles.

For years, dating back to the late 1930's, when two Swiss engineers combined the hollow charge (pioneered by an American named Munroe in the late 1800's) with a copper liner to produce the forerunner of today's shaped-charge munitions, the capability of penetrating armor with this particular mechanism was known. During World War II, all countries fielded some form of this weapon, the most notable being the US *Bazooka* and the German *Panzerfaust*. However, since both of these weapons were free-rocket types, the range and accuracy precluded either becoming a major threat to tanks in the open. However, in the closing days of World War II, and especially in city fighting, the *Panzerfaust* did manage to produce a significant number of U.S. tank casualties.

The marriage of the shaped-charge warhead, with its tremendous capability of penetrating armor, with the range and accuracy of the guided missile, did much to correct the shortcoming of the earlier free-rocket weapons, and therefore, for the first time, posed a serious threat to tanks in open terrain at extended ranges.

The capabilities resulting from this marriage were quickly picked up by most major powers. By the early 1960's, many of the major powers had fielded first and even second-generation guided missiles employing shaped-charge warheads capable of penetrating armor two to three times as thick as any fielded tank's best armor. Even greater penetration was on the drawing boards.

Another significant aspect of the antitank guided missile was that it could be employed from a wide range of platforms, including ground tripods, lightweight armored vehicles, wheeled weapon carriers, and also helicopters, and fixed-wing tactical aircraft.

The ATGM and its relatively rapid proliferation to a large number of launch platforms caused many tacticians and military analysts to predict that this relatively simple and widely-employed weapon would end the dominance of tanks on the battlefield. In fact, some "doomsday" forecasters in the mid-1960's and mid-1970's even went so far as to predict that in a decade the tank would cease to exist as a major factor in land combat, because of its vulnerability to this new, relatively simple, and widely-employed threat.

This paranoia concerning the dismal future of tanks was widespread, and included senior military oficers, tacticians, designers, and many members of Congress. The emergence of the ATGM and its expected proliferation and effectiveness on the battlefield was one of several factors in the cancellation of the *MBT-70/XM-803* program, due to the vulnerability of its armor to the shaped-charge threat. This ATGM threat played an equally major role in defining the required armor envelope of the *M-1 tank*.

All countries, and particularly the U.S., were caught up by the potential offered by the ATGM. The U.S. even went so far as to develop and field two systems, the M-551 and the *M-60A2* tank, both of which relied principally on the *Shillelagh* missile as the main antitank round. They were almost on the verge of recommending the same weapon for the *MBT-70*, until a handful of people from TACOM and DA prevailed, and the long tube 152-mm gun and the KE warhead were included, along with the missile and combination HE and HEAT warhead of the *M-409* round.

But the "doomsday" analysts had not correctly assessed the resiliency and survival capability of the tank. Two major events upset their dire predictions that the tank was doomed. The first and perhaps most important was the development of a special armor that was amazingly efficient against the penetration mechanism of the hollow charge. This armor was initially developed by the UK and refined and perfected by the U.S. for system application and manufacturing. The second, and almost equally significant, was the growing awareness, albeit belated, on the part of some hard-nosed armor tacticians that a direct-fire missile launcher system with little or no armor protection taking on a tank at reasonable battlefield ranges, high-level people, formerly supporters of tanks, to side with fear from the missile. This relatively simple realization was a long time in reaching center stage, and this delay caused many high-level people, formerly supporters of tanks, to side with "the tank is dead" crowd.

Another, and perhaps equally important, part of the survival equation was the rediscovery of the combined arms approach to enhance tank survival as a key factor in battlefield

tactics. In other words, use tactics that do not expose a tank to a cheap kill if some other member of the combined arms team can defeat the thin-skinned, vulnerable ATGM threat without providing themselves as a suitable or viable target.

The lesson here is that a lightly-armored system in open terrain, challenging a tank on its own turf at the critical 1,000-2,000 meter direct-fire range, is really taking on a pretty formidable foe, and is destined to lose most of the time, if the tank is properly employed.

This was proven many times in the 1973 Yom Kippur War. On the first and second day of the war, the Israeli Army suffered heavy casualties when they committed tanks alone against an in-depth, well-prepared defense employing ATGM's at long ranges. After this hard-learned and costly lesson, the Israeli Army quickly went to the combined arms tactics, and ATGM's were no longer a significant threat to properly-employed Israeli armor, although they remained a potential threat if careless battlefield tactics were used.

Future ATGMs or PGMs

Although the tank has been able to gain renewed life against the current generation of ATGMs through the employment of combined arms tactics and the application of special armor that is highly efficient against shaped-charge munitions, what about future more sophisticated Precision Guided Munitions (PGMs)?

There is certainly cause for concern by tank developers facing the threat of even more effective ATGMs. Larger missiles with more efficient warheads, shorter time of flight, and greater ranges, coupled with passive terminal homing, will call for even more ingenious armor arrays and more efficient armor material until perhaps the ultimate tolerable limit of weight and armor thickness will be reached. This will cause tank developers and technologists to explore other ways of defeating the threat; such as detection avoidance and hit avoidance employing a broad and challenging spectrum of countermeasures. Major programs are now underway at various sites that employ these imaginative and innovative technologies.

The tacticians must continue to base their tactics on the lessons learned earlier in the Yom Kippur War, that the tank can still be the "bully of the battlefield" on its own turf in that 1,000-2,000-meter direct-fire range, even against more advanced PGMs. This is because the countermeasure tactics employed by the tank are based on going after the vulnerable member of the threat, the launcher, utilizing the tank's cannon firepower and superior agility and mobility.

Many analysts fear the real future threat to armor by the PGMs will come about by the marriage of the advanced PGMs and the helicopter and the inevitable full tactical and technical maturity of this combination of firepower and mobility.

This new combination will act in a threefold manner to significantly increase the threat to armor. First, the helicopter's ability to extend the normal direct-fire range of the battlefield by quickly changing the vertical height of the launcher platform from unpredictable locations, and to present a highly agile maneuvering target during launch. At ranges of 4-6 km, the equation involving the "tank's optimum turf" and firepower is significnatly altered. Secondly, the helicopter's ability to move laterally on the battlefield rapidly and to pop-up at unexpected locations enhances the capability of the PGM threat to attack the tank outside of its highly-protected frontal arc. Again, the attack can be made at extended ranges and with little exposure time, in the event that the target tank or another tank should spot the helicopter. Third, the sophisticated target acquisition and all-weather, day or night sight of the helicopter will permit wider employment of the helicopter against armor, using future faster homing missiles, will largely negate the increased agility of the tank. Helicopters employing fire-and-forget missiles will almost eliminate exposure time, and thus reduce their vulnerability to tank counterfire.

An even greater threat to future armor formations may be just over the horizon, both literally and actually, by the technical coming of age of PGMs with capability of hitting and killing armor with the shaped-charge warhead fired indirectly. This type of threat is being developed by several countries, and the U.S. has started to field the semi-active terminal homing *Copperhead* fired indirectly at armor targets by artillery. The real threat, however, according to military analysts and technology forecasters, will come from passive terminal-homing munitions, employing sophisticated dual-mode seekers, fired singly and in multiple warhead dispensers from just beyond direct-fire ranges out to 70-100 kilometers.

These last two means of employing PGMs, by helicopter and by indirect fire, will most certainly challenge the armor and countermeasure technologists and designers to the utmost and cause the tacticians to institute even more new and innovative battlefield tactics.

The Kinetic-Energy Threat

Now, let us take a look at the second major occurrence of an upset to the delicate balance between firepower and armor, the emerging new kinetic-energy threat. The modern-day, kinetic-energy threat can be traced back to the latter part of World War II, when two British designers named Permutter and Coppock, working for the Armaments Research Establishment, developed the "ultimate tank killer," the Armor-Piercing, Discarding-Sabot projectile (APDS). In this projectile, the slender tungsten core was surrounded by a lightweight framework (sabot) which fitted the bore of the gun. When fired and clear of the muzzle, the sections of the sabot framework fell away and left the tungsten core, contained in a thin, streamlined steel sheath, to fly to the target. The advantages of this projectile are obvious. First, a given propellant charge, acting over a certain tube length, will impart to the lighter APDS projectile a significantly higher muzzle velocity than for a heavier, full-bore, armor-piercing shot. Secondly, the air resistance during the flight is considerably less for the slender APDS penetrator, so it reaches the target with a much higher percent of its original muzzle velocity than does the full-bore projectile.

In addition to increased penetration, due to higher energy per unit area on the target, the APDS round has still another advantage for a direct-fire weapon. The increased muzzle velocity and reduced fall-off of velocity in flight reduces the time of flight, and thus reduces the time gravity, wind, and target motion can adversely affect accuracy and hit probability.

By the early 1950's, most countries were convinced of the merits of the APDS and were adapting it to their weapons. The wide proliferation of the U.K. 105-mm cannon in the mid and late 1950's throughout NATO countries, as well as Japan, Sweden, and other armies, pretty much made this weapon the universal Free World main tank armament system.

Throughout the 1950's and 1960's, the penetration capability of the APDS round worldwide was moderately improved through small but important changes in design and material. These improvements were generally met with modest improvements in armor or small tolerable increases in armor thickness, and so the delicate balance between armor and projectiles remained relatively stable during this period.

Since longer, slender projectiles held the promise of increasing armor penetration, the barrier to a major increase in penetration with a given weapon muzzle energy level was the restriction on the projectile length-to-diameter (L/D) ratio imposed by the rifled tube. At the higher velocities and beyond an L/D ratio of approximately 5-7, spin, imparted to a projectile in a rifled tube, will not provide the required stability in flight, so projectile designers were at somewhat of an impasse with the rifled tube. Two options were open to the designers to exploit the payoff of higher projectile L/D. First, find a way to offset or eliminate the spin imparted to the projectile in a rifle tube, or go to a smoothbore tube. In both cases, fins would provide projectile stability.

Thus, in the early 1960's, the U.S. and others with the rifled 105-mm tubes began to experiment with slip collars between the sabot and higher L/D projectiles with fins. By the mid and late 1960's, the problem was essentially solved in the laboratories, so it remained only to get the improved fin-stabilized projectiles into the field.

Meanwhile, it must be assumed that the Soviets were making essentially the same discoveries in their weapons laboratories and not as wedded to the rifled tube as were the Free World countries, which had universally adopted the U.K. 105-mm tube. They had chosen the smoothbore approach, and their experiments apparently convinced them that this was ultimately the preferred way to go, because they brought out a smoothbore 115-mm cannon in their *T-62* tank in 1960. The Soviets continued their smoothbore cannon trend in their next two tanks, the *T-64* and the *T-72*, with an even larger 125-mm smoothbore cannon. Meanwhile, the Federal Republic of Germany was swinging over into the smoothbore tanks, and in their new *Leopard 2*, they introduced a 120-mm smoothbore cannon, which the U.S. has chosen to adopt as an improved weapon for the *M-1 Abrams* tank.

Thus, by the mid to late 1970's, the stage was set and the barriers removed for initiating what may eventually be recognized as the long-rod penetrator era in tank and tank weaponry design. If the unique capabilities opened up by the long-rod principle of penetrating armor can be matched by complementary improvements in penetrator materials and design, the increase in the capability of a projectile to penetrate rolled homogenous armor may equal or surpass, in a decade or less, the total penetration reached during the preceding 50 years. And so, a new threat to the shaky armor/projectile balance is upon us. Although not so widely recognized or publicized thus far, outside the relatively small tank development community, it may eventually have a greater impact on future tank employment and future tank design than did the introduction of the ATGM in the late 1950's and early 1960's, and the PGMs in the 1970's.

The impact on tank tactics and operational employment brought on by the capability of the long-rod penetrator may be far-reaching. It is noteworthy to reiterate the fact that the coming-of-age of long-rod penetrators will provide a major increase in penetration at essentially the same weapon energy level. Simply put, this means all the Free World tanks with 90-mm and 105-mm cannons, and the Soviet 100-mm and 115-mm cannons, will have the capability of significantly upgrading their offensive capability both in effective range and penetration. Even Third World powers with weapons of World War II vintage, previously regarded as outdated in terms of penetrating armor, will have the capability of significant upgrading.

Perhaps of even greater importance, tanks fielded before the long-rod penetrator era and designed against a projected KE threat based on normal technical growth may be vulnerable in the frontal areas at ranges where the armor protection was previously regarded as being invulnerable. Simply put, some modern-day tanks may find themselves suddenly vulnerable to some relatively "old" weapons due to the rapid advances in penetrator technology.

New weapons, such as electric rail guns, liquid propellants, kinetic-energy missiles, etc., will all be able to capitalize on and further exploit the new long-rod penetrator technology.

The Future for Tanks

In view of the preceding discussion on the most recent imbalance in the firepower/protection balance in regard to tanks, what does the emerging revolution envisioned for the kinetic-energy penetrator mean to the current tanks in the field, those in production and future tanks?

First of all, for those tanks currently in the inventories of all countries, the potential upgrading envisioned for the kinetic-energy projectile in terms of armor penetration, must be regarded by analysts with mixed emotion. If they view the main threat to be enemy tanks, then they have to be also concerned about enemy upgrading and the increased threat to their armor. Another consideration is the availability of the new munitions to countries who are not munition developers. To tanks currently in production, the problem is one of seeking to match the new kinetic-energy threat with product improvements in armor, and this may be a near-impossible challenge, because of added weight, the impact on cost, reliability, availability, maintainability, and mobility. Countermeasures, other than armor, may provide the answer, and will certainly be pursued by those who have the capabilities.

For the U.S. and other NATO countries, from an overall philosophical viewpoint, any new technical breakthrough that can act to help negate, neutralize, or offset the numerical superiority in tanks enjoyed by the Warsaw Pact forces has to be viewed as a potential advantage. It would be much easier to appreciate if perhaps the technological breakthrough came in such areas as terminally-homing missiles or projectiles and was purely a U.S. or NATO advantage. And certainly the U.S. has to pursue with great intensity all technological opportunities that promise to make the numerical superiority of the Soviets in armored vehicles less of an advantage.

If technology related to detecting, acquiring, and killing tanks is moving at a more rapid rate than defense-related technology, then the U.S. should be going all-out to make this a real problem for the Soviets, since they have so much invested in armor.

Now, let us look at the future U.S. tank design alternatives in view of the above discussion of the threats to tanks, represented by the tremendous improvement in the kinetic-energy penetrator's capability to defeat armor. When the full extent of the advancements in kinetic-energy projectiles are known, many knowledgeable people will again ask: Can the tank survive and be tactically viable and cost-effective on future battlefields? The answer, again, is that some form of mobile protected firepower is absolutely essential to offensive land warfare. The challenge to tank designers is to determine the "optimum" configuration, offensively, that can survive.

It is generally conceded by all knowledgeable people in the development of tanks that the key to reduced target area and greater protection for the same weight is through reduced armored volume. Many in-depth and detailed analyses, conducted by TACOM and others, have validated the direct relationship between armored volume, protection level, and weight. These same studies have highlighted those areas where volume reduction can be achieved, and with it, increased armor protection for a given weight. Equally important, these studies have served to point up the limitations of armor to provide protection against future threats for current configurations with their relatively large armored volume, compared with Soviet tanks. More directly, the tank turret, which is the key to optimum offensive tank configuration, has come under heavy scrutiny and considerable analysis by volume-minded tank designers because:

•The turret's upper location, in most terrain, presents the greatest amount of target area, and thus, is more likely to be hit.

•The majority of crew members are in the high and more vulnerable turret.

•There is an inherent vulnerablity in the shield/turret interface area, and the hull/turret juncture, in addition to posing reentry ballistic traps, is most difficult to protect against projected penetration.

•In U.S. tanks, a major part of the ammunition is stored in the turret.

•It is generally regarded as the major design problem in the expected dimensional growth of special armor forms, due to critical internal space, external dimensions, and functional openings of the conventional turret.

A summary of the above is shown in figure 1.

Therefore, defense-minded designers have been driven to explore conceptual approaches that tend to minimize turret volume, or that completely eliminate the turret, except as a rotating platform for the externally-mounted weapon. This,

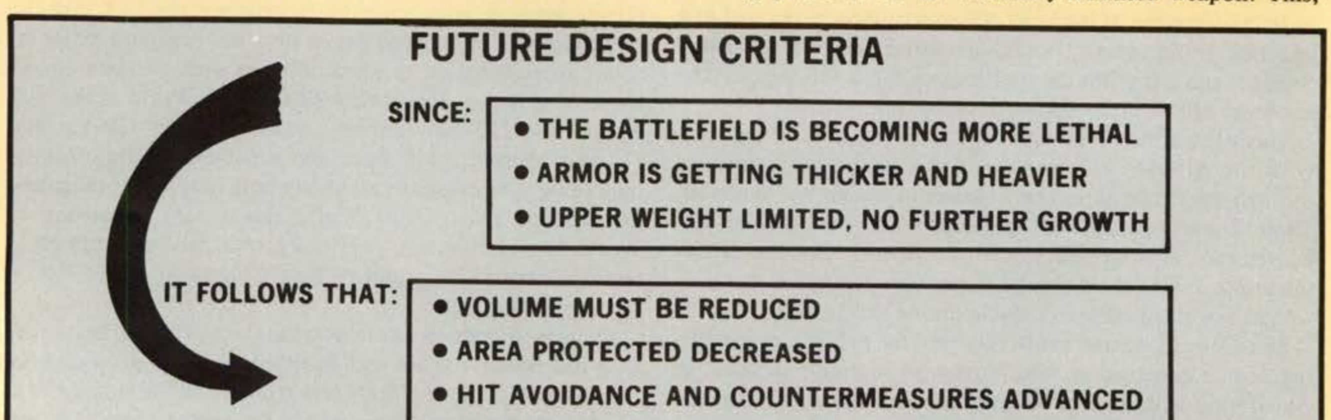


FIGURE 1

with automatic loading, has led to reduction of crew members from four to three and even two men, performing their operational tasks from the more effectively-armored and protective hull envelope.

External weapons, with the crew mounted low in the basket or outside the rotating weapon volume, will pose serious technical and operational challenges regarding the normal commander and gunner functions from the new crew positions. The loss of the manual loader and a conventional secondary weapon station is also of concern to the user.

The offense-minded user will surely deplore the operational compromises that may be imposed by the external weapon approach. He is likely to opt for the configuration that lets him fight and operate the tank as he feels it must be employed, accepting whatever survivability is possible with the optimized turret configuration. He just may be right; thus, we must also continue exploring all approaches to making the turreted configuration more survivable. Therefore, the approach to future tank design must be threefold:

•Make the turreted configuration more survivable through improved armor "paid for" through reduced armored volumes, and more vital protection at equal or reduced weight.

•Explore the implementation of new and innovative design approaches and subsystem technology that will permit performance of the commander and gunner functions from more survivable locations within the hull envelope of the external weapon concept.

•Pursue technology that will lessen the dependence of armor for survival such as armor augmenting devices, detection and hit avoidance, and other countermeasure systems.

In recent months, some people have expressed grave concern about the complexity and fightability of some of the future concepts that are being discussed throughout the development community. I believe they have a valid point. In our zeal to have the tank survive, we must not lose sight of the primary mission of a tank, which is basically *offense*. We simply cannot afford to *"protect it to death."*

The solutions will not come from well-meant advocacy of views extolling the virtues of "better" conventional tanks, or smaller, more agile tanks that are harder to hit. Neither will solutions come from detailed paper analyses that show that reduced target area with thicker armor to resist penetration is the answer. The only valid answer will come from a broad spectrum of conceptual and technological alternatives; screened and evaluated by the best available methodology; narrowed down to a few select candidates that will lead to carefully-designed, fabricated, and evaluated test beds. Anything less will not have the confidence level needed for such "high stakes" decisions confronting those who will be writing the specifications for the next tank.

Funding for the Future Close Combat Vehicle Program Test Beds is in place for the FY82-FY87 time frame and beyond. It is hoped that the importance of these test beds to future decision makers will be so regarded by future Army decision makers, and that the usual eroding of planned research and development funds will not take place as the implementation year approaches.

WHAT IS A TANK?

To a Tank Crewman, a tank is a large complex track-laying vehicle that requires a great deal of maintenance, mounts a monstrous cannon, is armored to resist battlefield threats, and is capable of negotiating rough terrain and of running over most obstacles.

To an Enemy Foot Soldier, an attacking tank is a large, awesome, noisy, frightening, invincible machine, capable of instilling terror, in spite of what his leaders have told him about the capabilities of his weapons against the "weaknesses" of the tank.

To a Tactical Commander of Armor Units, a tank is the ideal instrument for employing mobile protected firepower in the aggressive assault role so vital to offensive land combat.

To a Commander of Combined Arms, the tank is the centerpiece of land combat — the optimum combination of firepower, shock action, mobility and protection, when employed with other close-combat units.

To a Tank Developer, a tank is, in essence, a response to certain demands created by a tactical role. These demands are functional and can generally be described by a set of requirements or system capabilities derived from the interaction of the threat, technology and intended operational concept, and can be related to design in terms of configuration and characteristics.

To a Force Structure Efficiency Analyst or Military Economist, a tank is a unit of firepower, whose cost and performance must be quantified and assessed in realistic combat scenarios, in comparison with other existing systems or possible new systems in a force structure, in search of the optimal mix.

A tank may be viewed differently by various people, but no one can question that this combination of firepower, mobility, protection, and shock action called a tank is the most effective instrument of aggressive assault in land warfare today, and will continue to be in the forseeable future. Clifford Bradley

CLIFFORD D. BRADLEY is currently serving as Chief of the Exploratory Development Division, Tank-Automotive Concepts Laboratory, Tank-Automotive Command (TACOM), Warren, Michigan. He joined TACOM in June 1951 after receiving his BS degree in mechanical engineering from Wayne State University. Prior to entering college, he served in the U.S. Army from July 1940 to September 1945 in the 7th Cavalry Brigade and 1st and 4th Armored Divisions.

Since completing a 15-month engineering training period at TACOM, Mr. Bradley has been associated with advanced military vehicle concepts for his entire career, and has participated to some degree in all major vehicular development programs initiated at TACOM.

PROFESSIONAL THOUGHTS

Are We Training To Fight That First Battle...and Lose?

This scenario is set in Western Europe. The poltical situation has worsened rapidly over the past week and open warfare is considered imminent. All U.S. and NATO forces are deployed. Let us now join a U.S. tank platoon on its general defense position (GDP).

0430 Stand-to—All quiet, although the ground surveillance radar (GSR) section continues to report tanks and mechanized infantry massing just across the border.

0438—GSR section reports massed formation moving up to the border.

0439—GSR section reports Warsaw Pact forces have crossed the border *en masse.* Scouts confirm report *but* radio contact is lost in mid-transmission.

0442—Beginning morning nautical twilight. Visual contact with approaching enemy motor rifle regiment, estimated range 3,000 meters.

0445—Incoming artillery on the platoon position. Crews button up and take maximum nuclear, biological, and chemical (NBC) protective measures. Enemy forces are now at 2,000 meters and closing at 20 kph. Platoon leader issues platoon fire command and reports to company commander.

0446—Platoon opens fire at 1,700 meters destroying three enemy tanks. TOWs on an adjacent battle position are observed engaging enemy *BRDMs* and *ZSU-23-4s* at near maximum ranges. Smoke and incoming artillery make long-range fire marginally effective.

0447—Platoon has fired two rounds per tank and begins taking effective aimed fire on their positions. One tank is lost. Remaining four tanks move to alternate positions. Range to the enemy lead elements is now 1,400 meters.

0448—Pulling into alternate positions, one more U.S. tank is destroyed. The three remaining tanks open fire. Range to the enemy is now 1,000 meters. Platoon leader informs company commander that platoon must withdraw or be decisively engaged. Company commander relays this information to the battalion commander on the secure net.

0449—Battalion commander refers to the situation map that his operations sergeant is struggling to keep up. Agrees that the platoon should withdraw to its next prepared position. Informs the company commander of his decision (Enemy is now within 700 meters of the three remaining tanks of our platoon.)

0450—Company commander calls platoon leader but gets the platoon sergeant because the platoon leader's tank is a ball of flame. Platoon is given permission to withdraw its two remaining tanks. Company commander calls for artillery fire just forward of the platoon position to cover the withdrawal. (Range to the enemy is down to 350 meters)

0451—"Platoon" withdraws by best available routes. U.S. artillery begins impacting on the platoon position as first enemy tank overruns the now abandoned position. Lead enemy unit continues advance only 100 meters behind withdrawing platoon.

0454—"Platoon" pulls into position. One *T-72,* using the same covered and concealed route that they employed, is now rapidly closing on their rear. Tanks take effective aimed fire as they occupy their positions. The enemy main body is only 300 meters to their front. One US tank is destroyed. The other fires one quick round and backs out of the position hoping to find a better position. Backing out, he suddenly observes the *T-72* coming up the tank trail, only 50 meters away. As he begins to swing his turret, the *T-72* fires and the battle ends for our platoon.

What went wrong? Why? Unfortunately, the platoon in our scenario fought exactly as it had been trained to do. The crews opened fire at their best range. They changed positions as soon as they began taking aimed fire. They developed the situation and requested permission to withdraw before being decisively engaged. All exactly as they had done hundreds of times in training. In all their training, however, they had never faced an opposing force like this one. They had never faced five to one odds; faced an enemy that would close at 20 kph and accept the losses; or tried to acquire targets buttoned up, in full NBC protective clothing, while under artillery and smoke. In short, they had never trained to face the Warsaw Pact. What they had done was train to fight the first battle of the next war, and lose.

What can be done to improve our training? Each tank platoon should regularly train against *two tank platoons plus a mech infantry company,* or the largest opposing force that can be made available. Crews should train in *full* NBC protective clothing and equipment—train in it, not just wear it. Smoke and simulated artillery on the platoon position must be a normal part of our training. Opposing forces must play Warsaw Pact organization and tactics. The decision to withdraw must be made before the enemy is within battlesight ranges. At 20 kph an enemy force will close 333 meters every minute. How long does it take *your* unit to request and receive permission to withdraw and then move to and occupy its next position?? (Take a moment to figure out how many meters "edge" you need when you withdraw.)

Implementation of the above suggestions will make one more change clearly necessary—longer engagement ranges. Ten years ago, before it was "proven" that the 105-mm tank cannon doesn't hit point targets at long ranges, we had targets at 2,400-2,800 meters on our gunnery ranges—*and we hit them.* Now we don't even have targets beyond 2,000 meters in any gunnery firing table (as listed in FM 17-12-2 w/change 2) Table VP is the best with five of its nine engagements being multiple targets between 1,600-2,000 meters, but this is a subcaliber, scaled range table. Table VIA has no targets beyond battlesight range, while Table VIB does offer one engagement with two tanks at 1,600-1,800 meters and one engagement with an antitank position at 1,400-1,800 meters. Table VIIA offers one engagement with two tanks at 1,800-2,000 meters. Table VIIA likewise offers one engagement with two tanks at 1,800-2,000 meters. The sample Table IX (defense—day) offers one threat tank company at 1,600-2,000 meters. The sample night defensive run has no targets past 1,600 meters. The sample offensive battle run (day) has one engagement that includes four threat tanks at 1,800-2,000 meters.

As recently as 5 years ago, they forgot to tell the 72d Armor Crusaders that the 105-mm tank cannon won't hit long-range targets. The Crusader Table VIII included an ATGM target (HEP engagement) at 3,200 meters and several tank targets beyond 2,000 meters. We didn't know any better, so we hit them. Long-range gunnery isn't impossible. . .True, you won't get the percentage of hits at 2,400 meters that you do at 1,400, but you will get hits. The main advice I want to offer on long-range gunnery is "try it, you'll like it."

Now let's get out there and train to fight the first battle of the next war, *and win!!!*

THOMAS P. CURRY
Sergeant First Class

Why Not a Combined Arms Vehicle?

Since the 1930's, armored fighting vehicle design has centered around development of separate types or categories of weapons. The field has been dominated by the turreted, track-laying weapon carrier, commonly called the tank. Other systems designed for specific roles that have appeared from time to time include various wheeled, tracked, and half-tracked designs for antitank, scout, and personnel carrier missions. Each type of armored fighting vehicle was optimized for its job, and little attention was paid to the functions of the other systems.

Today, the requirement to fight and live as combined arms forces and to produce and support large numbers of systems has led to the need to create multipurpose armored fighting vehicles.

A few vehicles of this class are in the field today. However, it must be understood that, at least initially, these vehicles were not conceived as general-purpose, mounted-combat vehicles and were not employed to their full potential. The failure to use all their capabilities is more an effect of their parentage than of misguided mission profile analysis.

A widely deployed system is the Soviet *BMP*. Although originally designed as an infantry mounted-combat vehicle, the addition of a heavy antitank missile and a 73-mm gun gave this armored fighting vehicle many of the characteristics of a light tank. The Soviets have also fielded a new airborne light tank, the *BMD,* that sports the *BMP* turret on a new hull, but retains the ability to carry an infantry team.

Earlier attempts to develop a multipurpose combined arms fighting vehicle are traceable to the German Army of World War II, when, in an effort to provide armored infantry formations with additional firepower, the 75-mm assault guns and 28-mm tapered bore heavy antitank weapons were mounted on standard half-tracked infantry carriers. These vehicles proved most effective in the great mobile warfare battles fought in the Ukraine in 1943.

The Germans have not forgotten the lessons of the Eastern Front and, in conjunction with Argentina, have introduced a new and highly developed combined arms fighting vehicle, the TAM. The TAM configuration is based on the hull of *Marder*, the heavy infantry fighting vehicle. By sacrificing some of its infantry carrying capacity, it manages to mount a 105-mm tank cannon in a fully rotating turret. At 30 tons, this is truly a medium tank that is capable of carrying infantry in the combined arms role.

France is producing for export the *AMX-10/PAC 90.* This vehicle mounts a turreted 90-mm gun on a modern armored personnel carrier (APC) chassis and can still carry four infantrymen.

The United States has stumbled into a combined arms combat vehicle with the *M-2* and *M-3* infantry and cavalry fighting vehicles (IFV/CFV). The vehicles are identical in external appearance and both are armed with a 25-mm automatic cannon and a two-pod TOW launcher. The infantry vehicle is designed to carry an infantry squad and is equipped with firing ports and firing port weapons. The cavalry vehicle, on the other hand, carries a crew of only five scouts, but is configured for stowing a much heavier combat load of ammunition and TOW missiles.

Each of these systems is a start in the right direction, but each is deficient in its tank role, primarily because of a lack of sufficient armor protection and main gun firepower. We must remember, however, that each started life as an infantry vehicle.

The Israeli *Merkava* tank is somewhat the same type vehicle, but from an oppposite direction. This heavy tank is, by happy circumstances, able to carry a small number of infantrymen.

Despite its 105-mm cannon and heavy armor, the *Merkava* is deficient as a combined arms vehicle because it does not allow the infantry to participate in mounted combat. The infantry is carried in the rear-mounted ammunition bay without viewing devices or firing ports.

Where are we going today with the concept of combined arms combat vehicles?

The proposals developed under the Combat Vehicle Technology Program include 27 concepts, 9 of which include some form of on-board infantry elements and medium-tank firepower. Combined arms vehicles were proposed at Rock Island Arsenal more than 10 years ago. This is long-range planning for a combined arms vehicle.

Short-range consideration should be given to up-gunning the *M-2/M-3* to tank firepower standards and uparmoring it to something like medium tank protection levels. A turret mountting either a 105-mm tank gun or one of the new "super" guns being developed could replace the current TOW/25-mm turret either on the standard 60-inch turret ring or on a ring up to 88 inches in diameter *(M-60)*. More frontal armor and generally increased ballistic protection would be desireable. The swim capability and the ability to carry a full infantry squad would be traded for these improvements.

What would we do with these combined arms combat vehicles (CACV)? In the central battle, large numbers of tank/antitank vehicles supported by small groups of mounted infantry are needed. Since the CACVs are neither heavy tanks nor APCs, they would shine by maneuvering from keypoint to keypoint, bringing their tank firepower to bear on the enemy, and then pressing on to strike him again on another front. In the great melee battle, where allied and enemy forces are mixed in ever-shifting, churning, violent combat and the critical tank firepower of every vehicle in the force is combined with the suppressive fires of mounted infantry, maneuvering with the same mobility and armor protection of the "tanks," we have the ultimate in combined arms maneuver — infantry and tanks integrated at the lowest level of mounted combat, closing with and destroying the enemy.

When given a mission to seize an objective, the CACVs attack as tanks, with firepower and shock action, and quickly shake out infantry to clean up and consolidate the ground. Given orders to hold an objective, outposts and strongpoints come from the dismounted fire teams, while the major firepower is provided by the cannon and machineguns of armored vehicles.

Tank battalions would be used in the pure tank role to provide the heavy defensive and offensive backbone for the division by supporting the combined arms battalions. Likewise, infantry battalions mounted in battle taxis, APCs, IFVs, or helicopters would be retrained to fight dismounted in forests, cities, and fortified areas. In any event, the combined arms battle is borne by and won by the combined arms force.

How would we organize our fighting teams and divisions if we had such equipment? Tank battalions and mechanized infantry battalions would not be eliminated, but their numbers would be curtailed to make room for combined arms battalions equipped with CACVs in the division.

The combined arms battalions would use the CACV as its primary fighting system. Combined arms maneuver vehicles would be used down to platoon level. Each platoon would be equipped with five CACVs, with two carrying infantry fire teams and two with rear bays fully loaded with ammunition. The fifth vehicle would carry the platoon leader with a mission-oriented mixed load of ammunition, people, and equipment.

Four platoons would make up a company, with three companies to a battalion. Conceivably, a division might have seven combined arms, two tank, and two infantry battalions, along with the usual division troops. However, this structure is just a notional arrangement designed to keep the personnel numbers about in line with current strengths and the number of battalion headquarters constant.

Other superior organizations are possible, but they should all contain the idea that combined arms must be integrated at the lowest level.

What advantages could be gleaned from the adoption of such a combined arms fighting vehicle?

First, and most obvious, is the advantage of commonality for procurement, maintainance, and logistics.

Second, such a system would increase battlefield strength. The conversion of 7 battalions of a mechanized division (3 tank and 4 mechanized infantry) to a like number of combined arms battalions would delete 162 main battle tanks and 168 infantry carriers used by the (108) infantry squads and their commanders (330 vehicles). This situation involves 648 tankers and 1,444 infantrymen, for a total of 2,092 men.

Such a force would be replaced by 7 battalions organized with CACVs and structured with a battalion command group, 3 companies, and 12 platoons of 5 vehicles; i.e., 69 vehicles per battalion. This force constitutes 483 CACVs and 84 infantry squads, for a total strength of 2,121 men (29 men are picked up in the rounding), with a 46 percent increase in tank strength — 483 versus 330, and a loss of only 22 percent in infantry squads — 84 versus 108.

Finally, the introduction of such a system might reduce the constant in-fighting between infantry and armor proponents for dominance in the combined arms force.

What would such a combined arms vehicle look like? With the technology available today, the CACV would probably be turreted, possess a track-laying capability, and be designed with a front-mounted engine and rear located infantry/ammunition bay with rear opening hatches and side and rear facing firing ports. Its armor would be maximized with its silhouette minimized. Its mobility would be optimized consistent with an all-round balance.

This configuration is at variance with the pattern for a standard tank and is inconsistent with the design for an infantry vehicle. However, why must we jam every vehicle into some preconceived class; i.e., tank, armored infantry vehicle, antitank, helicopter, whatever? Why not develop a system for the kind of war we expect to fight — a combined arms war of movement and maneuver. The armored fighting vehicle of the future must support the concept of combined arms.

ALFRED T. BOWEN
Major, Armor
Ft. Leavenworth

FORGING THE THUNDERBOLT

Armor NCO Advanced Course

CLASSES PRESENTED TO ALL ANCOC STUDENTS

CLASS TITLE	HOURS
Maintenance Department	
Maintenance and Historical Records	7
Maintenance Retest (Management)	1
Vehicle Recovery	8
Maintenance Retest (Recovery)	1
Introduction to Organizational Maintenance	1
Turret Armament and Controls (19D only)	4
Recognize Malfunctions of *M-68* Main Gun and Combination Gun Mount, Supervise Crew Maintenance	5
Recognize Malfunctions of Gun Elevating and Turret Traversing System, Supervise Crew Maintenance	4
Recognize Malfunctions of the Stabilization System and Supervise Crew Maintenance	2
Recognize Malfunction of the Fire Control System, Supervise Crew Maintenance, *M-60A1*	8
Recognize Malfunction of the Fire Control System, Supervise Crew Maintenance, *M-60A3*	4
Supervise Crew Maintenance in Performing Quarterly Preventive Maintenance Checks and Services	8
Performance Examination	12
Command, Staff and Doctrine Department	
The Threat	4
Air Defense	2
Field Artillery	4
Tactical Air Support	2
Combat Service Support	1
Role of the NCO	4
Motivation Techniques	2
Enlisted Personnel Management System	2
Soldier's Forms and Records	1
Counseling and Communications	4
Military Justice I and II	6
The Law of War	2
Supply Management	3
Introduction to Training Management	1
Battalion Training Management System	2
Assessment of Training	3
Mission Task Analysis (Tng)	2
Platoon Planning (Tng)	2
Training and Evaluation Planning	3
Performance Oriented Training	4
Organizational Effectiveness	4
Leadership and Command Examination, Critique, and Retest	5
Electronics/Communications Warfare	1
Signal Security	1
NBC Defense	8
Decontamination	4
Educational Technology	
Welcome and Orientation to Educational Technology	1
Reading Diagnostic Test	1
Listening Diagnostic Test	1
Orientation to Reading/Listening Training	1
Tour of Learning Center	1
English Diagnostic Test and Orientation to Effective Writing	2
Effective Writing: Clarity and Organization	10
Effective Writing: Usage and Structure	12
Effective Writing: Mechanics	12
Effective Writing: Spelling	6
English Diagnostic Test (Post Test)	2
Mathematics Diagnostic Test	1
Performance Training	3
Preparation to Instruct	3
Student Presentation	5
Committee Group	
Communications—Examination	1
Communications—Procedures	4
Operation/Maintenance VRC-12 Radio and Associated Equipment	4
Techniques of Communications Security	2
Operation of KY 57	4
Radio Net Exercise	4
Map Reading Diagnostic Test	2
Map Reading Review	6
Map Reading Diagnostic Retest	2
Large Scale Map Analysis of Terrain	3
Medium Scale Map Analysis of Terrain	3
Map Reconnaissance	4
Weapons Department	
Introduction to Gunnery Division Instruction	2
Tank Gunnery Training Management	10
Turret Mechanical Training	8
Tank Crew Gunnery Skills Test	8
Gunnery Skills Subjects Review	6
Tank Crew Gunnery Skills Retest	4
Conduct of Tank Ranges	2
Table VP	5
Special Gunnery Techniques	7
Advanced Gunnery	8
NCO Academy	
Physical Training	38

CAVALRY—SPECIFIC

CLASS TITLE	HOURS
Command, Staff and Doctrine Department	
Introduction to Cavalry Organization and Tactics	2
Command and Control Techniques	3
Pioneering for Cavalry	16
Fundamentals of Cavalry Platoon Operations	16
Mounted Tactical Training (Cavalry)	84
Performance Examination	8
Performance Examination (Retest)	4
Weapons Department	
Tank Machineguns	6
Armament Controls and Equipment	8
Primary Direct Fire Control	4
Prepare to Fire	16
Conduct of Fire	24
Auxiliary Fire of Control Instruments and Range Cards	6
Tank Ammunition	2
Table I, II, III and IVA and B	12
Table VIA and B	36
Table VIIA or C, B or C	20
Platoon Fire Control	3
Table IXB, Cavalry	12

TANK—SPECIFIC

CLASS TITLE	HOURS
Command, Staff and Doctrine Department	
Introduction to Tank Organization and Tactics	2
Command and Control Techniques	3
Pioneering for Tankers	14
Fundamentals of Tank Platoon Operations	16
Mounted Tactical Training (Tank)	84
Performance Exam and Performance Exam Retest	12
Weapons Department	
Subcaliber Training Devices	8
Prepare to Fire	4
Conduct of Fire	4
Auxiliary Fire Control Instruments and Range Cards	5
Platoon Fire Control	4
Table IXB Tank	12

The Secret to Reliable Generator Operation

Units requiring generator power are constantly searching for effective methods of keeping the equipment operational. Over the years, this search has led to a special military occupation specialty (MOS) for operation and organizational maintenance (MOS 52B) with TO&E changes to add generator operator spaces and, later, the deletion of the MOS.

So, where do we stand now?

Presently, *operation* of the generator is the *additional* responsibility of any MOS so designated by the unit commander, *organizational* maintenence is the responsibility of MOS 63B, and *support* maintenance is the responsibility of MOS 52D.

Direct and general support maintenance is taught in the 52D10 course at Fort Belvoir. Organizational maintenance of generators is taught at the 63B10 course conducted at three Army training centers: Forts Dix, Jackson, and Leonard Wood. As the proponent for MOS 63B, the U.S. Army Ordnance Center and School has recently revised the 63B10 course as part of a continuing effort to improve generator maintenance. All MOS 63B10 soldiers graduating from the revised course receive additional skill and the knowledge to perform power generation equipment maintenance tasks.

The training also includes performing maintenance tasks such as troubleshooting the 5-kW diesel and gasoline driven generators and the 60-kW generator.

In addition, some automotive-type tasks are performed on both vehicles and generators; for example, soldiers in the 63B10 course perform maintenance tasks on the cooling system of wheeled vehicles and also replace the water pump, cooling fan, and fan belts on the 60-kW generator. Students in the course use test equipment to troubleshoot vehicle and generator electrical systems. Field application of generator sets, generator set selection, installation and paralleling of the 60-kW generator is also taught. In addition, students are required to perform scheduled preventive maintenance checks and services (PMCS) on the 5-kW gasoline and diesel driven engine and 60-kW generator sets.

Testing of generator maintenance tasks is included in an 8-hour end-of-course performance test. Maintenance tasks that have been taught, and some tasks that are not taught in the course, are tested to evaluate transfer of skills and knowledge. This revised course was implemented in October and November 1980 at the three Army training centers teaching the 63B10 course. Commanders should note that generator training for MOS 63B10 is maintenance training and not operator training. The duties of MOS 63B10 include organizational maintenance of power generators, but they do not include the duties of the generator operator. However, to be capable of performing PMCS and many maintenance tasks, the soldier with MOS 63B10 must be able to operate the generator. Therefore, some generation operation is taught in the 63B10 course along with maintenance tasks.

Since the generator operator is an additional duty of any MOS so designated by the unit commander, generator operators must be trained on-site in the unit. Soldiers with MOS 63B should be used to assist in training generator operators to perform generator maintenance.

This on-the-job training (OJT) should include all aspects of generator operation including operator maintenence. The following listed Training Extension Course (TEC) lessons can help you in your OJT effort:

1-662-051-7601A	Location and Installation of GED Generator Set
1-662-051-7602F	Servicing of GED Generator Set, Part I
1-662-051-7603F	Servicing of GED Generator Set, Part II
1-662-051-7604F	Servicing of GED Generator Set, Part III
1-662-051-7605E	Servicing of GED Generator Set, Part IV
1-662-051-7606F	Preparing the GED Generator for Starting
1-662-051-7607F	Preparing the GED Generator Set for Starting and Stopping
1-662-051-7608F	Preparing the GED Generator Set for Load
1-662-051-7609A	Technical Tables for Service & Troubleshooting of GED Generator
1-662-051-7610E	Operation of GED Generator Set
1-662-051-7611F	Temporary Expedient Repair for Cables
1-662-051-7612A	Compute Load and Selecting Appropriate Generator
1-662-051-7613A	Balancing Load and Drawing Distribution System
1-662-051-7614A	Selecting Proper Line Cable

These TEC lessons should be available at your battalion learning center. If not, write to: **Commander, US Army Training Support Center,Attn: ATIC-AET-TP, Fort Eustis, VA 23604.** *(Submitted by Commander, USATSC).*

RECOGNITION QUIZ ANSWERS

1. **OT-64C,** Czechoslovakia Poland (1964)—8-wheeled APC; 14.5-mm and 7.62-mm, 14.3 tons; 2-man crew plus 18 passengers. Max speed 95 km/1,700-km range. Note centrally-mounted turret.
2. **BTR M-1978** (BTR-70), Soviet (1978)—8-wheeled APC; 14.5-mm and 7.62-mm MG; 3-man crew, 8 passengers. Longer than a BRT-60PB with space between the second and third wheels for a troop access hatch.
3. **BMD**—airborne IFV, 2-man crew and 5 passengers; 73-mm AT gun, 7.62-mm coax, AT-3 *Sagger,* and 2 fixed front-firing 7.62-mm MG. A very mobile system with a 32:1 power-to-weight ratio, amphibious capability, and hydropneumatic suspension.
4. **Scorpion UK**—armored reconnaissance vehicle; 76-mm L-23 gun, all-welded aluminum hull with 5 roadwheels per side; engine and drive sprocket in front; 2-man crew.
5. **M-1974 122-mm SP gun/howitzer USSR**—seven roadwheels evenly spaced per side. Large armored turret mounted at rear of hull, and muzzle brake fitted to gun. Maximum range, with conventional HE, about 15,300 m and 21,900 m with rocket-assisted projectiles. Can be used in the direct-fire roll with HE and HEAT rounds.
6. **HIND E**—a modified HIND D designed to carry four AT-6 ATGM. In addition, it can carry four 32-shot rocket pods.

This quiz and those appearing in several previous issues were prepared by SFC Noteman, Threat Branch, DCD, USAARMC, Fort Knox, KY.

news notes

New Lightweight Armored Vehicles

Vought Corporation plans to offer a new lightweight armored vehicle called the *Wolverine* in the upcoming U.S. Marine Corps Mobile Protected Weapon System (MPWS) competition.

Vought will be the prime contractor for the program. Groupment Industriel des Armaments Terrestres (GIAT), the French Ministry of Defense's armored vehicle manufacturer, will provide the basic vehicle. Other *Wolverine* team members will be Rheinmetall of West Germany, which will supply the gun and turret for the vehicle, and Texas Instruments Incorporated of Dallas, which will provide the fire control system.

Canadian Army Trophy Competition 1981

The United States placed third behind Germany and Belgium in the annual Canadian Army Tank Gunnery Competition held on Range 10 at Grafenwoehr 15-19 June 1981. Representing the United States were five platoons of *M60A3* TTS tanks of 1-32 Armor commanded by LTC Ross A. Johnson. Following the US in order of finish were Canada, Great Britain, and the Netherlands. Germany and the Netherlands fired the Leopard I with coincidence range finder, Canada and Belgium fired the Leopard II with integrated fire control, laser rangefinder, and digital computer; Great Britain fired the only 120-mm gun in the competition on the Chieftain equipped with laser range finder. Range 10 has been specially built to accomodate this international tank gunnery competition. The scores were:

Germany	41,770
Belgium	36,577
United States	35,182
Canada	34,990
Great Britain	34,840
Netherlands	30,724

Reunions

The 704th Tank Destroyer Association, 4th Armored Division, will hold its annual convention July 23-25, 1981 at the Marriott Hotel in Stanford, CT. For more information, contact Sam Schenker, 2440 Victoria Drive, Sharon, PA 16146.

35th Annual reunion 43d Infantry Division Veterans Association, September 11-13, 1981, Holiday Inn, Downtown, Providence, RI. Contact Romeo Del Rossi, 176 Benefit St., Providence, RI 02903.

The 10th Armored Division Association will hold its annual reunion Sept. 4-9, 1981, at Stouffer's Inn, Indianapolis, IN 46208. For more information, contact James Bierce, national secretary, P.O. Box 976, Port Richey, FL 33658.

The Society of the 3d Infantry Division will hold its 62nd annual reunion Sept. 9-12, 1981, at the Raddisson Plaza Hotel in St. Paul, Minnesota. For more information, write Tom Rafferty, 1201 Hubbard Avenue, St. Paul, MN 55104 (612-645-7809).

Oil Analysis Program

The Army Oil Analysis Program (AOAP) can be used by commanders to determine whether vehicles are capable of completing a mission and to evaluate the adequacy of preventive maintenance procedures. All that is involved is the collection of a 3-ounce oil sample from a vehicle and a request for analysis directed to the AOAP oil analysis laboratory.

If the analysis reveals a high level of wear metal, the laboratory advises the unit and makes specific maintenance recommendations. These recomendations can lead to savings in repair costs of from $15,000 to $16,000 when a tank engine is involved. The cost of processing the oil sample is $5. The success of the AOAP is the early discovery of engine component problems at a stage when they can be corrected with minor maintenance procedures, as opposed to replacement of an entire engine — $500 compared with $16,000.

Savings like this in maintenance of ground vehicles have been realized since 1976. Earlier, the program had been limited to aircraft. In the past 2 years, the number of ground vehicles included in the AOAP has tripled, and the number of laboratories servicing Active, Reserve, and National Guard units in the U.S. and overseas has increased from 7 to 16.

The program has other benefits. For example, consistently poor oil analysis results for *M-60* series tanks — when investigated by contact teams — may disclose improperly-fitted air intake lines, debris between the seal and filter box lid, or filter box covers that are bent and cracked. Such defects will allow dirt to be drawn directly into the engine, resulting in extensive damage. These conditions can be corrected through closer control of maintenance activities.

The AOAP Management Office, Bluegrass Army Depot, Lexington, KY, is expanding the AOAP data system to provide all existing and future laboratories with stand-alone mini-computers. This will eliminate manual record keeping, increase the support to each installation, and provide the capability of producing equipment inventories and other management data.

BOOKS

THE ARMY GETS AN AIR FORCE: TACTICS OF INSURGENT BUREAUCRATIC POLITICS by Frederick A. Bergerson. Baltimore: The Johns Hopkins Press, 1980. 216 pages.

The Johns Hopkins Press is known for the quality of its scholarship, and the addition of Professor Bergerson's examination of and model for a kind of organizational behavior superbly continues the tradition. My first expectation in reading this book argued that it would not be so. Every instinct that I posess rages against the possibility of creating an aggregate man, a model that will stand for man, no matter how "useful" such a model might be. Yet, given my prejudice, there is no denying that, while man as an individual is preeminently unpredictable, men in groups will often act in concert, repeating patterns of behavior, if only to emulate previous successes. Occasionally, with patient and sustained attention and analysis, a historian can construct a useful model of this group behavior. Professor Bergerson has done this, as the potential value of his study shows.

As a carefully researched and crafted history of Army aviation, written by someone sufficiently outside the arena to avoid biased predispositions, the book is a most useful and concise understanding of how the Army obtained the "air force" that it wielded against Southeast Asia.

While the book might possess a broad use, its purpose allows for a more significant, albeit narrower, use as a case study of military and political behavior in the perennial arena of our defense establishment—the "roles-missions-budget" melee. As a case study of how bureaucracies operate and how they can be thwarted, the book could be a most useful text in several courses with which I am familiar at the Naval War College.

Perhaps the most profit of all would be obtained if a number of officers took the book as a cue to crank up the conspiracy again. Brigadier Simkin, a retired British officer who has done studies of tank warfare, tank design, and mechanized infantry, argues that it takes at least 30 years for an army to learn to use its tools to their fullest effect. In the case of U.S. Army aviation, and in particular, air cavalry and attack helicopters, it would be nice to prove him wrong; probably, his prophecy will be conservative. Too many of our officers and, unhappily, some of our most senior aviators still see Army aviation as a sophisticated and capable fleet of trucks with armed escort—everybody should have some. They see the *AH-64* as an antitank weapon, the rotary wing equivalent of Rommel's "88" in the Afrika Korps' PAK Front. The Soviets have learned the lessons of airmobile warfare in Vietnam perhaps better than we have. In any case, surely we can avoid, with the *AH-64,* the "penny packet" approach of spreading out tanks as support weapons. Perhaps the book will mobilize our Chaffees, Guderians, Harts, and Tuchachevskis; but they will have to move fast.

MICHAEL S. LANCASTER
Major, Armor
USAARMC, Fort Knox, KY

ROMMEL'S WAR IN AFRICA, by Wolf Heckmann, Doubleday, New York, 366 pages, $14.95.

Rommel! The very name conjures up visions of *panzers* locked in deadly combat, sweeping across the sands of North Africa in pursuit of the British. No military commander since the days of Napoleon has been so highly regarded by his enemies as was Field Marshal Erwin Rommel. Even today, there is a mystique attached to his name, and his exploits have gained luster with time.

This book, however, does more than simply add more accolades to the Rommel legend. It brings the mighty commander of the Afrika Korps down to a more human dimension. In fact, it concludes that Rommel "became possibly the most overrated commander of an army in world history." For this reason it created considerable furor when it was initially released in Germany by Wolf Heckmann, *Wermacht* veteran, once chief editor of the prestigious Hamburg *Morgenpost,* and a serious, well-respected author.

By delving deeply into the Axis and Allied War Archives and then tracking down and interviewing over 1,500 participants from both sides, Heckmann pieces together an account of Rommel's North African campaign that paints an altogether different picture than the one normally found. He presents impressive evidence to support his claim that the basic reasons for Rommel's successes were not to be found in the Field Marshal's strategic or tactical grasp, but rather in a combination of fortuitous mistakes by the British, superior equipment in the German formations of the Afrika Korps, dedicated, hard-fighting troops, and just plain luck.

The author attributes the later German reverse to the British simply learning how to operate, the provision to the Allies of better tanks and antitank guns, and Rommel's loss of interest in the theater once the Fuehrer turned his attention to Russia, relegating North Africa to secondary importance, and thereby decreasing the opportunities for the Field Marshal to gather glory.

Was Rommel a mediocre glory-hound? Was he really a seriously overrated commander as Heckmann contends?

Even after reading the book, I could not quite make those judgements, even though some of the details would appear to point in those directions. There were simply too many other instances in the material in which the Rommel legend's niche in the warriors' pantheon appeared to be justified.

Should the book be read by today's armor officers? Without a doubt! Not only does it provide insights into leadership and the rigors of desert warfare, it also presents a picture of what it is like at the sharp end of the stick, down where the troops have to carry out the orders they are given. On top of that, it is a cracking good read!

The author follows the exploits and travails of real people on both sides in such a way that the narrative ties together in a fluid presentation that really "grabs" the reader. As you get into the book you *have* to empathize with the hapless 8th Machinegun Battalion which is repeatedly mauled, (decimated is too mild a term,) not because they weren't competent, but simply because they were unlucky. Can the redoubtable Sergeant Major Saenger stop the British counter-attack down the Via Balbia as Rommel ordered — with only two crippled *panzers?* You press on.. Will the doughty Sergeant McGinniley, his tank repeatedly struck by German tank and antitank gunfire, the engine destroyed due to a direct hit by heavy artillery, and being dragged across the desert by another tank with no gun, survive the pounding as he fights it out with the pursuing *panzers?* Read the book and see; it's worth it.

PHILIP C. GUTZMAN
Major, Armor
Fort Hood, Texas

STEEL ON TARGET

The 1981 Armor Conference marked a transition for the Army. The parallels between this transition and that of the late 1930's and early 1940's are unmistakable. Both transitions were responses to a threat through dramatic improvements in technology and operational methods. The men of Armor lead the way then in the transition from horse to combustion engine in forming the Armor Force and lead the way today in the transition to the turbine in modernizing the Armor Force.

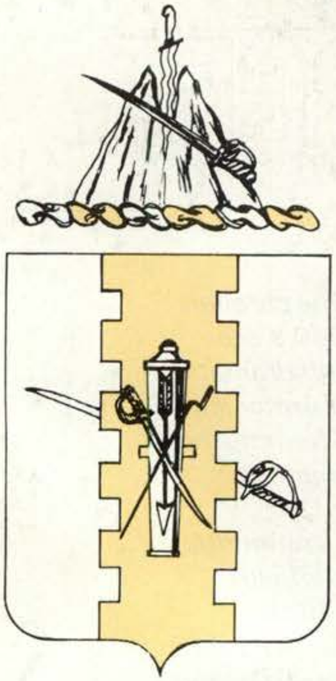
The systems and methods introduced four decades ago, built around the armor protected firepower of the tank restored mobility to a battlefield dominated by firepower. Since that time, however, the lethality of the battlefield has increased sharply. So, too, has our ability to operate on it with improved mobility, special armor, thermal sights, and laser designators and rangefinders.

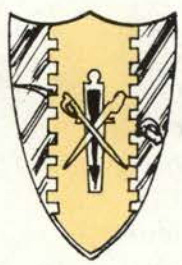
To enable our soldiers to fight, survive and win on today's battlefield, over 400 new systems, along with an operational concept in Division 86, are being introduced into the force in the decade of the eighties. The Armor systems, both ground and air, will provide our soldiers the ability to move, shoot, and communicate as never before in all kinds of weather, over all types of terrain, under all conditions of visibility, through all hours of the day and night.

The challenge for the men of Armor is to absorb these systems as they enter the force and insure our combat readiness in this decade and beyond, by structuring, manning, modernizing, training, and, if necessary, mobilizing the force as our predecessors did to meet the threat they faced.

The new logo for the editorial page, "Steel on Target," also marks the transition. The threat is apparent. But, just as obvious is the role of Armor in dealing with that threat as part of the combined arms team. The new systems and operational methods discussed at the Armor Conference have been developed to enable all members of the air-ground team—Armor, Infantry, Artillery, Air Defense Artillery, Engineers, and the combat aviation of the Army, Air Force, Navy, and Marines—to individually and collectively place deadly, effective "Steel on Target." Armor, the Magazine of Mobile Warfare, will continue to lead the way in providing stimulating professional articles to keep you, our readers of all arms, branches, and services, informed of the many new developments during this exciting decade of change for the Army and the Armor Force.

Good Shooting!





4th Cavalry

Symbolism

The shield is yellow for cavalry. The attack on the intrenchments at Selma is symbolized by the embattled blue pale and red bayonet. The capture of Hood's artillery is shown by the reversed cannon, the rout of the enemy's cavalry at Murfreesborough by the reversed sabre, and the successful Indian campaigns by the reversed arrow. The Bud Dajo campaign is indicated by the conventionalized volcano of the crest, and the defeat of the Moros by the reversed kris in the crater. On both shield and crest is the regiment's triumphant sabre at the charge.

Distinctive insignia

The distinctive insignia is the shield of the coat of arms.

4th Cavalry

Lineage and Honors

Constituted 3 March 1855 in the Regular Army as 1st Cavalry. Organized 26 March 1855 at Jefferson Barracks, Missouri. Redesignated 3 August 1861 as 4th Cavalry.

Reorganized and redesignated 16 April 1942 as 4th Cavalry, Mechanized. Regiment broken up 21 December 1943 and its elements reorganized and redesignated as Headquarters and Headquarters Troop, 4th Cavalry Group, Mechanized, and 4th and 24th Cavalry Reconnaissance Squadrons, Mechanized.

Headquarters and Headquarters Troop, 4th Cavalry Group, Mechanized, converted and redesignated 1 May 1946 as Headquarters and Headquarters Troop, 4th Constabulary Regiment. Reorganized and redesignated 10 February 1948 as Headquarters and Headquarters and Service Troop, 4th Constabulary Regiment. Inactivated 1 May 1949 at Salzburg, Austria. Redesignated 20 August 1953 as Headquarters and Headquarters Company, 4th Armored Cavalry.

4th Cavalry Reconnaissance Squadron, Mechanized, converted and redesignated 1 May 1946 as 4th Constabulary Squadron; assigned 17 June 1946 to 4th Constabulary Regiment. Reorganized and redesignated 1 April 1949 as 4th Reconnaissance Battalion; concurrently, relieved from assignment to 4th Constabulary Regiment. Reorganized and redesignated 1 December 1951 as 4th Armored Cavalry Reconnaissance Battalion. Headquarters and Headquarters Company, 4th Armored Cavalry Reconnaissance Battalion redesignated 1 July 1955 as Headquarters and Headquarters Company, 4th Armor Group (4th Armored Cavalry Reconnaissance Battalion (less Headquarters and Headquarters Company) concurrently inactivated at Camp McCauley, Austria).

24th Cavalry Reconnaissance Squadron, Mechanized, converted and redesignated 1 May 1946 as 24th Constabulary Squadron; assigned 17 June 1946 to 4th Constabulary Regiment. Relieved 1 May 1949 from assignment to 4th Constabulary Regiment and assigned to the United States Constabulary. Inactivated 15 December 1952 at Hersfeld, Germany. Redesignated 21 April 1953 as 524th Reconnaissance Battalion.

Headquarters and Headquarters Company, 4th Armored Cavalry; 524th Reconnaissance Battalion; and 4th Armored Cavalry Reconnaissance Battalion (less former Headquarters and Headquarters Company, then designated as Headquarters and Headquarters Company, 4th Armor Group) consolidated, reorganized, and redesignated 15 February 1957 as 4th Cavalry, a parent regiment under the Combat Arms Regimental System (Headquarters and Headquarters Company, 4th Armored Cavalry; concurrently, redesignated as Headquarters and Headquarters Troop, 4th Cavalry). (Headquarters and Headquarters Company, 4th Armored Group inactivated 1 April 1963 in Germany; concurrently, redesignated as Headquarters and Headquarters Troop, 14th Squadron, 4th Cavalry.)

Campaign Participation Credit

Civil War

Bull Run
Mississippi River
Peninsula
Antietam
Fredericksburg
Murfreesborough
Chickamauga
Atlanta
Franklin
Nashville
Missouri 1861
Kentucky 1862
Mississippi 1862
Mississippi 1864
Tennessee 1863
Tennessee 1864
Alabama 1864
Alabama 1865
Georgia 1864
Georgia 1865

Indian Wars

Comanches
Apaches
Little Big Horn
Cheyennes
Kansas 1857
Kansas 1860
Mexico 1873
New Mexico 1882

Philippine Insurrection

Manila
Malolos
Laguna de Bay
San Isidro
Cavite
Tarlac
Jolo
Luzon 1899
Luzon 1900
Luzon 1901

World War II

Normandy (with arrowhead)
Northern France
Rhineland
Ardennes-Alsace
Central Europe

Vietnam

Defense
Counteroffensive
Counteroffensive, Phase II
Counteroffensive, Phase III
Tet Counteroffensive

Decorations

Presidential Unit Citation (Army), Streamer embroidered *Bogheim, Germany* (4th Cavalry Reconnaissance Squadron cited; WD GO 109, 1945)

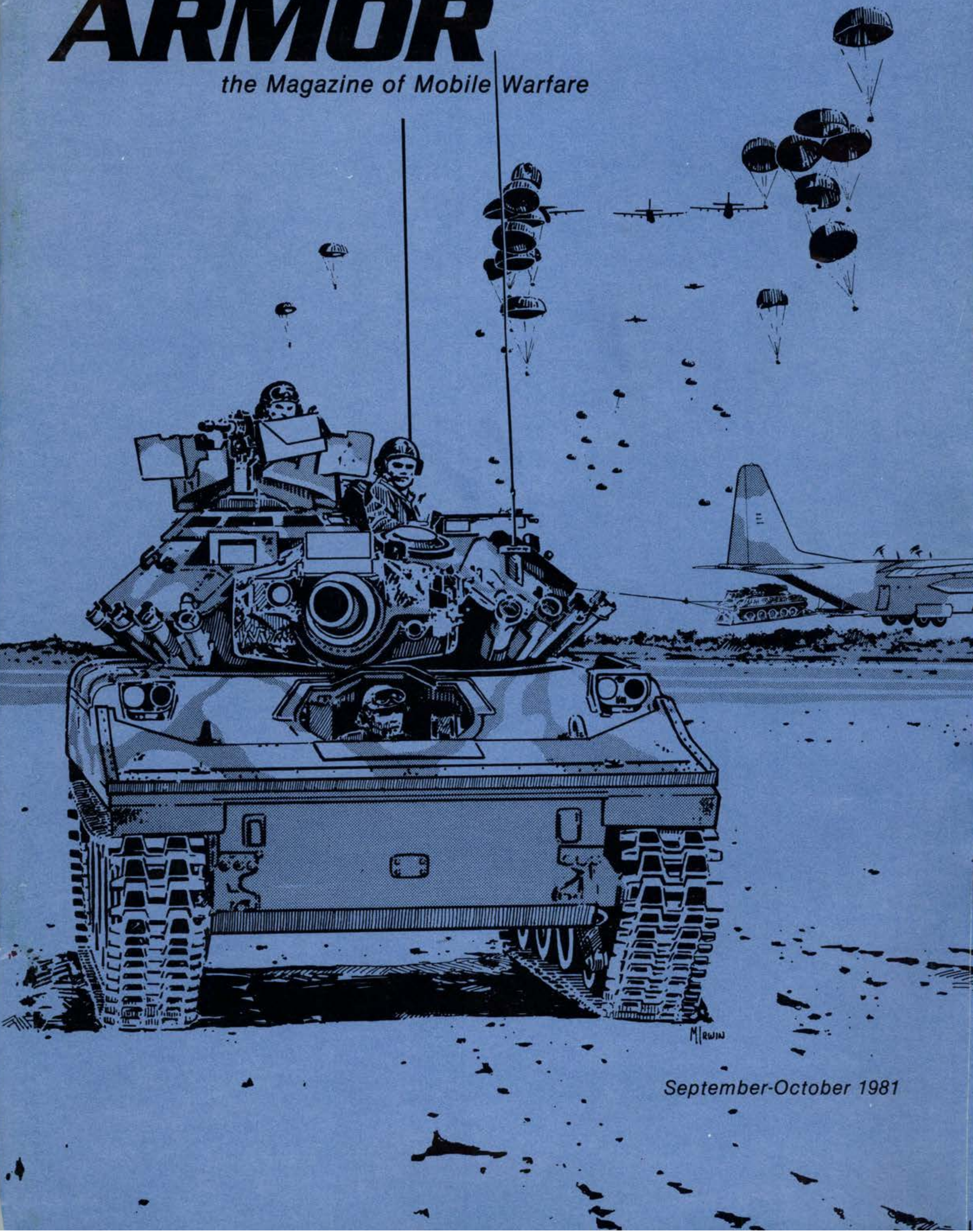
Presidential Unit Citation (Army), Streamer embroidered *Binh Long Province* (1st Squadron, 4th Cavalry, cited; DA GO 31, 1967)

French Croix de Guerre with Silver Star, World War II, Streamer embroidered *Normandy* (4th (less Troop B) and 24th Cavalry Reconnaissance Squadrons cited; DA GO 43, 1950)

Cited in the Order of the Day of the Belgian Army for action in the *Ardennes* (4th Cavalry Group, 4th and 24th Cavalry Reconnaissance Squadrons cited; DA GO 43, 1950)

ARMOR

the Magazine of Mobile Warfare



September-October 1981

United States Army Armor School

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ARMOR the Magazine of Mobile Warfare

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FEATURES

DEPARTMENTS

COVER

An Armored Reconnaissance/Airborne Assault Vehicle of the 4th Battalion, 68th Armor, 82d Airborne Division moves off a drop zone after insertion by LAPES, as follow-on waves of armor, troops, and equipment build up the airhead. Beginning on page 30, the unique character of the only airborne armor unit in the U.S. Army is revealed.

LETTERS

Comments on Cavalry's Last Campaign

Dear Sir:

I enjoyed "Cavalry's Last Campaign" by 1LT Johnathan Harbuck which appeared in the May-June 1981 issue of *Armor* and hope to see other articles of historical analysis which may have application to the modern day battlefield. However, I trust LT Harbuck will not take it amiss if I point out that his otherwise well done piece contained statements that could lead one to believe that the campaign in Palestine of 1917-18 was indeed "the last" campaign involving mounted cavalry. In the introduction, he states that the "Cavalry . . . was to enjoy one last, glorious moment before retiring from the field of battle . . ." and, "Cavalry's cradle had become cavalry's grave." The implication of these statements are that the mounted cavalry never appeared on the battlefield again, and disappeared as a fighting arm with this campaign. Historically, of course, this is incorrect.

The U.S. for example, continued mounted cavalry through WW II. In 1940-41, with the call-up of the National Guard, they, together with the regular units, constituted the largest body of mounted troops since 1865. The 26th Cavalry (PS) in the Philippine campaign of 1941-42, was the last U.S. regiment to be deployed mounted while under fire. The 112th Cavalry (Texas National Guard) was deployed mounted in the Pacific on the island of New Caledonia until mid-1943. There were also unofficial (i.e., non-TO&E) reconstituted units that obtained mounts for use in the ETO. Probably the most extensive use of large bodies of mounted cavalry during WW II occurred on the Eastern Front.

I recommend to those who are interested, Piekalkiewicz's book, *The Cavalry of World War II*. While inaccurate as regards the U.S. role, it does provide an interesting account of the last campaign by large units of German and Soviet mounted cavalry. In short, "Cavalry's Last Campaign" probably took place in Germany, Hungary, and Czechoslavakia in 1945. This, of course, ignores the use of horses by the Chinese during the Korean War and the continued use of mounted soldiers by various countries of the world today.

As I said, I appreciate Lieutenant Harbuck's work, but I feel compelled to correct the implication that the mounted cavalry ended in the Palestine Campaign of 1917-18.

DAVID O. HALE
Woodbridge, VA

Dear Sir:

I am appalled that *ARMOR* magazine, formerly the *Cavalry Journal*, could have made so grievous an historical error as to title the article on cavalry in Palestine in 1917-18 (May-June 1981 issue) as "Cavalry's Last Campaign." Horse cavalry was used on a far wider scale with great success by both the Polish and Bolshevik forces during the 1920 Russo-Polish War, and horse cavalry was used extensively in Eastern Europe during World War II by the Germans, Poles, Soviets, Rumanians, Hungarians, and partisan forces. Indeed, a book by Janusz Piekalkiewicz has recently been translated from the German and published this year in the U.S., entitled "The Cavalry in World War II."

STEVEN ZALOGA
Greenwich, CT

Dear Sir:

I enjoyed LT Harbuck's article on Allenby's Palestinian campaign, "Cavalry's Last Campaign," very much. There are a few points, though, that I would like to comment on. First, Gurkha Regiments are rifle regiments, and, as such, it is proper to refer to the Gurkha soldiers as riflemen and not as *sepoys*. Second, the Indian Army did not serve in South Africa. If it had done so, the war would probably have been concluded sooner.

LT Harbuck praises, quite justly, the fact that Indian Army units did not collapse when they suffered heavy casualties. This phenomenon, however, was not peculiar to the Indian Army. The same devotion to duty in the face of casualties and other vicissitudes of war was expected and received from other Commonwealth and Empire forces.

S. A. CHOUDHURY
New Britain, CT

Dear Sir:

We would like to commend you and LT Jonathan Harbuck for the marvelous article, "Cavalry's Last Campaign," in your May-June issue.

LT Harbuck is a sound historian combining a generous touch of the romantic.

While our format is closely involved with the "hardware" of militaria collecting/investing, we are tempted to approach you regarding the reproduction of this article in one of our future issues.

We also enjoyed "Sabers at Cress Ridge" (Nov-Dec '80).

Keep up the good work!

ANDREW MOWBRAY
Publisher
Man At Arms
Providence, RI

Author of Cavalry's Last Campaign Replies

Dear Sir:

Mr. Hale and Mr. Zaloga each cite valid examples of the continued use of mounted forces up to the present day, but none compare very neatly with Allenby's use of cavalry in the Mideast. J. F. C. Fuller, in *A Military History of the Western World*, observes that cavalry played its role in the Russo-Polish War of 1920, but also notes that Marshal Budienny's cossack horde played no part in the climatic battle of Warsaw. The Bolshevik commanders argued over where they should be employed, and were subsequently routed by a Polish force almost devoid of cavalry. Fuller and other historians also note that horsed cavalry had become a secondary arm by World War II. Soviet cossacks were employed principally as partisans and raiders, while German cavalry functioned in the reconnaissance role. Outside of desperation situations, the horsemen were stuck in a very narrow range of jobs; it is difficult to imagine a more graphic demonstration of the eclipse of the mounted arm than the slaughter of Polish lancers by the armor of the Wehrmacht.

I regret leaving the impression that no soldier has fought on horseback since Megiddo, but feel confident that the title embraces a basic truth: Allenby was the last major commander to successfully employ cavalry in the traditional mode. Horsemen have enjoyed a measure of success at various tasks since 1918, but never such a decisive role, on such a grand scale, with such significant results as when they served as the *masse de manoeuvre* for Allenby's destruction of the Ottoman Empire.

JONATHAN S. HARBUCK
Second Lieutenant
IIROTC Region

How to Retain Sergeants

Dear Sir:

In your article "Where have all the Sergeants Gone," you state "Even more devastating is the number of careerists in grade E-5 to E-7 not eligible for retirement who simply resign rather than face a return to Europe." I can understand your point of view, but what about the ones who want to go overseas, but can't because their commanders won't let them. Most of these guys are just looking for a change, or perhaps they just don't like stateside duty that much.

The Army should reconsider a move when someone wants to go overseas, or when they don't want to. It is better off sending a good soldier with a high morale who wants to go overseas before the one who doesn't.

Give your soldiers more freedom of choice and you'll have a better Army.

SERGEANT DAVID SMITH
1st Cavalry Division
Fort Hood, Texas

Calibrated Zero System

Dear Sir:

I read with interest CPT Braddy and SSG Graham's article, "Calibrated Zero System," in the May-June issue.

The goal of zeroing is to find out where the gun is shooting so as to have the sights aimed where the rounds will strike. Selection of the standard procedure to be used should be based on the following criteria:

- Achieves an acceptable probability of hitting targets.
- Minimizes expended and time required.
- Generates crew confidence in weapon system.

CPT Braddy's, and the new USAREUR procedures, imply that the accuracy of the zero is a function of the procedures or methodology used. But no system procedures can omit crew training. I submit that the primary key to a good zero is crew performance. The procedures used to zero are important and necessary because they insure that the tank is ready to fire and accurately move the sights to where the gun is shooting. But the real problem, and greatest payoff, comes from training and motivating crews. If the rounds fired while zeroing are dispersed around the aiming point by say 3 feet, it's not the gun that's bad, it's the gunner and tank commander (TC). Tankers of 3-35th Armor were motivated by carefully explaining that April 1980's zero exercise would be the last time they zeroed, and by letting the tankers see exactly where their rounds hit by taking them to the targets. The following zero procedures were used.

Crews were carefully prepared, gunners carefully selected, and all were made aware that the zero they established during the Spring gunnery would be retained—the battalion would not fire another complete zero exercise.

On the zero range targets were physically scored. Tanks moved to the firing line, were boresighted using Pye Watson devices, and prepare-to-fire checks were completed. The tower controlled only the first round to insure it was on the panel. The second and third rounds were fired at the TC's command.

When the range was cleared, TC's and gunners went down range with the master gunner to physically score and patch targets. Crews could see where their rounds went. Centers of shot groups were plotted on the target and the calibrated zero settings were determined (as in CPT Braddy's article). We rapidly learned, and passed to succeeding crews, that the key to a tight shot group was the TC's quality control of the accuracy of the lay on the aiming point. The *M-68* gun can put three rounds inside a steel pot's circumference at 1,200 meters—nine tanks proved it.

Calibrated zero settings were placed on the sights under the supervision of the master gunner and a confirmation round was fired. All tanks confirmed inside a circle having a 48-inch diameter.

During subsequent gunnery training, the confirmation round was fired at a circle having a 77-inch diameter. In June 1980, seven tanks completely rezeroed, two due to fire control component replacement. In March 1981, 11 tanks were completely rezeroed—five for predictable reasons.

The *M-60A1* will retain its zero, we proved it. The above procedures were designed to give crews confidence in their zeros and confidence that they would stay zeroed. The battalion's route to a general defense position doesn't pass the zero range at *Grafenwoehr*. The rounds saved were used for extra runs on Table VII, and provided greater training value that the zero range offers. Confirmation firing in July 1980 expended 90 rounds, and 86 rounds were used in March 1981.

This system delivers acceptable accuracy, less ammo and time consumed, and generates crew confidence in the weapon system. What more do we want?

JAMES M. SCHROEDER
Lieutenant Colonel, Armor
Commander
3-35th Armor

Compliments SQT Article

Dear Sir:

CSM Gillis' May-June 1981 Driver's Seat article, "SQT . . . What the hell is it?" was right on target with the SQT program. Individual training (or skill qualification training as CSM Gillis calls it) was always intended to be more than a 60 day crash program to train up on the 25 to 35 tasks tested in the annual Skill Qualification Test. Individual training was always intended to be integrated in the day-to-day interaction between NCO and soldiers—the year-around training schedules, and the unit collective training programs. SQT results show the individual soldier and his trainer only how well the soldier has trained on the tested tasks. Unit SQT summaries indicate how successful unit training programs are only for those tested tasks. In both cases SQT results must be put together with the unit's own evaluation on training for other critical tasks from the Soldier's Manual. Only then does the "whole man" or "whole unit" training status become clear. Training Managers who implement a year-round SQT program, such as the one described by CSM Gillis, will be doing their soldiers an invaluable service by insuring that they and their unit derive the maximum benefit from individual training.

SAM A. BROWN
Colonel, FA
Deputy Commander
U.S. Army Training Support Center

How Fast We Forget

Dear Sir:

I was most surprised at the theme of the article, "A Commander's Training Center Experience," in your May-June issue. However, having been at the Armor School now for almost 6 months as an AOAC student, I find that several of the officers (including instructors) express the same negative comments about the lieutenants they deal with in the field and in garrison. I find the comments and the article very distressing, as I am sure the lieutenants who have read them do.

In my 7 years of commissioned service, the most rewarding times for me have been while working with young lieutenants. The lieutenant is what our service structure is really built around. Almost every lieutenant I have worked with has been highly motivated, very dedicated, and wanted to be a leader. He lacks experience, but it is the job of the company commander to ensure that he gets the proper exposure. He will trip and fall, and probably do it more than once. However, he will do it giving 110 percent, as long as his C.O. shows him the confidence and proper guidance when he does make errors.

I recommend that other officers who have negative feelings about our lieutenants reflect on their own experiences—the good as well as the bad. I firmly believe that if a person expects one to fail, he will. We owe it to these young officers to offer our experience and knowledge by giving them the best guidance directed through positive leadership, not by belittling their capabilities. These officers are a key to communication with the young men coming into service. If we do our jobs correctly, not only will these lieutenants maintain a pride in themselves and their service, but they will also communicate that same pride and enthusiasm to our troops.

ALLEN C. VELO
Captain, USMC

Tank Acceleration

Dear Sir:

Mr. R. J. Lucas' response to CPT McCaig's letter in your May-June issue of *ARMOR* titled "Comments on Ratios" offers an explanation as to why tanks have limited acceleration. CPT McCaig's observations concerning the need for greater tank acceleration and response is well taken and merits additional comments.

Track-laying vehicles are usually designed to provide a maximum sprocket-tractive-effort to vehicle-weight-ratio of 90 to 100 percent. This characteristic is greater than the normal track/ground traction or drawbar pull capability of tracks, which amounts to 70 to 80 percent of the vehicle weight. However, due to the peculiarities of the propulsion system, track-laying vehicles do not take full advantage of the ground traction potential that is available to attain far greater vehicle acceleration and response.

Theoretically, a tank should be able to develop an initial acceleration of .7 to .8 Gs when operating on fairly hard ground, but tanks and tracked vehicles worldwide, at best, demonstrate an initial starting acceleration of not more than .2 G. A significant number of these vehicles have an initial lag of 1 to 3 seconds from the instant full power is applied. The very best current tracked-vehicle performers are capable of accelerating from a stationary position to a speed of 30 kmph (18.6 mph or 27.3 ft/sec) within 6 seconds.

The main reason tanks are not as responsive as they could be is the high rotational inertia of the engine and power-train, which is at its highest point during the initial start of vehicle movement. This resistance is due to the combination of high torque ratio and rotational inertia of the moving parts of the engine, transmission, final drives, track, and running gear, and it may amount to the equivalent of several times the actual weight of the tank during the initial vehicle movement. Also, highly turbocharged engines develop considerably added power, but only after the turbochargers are fully activated by the exhaust gas energy. In addition, powertrain response is degraded to some extent by parasitic power losses to the operation of ancillary equipment.

Thus, in response to CPT McCaig's letter, the track/ground potential is there to achieve far higher vehicle acceleration than is currently demonstrated. What is needed is more careful attention to the mechanics of the complete power flow system from the engine to the ground.

JOSEPH WILLIAMS
Largo, Florida

Urban Combat

Dear Sir:

I read with interest the article by Major Carlson in the March-April issue on the topical subject of urban combat. I agree wholeheartedly with the author's emphasis on the need to regard the urban problem as a combined arms task. In both our armies, the elements of that approach are already well established, and the key to success probably lies more in rigorous training in a realistic environment.

On the question of neutralizing buildings, I would suggest that a HESH round (HEP to you) is vastly more effective than HEAT. I can assure you that the effect against masonry is nothing short of staggering.

Soviet practice in the use of artillery weapons for direct fire support goes beyond the use of tubed artillery. Certainly, during World War II, they used multiple rocket launchers in the direct role on occasions, though, unfortunately, I do not have access to the relevant reference.

D. C. EDWARDS
Major, Royal Hussars
Gunnery School
Royal Armoured Corps Centre
Dorset, England

Seeks Information for Military Encyclopedia

Dear Sir:

I am just starting this new project, the editorship of a massive encyclopedia which the publisher and I hope to make the definitive source for information on all aspects of things military. It will take at least 50 volumes over the next 12 years or so. We particularly want to emphasize the interrelationship of military with economic, social, cultural, and political affairs. But we will also include all aspects of professional and technical military affairs as well.

My most immediate need is help in contacting a wider circle of potential contributors.

Your support would be extremely valuable in my obtaining the participation of Army officers and civilian professionals.

While we plan to include the entire range of human history, the emphasis will be on the 20th century, (40 percent on all before 1900 and 60 percent on all after 1900). Insofar as possible, each entry will include a comment on the significance of the subject both at the time and for us as students today.

JOHN F. SLOAN
P.O. Box 1109
Springfield, VA 22151

Medium Tank Eliminated by Technology

Dear Sir:

The articles "Will the *XM-1* Revive the Heavy Tank Doctrine" and "Light Tanks" in the January-February 1981 issue of *ARMOR* serve to point out how misunderstood the tank still is. The tank was the technical answer to the tactical requirement of a mobile, protected, direct-fire weapon system. Technology was and still is unable to provide one vehicle to meet all tactical needs. The heavy, medium, and light tank are the result of technology limitations and *not* tactical requirements. Doctrine was devised to use these vehicles on the battlefield. The perfect tank would weigh nothing, have enough armor to defeat all enemy fire at any range, be able to go anywhere at high speed, make no noise during operation, mount weapons capable of defeating all targets, and be small in size. The medium tank has been eliminated by technology, but the light and heavy tank are going to be around into the foreseeable future. Let us ensure that technology is applied to war and not war to technology.

CHRISTOPHER F. SCHNEIDER
Staff Sergeant, Armor

Where Have All the Sergeants Gone?

Dear Sir:

I am responding to Mr. Bob Cisco's article, "Where Have All the Sergeants Gone?", in the May-June issue of *ARMOR*.

At the recent Armor Conference, General Starry stated, "Readiness is a state of mind." Service in the combat arms is also a state of mind. It requires a willingness to serve in a difficult and dangerous job with no civil application. In this regard, the Army has unintentionally "shot itself in the foot." In all my assignments, the perceptions of the civilian and military communities were that the combat arms soldiers and NCOs were "dumb" and "couldn't make it on the outside."

This is a result of believing that all that is required of these MOSs is the ability to pull a trigger. The U.S. Army Recruiting Command has sold the Army as a job that almost always has civil applications, thus furthering the above perceptions. The Army has also fostered this concept by allowing the support types to become *prima donnas* in some instances. In one unit, while tankers (and maintenance personnel) were working long hours in the field, the clerical types were working from 0730-1600 even though paperwork was behind and of poor quality.

There is no glamour to serving in a ground combat unit. The Arborne, Ranger, and Special Forces units are praised as the elite of the Army. They may well be, but they are so small that I think their contribution may be negligible in a European war. They are paid $55.00 a month for jump pay. I maintain that maneuvering and firing a tank exposes the average tanker to more danger than the average airborne soldier. It is well known that the bulk of the fighting in the next war will be done by armor and mechanized infantry units. Let's glamorize them and recognize the danger involved.

Let's educate the Army and the civilian populace regarding the complexity of the skills that must be learned by our combat arms soldiers.

As for reclassifying NCOs to the combat arms—let's shelve that until it is absolutely necessary. In my last tour in Germany, while serving as a first sergeant, my two worst NCO problems came from two reclassified NCOs. These people usually do not want the combat arms and, therefore, are poor performers.

I also feel that the NCO candidate course is not the answer. During Vietnam many platoon leaders felt at a loss because the NCOs were no more experienced or knowledgable than themselves.

Promotion to E-8 should be expanded in the secondary zone. My own case is an example. Having been selected in the secondary zone for E-8 with 15 years of service, the Army knows (with some certainty) that it has me for at least 5 more years and a complete tour in Europe as a first sergeant. Conversely, many NCOs are selected at the 18-year mark, stay for their "lock-in" and retire. I can think of about 4 NCOs in this category.

Another area that needs to be looked into is the process of notifying the NCO (E-6 thru E-9) of being on levy for Europe. In my own case, I was not notified of my ultimate assignment officially until about 60-70 days from my availability date, and then only because of pressure from the office of the Sergeant Major of the Army. When received, the assignment instructions had the wrong Army Post Office number and unit identification code. If you talk to many NCOs, you will find that this, or similar aggravations, are so common that they are expected. Poor sponsorship programs in units in Germany also contribute to this dread of orders for Germany.

Why do we not investigate the feasibility of 1st Personnel Command sending the E-7 and E-8 vacancies by unit to Military Personnel Center? There, a name could be matched with a unit, the NCO notified, and, in cases where the individual is eligible for retirement, a phone call made to see if the NCO will go or retire.

The personnel or administrative types should develop a standard sponsorship model, and command emphasis should be placed on it to reduce the trauma of relocation to Europe.

I think the recent proposal for special duty pay for tank commanders, platoon sergeants, and first sergeants may be a step in the right direction, but I still feel that a lot of intangibles, some of which I have mentioned are close to the key.

Also, we must again have NCO academies to instill high standards and teach leadership. The NCO Professionalism Program must be given time on the company training schedule, and the first sergeant must "grab the bull by the horns" and train NCOs to be NCOs before the institutional memory retires. Marginal NCOs must be brought up to standard or reduced to their level of competence. Too often they are sent for duty in the dependent youth activities, theater, or craft shop with no action taken, and the good NCO is still caring for his troops and riding in the rain.

I realize that I have not offered any real solution to the problem, but maybe some food for thought. I can think of no quick fixes for our problem.

RICHARD A. TROTTER
Sergeant First Class, USA
Senior Enlisted Advisor
Fort Sam Houston, TX

Seeks History of Pershing Rifles

Dear Sir:

I am writing a detailed history of the National Society of Pershing Rifles. This organization is a Reserve Officer Training Corps honorary founded in1894 in honor of then Professor of Military Science and Tactics at the University of Nebraska, 1LT John J. Pershing.

I work for the National Headquarters of the present organization, and they estimate that over 75,000 former members are alive. Some of these members are now active or reserve officers and enlisted personnel. I am interested in contacting former members, who were active at any time since its founding or anyone else having information on the organization. I am interested in both personal experiences and historical information. All loaned materials will be returned.

Write me at 1826 A St., No. 5, Lincoln, NE 68502.

KEVIN M. BORN
Cadet, Army ROTC

Someone Has to Man the Cupola

Dear Sir:

In my May-June issue of *ARMOR,* I was immediately drawn to the article entitled... "Where Have All The Sergeants Gone?" There seems to be something pertinent here that hundreds of personnel specialists have been overlooking for decades.

Your first point in the article is that the armored community is very short of soldiers to fill the required strengths according to TO&E. As time goes by and nothing is done about this, the shortage of E-7s will become critical, because you don't retain enough E-5s and E-6s to promote to E-7. Those who stay and are promoted will be of somewhat lower caliber, simply because the Army will be forced to promote them in order to maintain the structure. Promoting from E-4 to E-5 will not solve the problem—nor will reducing the grade of the tank commander to E-5. In practice—in the *real* armored units in USAREUR and CONUS—*Many TCs are already E-5s*. Somebody has to man those cupolas, and one E-6 can only supervise maintenance on one tank at a time—he can't ride two of them into battle. When we go to war, the survivor will find the rank pins of young E-4s and E-5s littering the "modern, high-intensity battlefield"—right along with those burnt-out American tanks.

Don't blame the four-man crew concept for the Army's problem. Adding a fifth man to a tank crew only allows the unit to request a higher replacement and turn in higher "under strength" figures at the end of the month.

The benefit of promotion that you point to in the article can also be pointed to as a liability. If you promote men from E-4 to E-5 before they are ready, they make damned poor buck sergeants in an Army where handling younger soldiers requires a bit more wisdom than it used to. Experience in the "ways of the Army" and in personnel management cannot be given to a sergeant when you give him his first set of stripes. He has to learn the skills.

Let us now take a look at the USAREUR problem. Retirement-eligible personnel would rather get out of the service than face another round of the "Germany-hassels."

The problem of MOS migration is a much more complicated one to solve, but can be attributed to the recruiting styles we have adopted in order to fill the quotas for the volunteer Army. Soldiers are not enlisted for the hardships of a tanker—they are enlisted for schools and MOSs that suddenly aren't available at the end of basic training. Tank computers don't look or function anything like the computers he was told he might be working on by that slick recruiter in Hometown, USA.

The four measures you mentioned as solutions to the problems will not solve the problem. Changing your structure to accommodate the force levels is just as bad as "lopping off the fifth man on an *M-48*." The NCO Candidate Course is just a quick-fix that will give you an armored corps full of "shake and bake" sergeants. Ask any first sergeant why they call them "shake and bakes." Involuntary reclassification has been tried before and has turned out some of the sorriest tank NCOs that I have ever seen. Supply sergeants and clerks get disgruntled even more quickly than a trained tanker. Your force levels will continue to drop.

Reducing attrition from MOS changes and discharges will solve your problem, and it is the only long term solution to the problem. You will have to increase the incentives if you expect soldiers to withstand the hardships of combat arms—Pro-Pay, more housing for families, full payment of reasonable travel allowances when soldiers relocate, lengthening CONUS tours, choice of duty station (at least in CONUS), tax-free pay for soldiers, increased leave time for combat arms, extra pay for field duty and field training, and so on.

The Army taught me a great deal, but it also taught me that there was more to life than what could be found in a tank turret in some damp German forest.

LARRY L. BOST
ex-Staff Sergeant, Armor

Boresight Theory Tested

Dear Sir:

Since publication of my article, "Boresighting and Zeroing," in the March-April 1981 Master Gunner's Corner, I have had the opportunity to put some of my thoughts to the test.

During May-June 1981, this battalion attended its Annual Training at Fort Irwin, CA. During that time we fired Tables VIA & B, Table VIIC, and Tables VIIA & B. Additionally, we conducted a carefully structured boresight and zero exercise before firing Table VI.

The boresight and zero exercise was fired using the sequence published in the tank operator's manual and a locally-produced checklist. The exercise was carefully supervised by all leaders and the battalion's master gunner. With the exception of one tank, which had a defective fire control system, all tank main guns were zeroed with an average of 4.25 rounds per tank. Zeroing was done with *M-724A1* target practice, discarding-sabot (TPDS) ammunition.

As I mentioned earlier, zeroing with TPDS is a difficult task, particularly in the dust and heat of Fort Irwin. We used a commercially-produced 20-power observation scope and the JVC ¾-inch TV training (TVT) system with a 500-mm lens to assist in scoring. Both systems were successful, but particularly the TVT with its ability to provide "instant replays" (see *Armor*, May-June 1977).

Another factor that seemed to benefit the zeroing exercise was the use of 12 x 12-foot zero panels. A recent TRADOC report, "Concept Evaluation of Battlefield Boresight Techniques and Zero Retention," strongly recommends larger boresight panels. This report states, "In no case was a zero target smaller than 12-ft square justified by the criterion of cost effectiveness."

The premise for using larger zero panels is two-fold. Initially, hit performance of *M-724* TPDS, when fired from a standard boresight is substantially lower than when fired from a muzzle boresight. Secondly, there is evidence to indicate some degree of ballistic "mismatch" between *M-724* TPDS and *M-392* armor-piercing, discarding-sabot (APDS). In the simple fire control systems of the *M-48A5* and *M-60A1*, the only fire control solution available is for *M-392* APDS. I feel that these two factors, when combined, more than justify the added cost of larger zero panels.

Our next big test arrived 6 days later when we attempted to confirm our previously recorded zero, before firing Table VII. In summary, all but one tank was able to confirm using two or less rounds. As it turned out, the one tank that had difficulty had simply failed to record their zero!

I feel that the ability of this battalion to conduct efficient and accurate boresighting and zeroing has improved many times. We have successfully demonstrated the need to treat boresighting as a precision task and not something we "just have to do." Our tank crews have gained new confidence and understanding of the established zero. In short, they are better tankers, and maybe the are just a bit "above average."

GEORGE W. SMITH
Captain, Armor, CALARNG

Wants to Trade Band Music

Dear Sir:

I'm not in any service, but perhaps there are readers who like military band music and would like to trade tapes.

In my collection, I have nearly every band that ever recorded. I have more than 2,000 marches by such bands as U.S. Services, Sousa, Goldman, college, and high school; and Canadian, German, and English bands, such as the Canadian Ordnance Corps, *Deutchmeister,* Queen's Royal Regiment, Canadian 22d Regiment, Berlin Guards, Aldershot Massed Bands, etc.

If anyone is interested, write me and I'll be glad to respond.

S. ROSEN
Box 181-T
Toronto 19, Canada

Comments on Advanced Course

Dear Sir:

I'd like to pick up on MG Wagner's (May-June issue, p. 6) suggestion soliciting comments from the field on the content of the Armor Officer's Advanced Course.

If 8 hours can be allotted to Armor Operations in World War II, 6 hours to Arab-Israeli conflicts, and 4 to World War I and the interwar period, then how about 10 hours or so specifically on Armor and Cavalry in Vietnam and Cambodia? GEN Donn Starry's "Mounted Combat in Vietnam" would make a fine point of departure for readings and seminar discussion, especially on key engagements such as those during the February 1968 Tet Counteroffensive.

Regardless of what one may think of the performance of our foreign policy makers during the Vietnam conflict, history records that our tankers and cavalrymen there performed admirably. They faced one of the toughest and most determined foes in the history of American arms.

Simply because the final outcome was a defeat for our ally, we must not foster willful ignorance of the many techniques which proved useful in Vietnam. We owe the younger generation of Armor leaders valuable lessons learned there, paid for in blood.

ROBERT P. FAIRCHILD
Major, GS, NYARNG
ARNG Advisor
1st Cavalry Division

Wants the Black Beret

Dear Sir:

I would like to address the issue of the black beret.

I believe that armor personnel should be authorized to wear the black beret because:

- Our NATO allies issue the black beret to armor personnel as recognition for their particular specialty,
- It has been used by armor personnel since long before the Rangers thought of it,
- The infantry has the combat infantryman's badge, while Armor has nothing.

The Armor branch has represented the Army and the United States as a whole in a way the infantry never could. The cavalry should be considered an elite force for the mission it performs, one for which it is rarely thanked.

MICHAEL P. BURKHARDT
Specialist 5
Cincinnati, OH

English Language Instructors Sought for Korea

Dear Sir:

The Republic of Korea Army Administration School is reorganizing its English language program and establishing an Army English Language Institute in Seoul, Korea. Suitable instructors for the English Language Institute are needed. Retired military officers are desired; however, all qualified applicants will be considered, including spouses. Retired military personnel should consult AR 600-291 for waivers required before employment by a foreign government. Applications or inquiries should be addressed to:

ROKA Administration School
c/o Army Section
JUSMAG-K
APO San Francisco 96302

Seeks Articles for Magazine

Dear Sir:

ARMOR is certainly an impressive magazine. You are to be complimented upon its total makeup and content. I have a somewhat sentimental feeling in this connection because, as a young Infantry Reserve Officer, I was a member of the inactive Regular Army 17th Tank Battalion (Heavy), headquartered at Camp Meade, MD, in 1927 and 1928. I enjoyed several periods of active duty with this "ancient" *Mark VIII* heavy tank outfit, and, as a graduate mechanical engineer, became interested in tanks in general. While my WW II service was as S-4 of the 4th Engineer Special Brigade in the Southwest Pacific, and later as an Air Force aeronautical engineer, I have always retained an interest in the Armored Forces. Unfortunately, we have had no papers on the logistics support of armor in our journal.

Perhaps you or some of your associates at the Armor School would be interested in preparing such a paper for possible publication in *The Logistics Spectrum.*

LOUIS C. ROSENSTEIN
LTC (Ret) USAF
Managing Editor
The Logistics Spectrum
810 Forest Hills Drive
Elkins Park, PA 19117

Thanks to the United States Armor Association

As a member of the National Sponsoring Committee of the Vietnam Veterans Memorial Fund, I wish to thank you for your generous contribution. Your support of this special cause is a true expression of gratitude and honor for the service and sacrifice rendered by those who served in the Vietnam War. With best wishes,

Sincerely,
Nancy Reagan
The White House

The U.S. Armor Association contribution was $1,000. See news note on page 56. Ed.

Armor Ball

Tankers and Cavalrymen in the National Capitol Region will celebrate the 205th anniversary of Armor with a Ball on 7 November 1981 at the Bolling Air Force Base Officers' Club. Master of Ceremonies is MG William Webb. Dress is formal. The menu features a selection of prime rib for $15.95 or veal cordon bleu for $14.25. Speeches, door prizes, entertainment, and dancing will highlight the evening's festivities. All Armor officers are cordially invited to attend. Contact LTC Norm Beatty (202) 325-6341/9696 for information and reservations.

COMMANDER'S HATCH

MG Louis C. Wagner, Jr.
Commandant
U.S Army Armor School

The Basic NCO Course

This month, as part of my continuing series on training conducted at the Armor School, I would like to tell you about plans for a new Basic Noncommissioned Officer Course (BNCOC), which I see as a key to future Armor readiness.

On the battlefield of the future, our tank commanders, squad leaders and section leaders will have to be more than just weapons and equipment experts, they will have to be highly trained vehicle commanders and trainers.

To prepare for the Air-Land Battle of the Eighties, we will need competent, dedicated NCOs who can lead their men, train their men, and direct both men and machines to function at maximum capability in combat.

Our tank commanders and armored cavalry vehicle commanders will be in charge of increasingly complex and expensive weapons systems. The *M-1* tank commanders and CFV commanders, you must remember, are in charge of fighting systems that cost nearly as much as a current scout helicopter and require a similar degree of training for the commanders. Right now, at the Armor School, we're developing an improved Basic Noncommissioned Officer Course designed to train soldiers to be both equipment experts and expert leaders, key NCOs who "can do it all."

I am convinced that we can succeed. Although we face a decade of increasing threat, we *have* the weapons systems to counter it. Now we need the well-trained NCOs who can wring the last ounce of design performance from these machines. Our new BNCOC will be the first step of many toward improving NCO training.

Soldiers attending the new BNCOC will find themselves immersed in the intense, 24-hour-a-day learning and leadership setting of a Noncommissioned Officer Academy environment. The live-in course will be 4 to 6 weeks long, and local commanders will continue to have the option of adding an additional week of training to meet local needs.

The Battalion Training Management System (Trainer's Workshop) will continue to be part of the new course, but will be beefed up. More emphasis will be placed on training the NCO to be "the trainer."

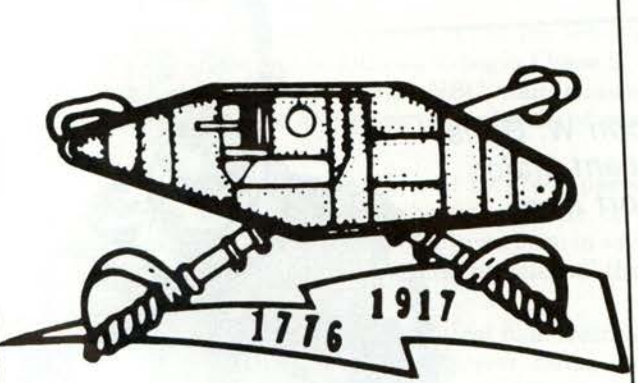
In order to be graduated, each NCO must successfully complete a comprehensive, performance-oriented, end-of-course examination. This test will insure that the NCOs completing the course have all been trained to a standard level of performance.

In addition to identifying and training NCOs who can command, shoot, and maintain a tank, and are able to train others to work together as a cohesive crew, the course will also identify soldiers who do not make the grade.

To be qualified to attend the course, soldiers should have mastered the Skill Level 1 and 2 tasks of their MOS. Upon arrival at the course site, each NCO will be required to undergo diagnostic testing on lower skill level tasks, not for the purpose of weeding out failures, but to identify each soldier's weak points so that he can receive additional training on his own time before retesting. The soldiers will also be pretested on selected core tasks. Soldiers who do well on this phase of testing will be identified as potential peer and assistant instructors, further stressing the train-to-train emphasis of the BNCO Course.

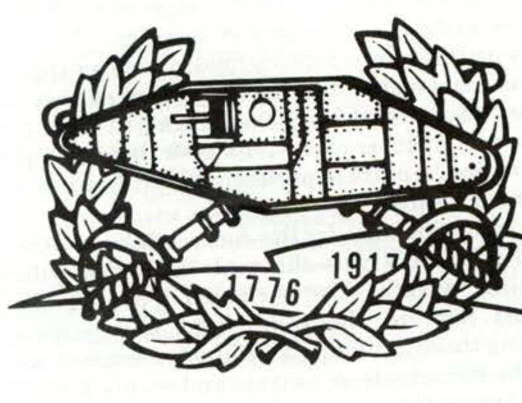
But let's back up a moment and look at the new course the way the aspiring vehicle commander will see it.

The first phase of the course—6 to 8 days—will include the diagnostic testing of Skill Level 1 and 2 tasks, the pretest on core subjects, a diagnostic PT test to determine the physical condition the soldier is in as he begins the course, and a train-to-train module. This



Proposed Armored Force Badge

"The Armored Force Badge would be a specific distinguishing mark of the tanker and Armored reconnaissance soldier. In line with tradition and modern training procedures, this soldier has undergone the extensive training and skill developmental processes which are designed to prove him worthy as a tank or scout vehicle crew member. The badge would be authorized for all currently serving branch-qualified Armor and Cavalry officers, all senior noncommissioned officers at SL5 for which no SQT has been developed, junior officers upon completion of the Basic Course, and enlisted men in SL2 through 5, upon obtaining a score of 80 on their SQT test. Initial award of the badge would be permanent. It would equal in precedence the Expert Infantry Badge and be worn in the same manner on the uniform."



Proposed Combat Armored Force Badge

The Combat Armored Force Badge would be a replica of the Armored Force Badge surrounded by a wreath. It would be awarded under the same criteria as is the Combat Infantry Badge, be equal in precedence, and be worn in the same manner on the uniform.

"The Combat Armored Force Badge would greatly enhance the pride and motivation of Armor and Cavalry soldiers who will be called upon to provide the major part of the combat power on the modern battlefield."

In forwarding the proposal to the Commanding General of the Training and Doctrine Command, MG Wagner stated in his letter:

"The leadership of Cavalry and Armor from at least 1833 has seen the need and sought approval for a distinctive insignia/badge. The evolution of Armor as the dominant force on the battlefield; historical recognition, worldwide, of 'heroes of Armor', such as Generals Chaffee, Patton, and Abrams; and the importance of the Armored Force in future planning of the US Army with the *Abrams* Tank, Cavalry Fighting Vehicle, and Division 86, continue to state this need for a distinctive badge. In fact, it is more than a need, it is conclusive evidence of a requirement."

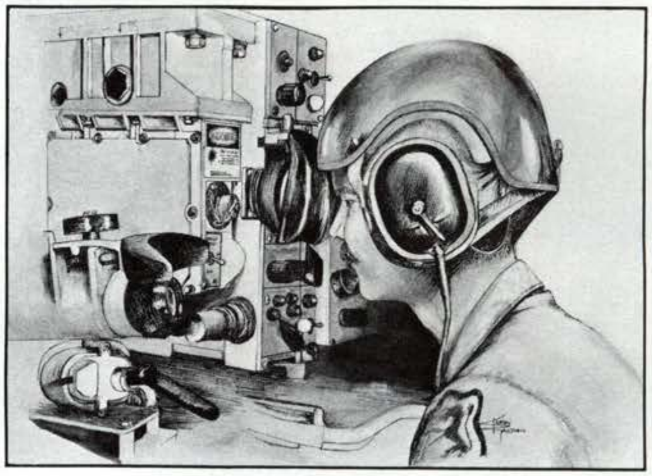
The design of the badge may be familiar to many who have served at Fort Knox. It was developed at the Armor Center in 1977, although for a different purpose. Many other designs were considered, but it was determined that the design as proposed would best represent the Armor Force. Despite our stated preference for this design, we have stressed in other communications that the design is of *secondary importance*. Our goal is to get the Armored Force Badge *approved* by the Department of the Army. We believe it is critical to the success of this goal not to get "wrapped around the axle" on the design. That can be resolved after the Armored Force Badge concept is adopted.

We have made this same point concerning our recommendation that awarding the Armored Force Badge be tied to a score of 80 or better on the SQT. Obviously, we feel that is the way to go, as it ties awarding of the badge to a high level of individual achievement in training and reinforces the entire Skill Qualification Training/Testing Program. However, this, too, is secondary to approval of the badge. Additional criteria for awarding it can also be decided after adoption.

In researching material to draft the proposal for the badge, I was amazed to discover that, on several occasions during the past *99* years, such a proposal had been recommended to DA. The initiatives of the Chief of Staff of the Army concerning unit cohesion; the recent approval of four new awards; and current DA practice to work closely with and *listen to* the field—all of these suggest that the time is right in our Army for submission of this proposal. We now have tried for 100 years. It's time we succeed.

John W. Gillis

MASTER GUNNER'S CORNER



WO2 Albert Hogg
British Exchange Instructor
Weapons Department
U.S. Army Armor School
Fort Knox, KY

How To Use the Muzzle Boresight

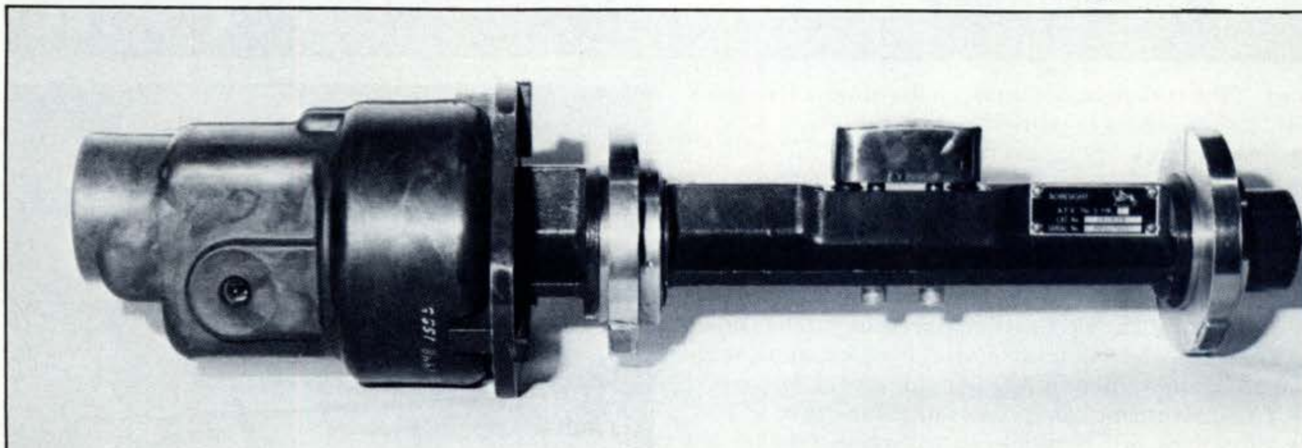


Figure 1

A misconception common to tank crews is that boresighting is used only as a means of getting the first round on target, so that zeroing can begin in earnest. Unfortunately, this has allowed errors in the boresight procedure to go unnoticed and boresight loss and zero loss to be classed as one and the same.

Now that boresighting is to be employed as the sole input to the fire control system, the necessity for an accurate adjustment becomes essential.

The Pye Watson device, hereafter referred to as the muzzle boresight, is to become a standard item within the U.S. Army. Currently, the planned authorization is two per platoon.

The muzzle boresight is simple to operate and rugged in construction. The device, shown in figure 1, is basically a 7-power telescope with a right-angle eyepiece on the side, mounted on the end of a rigid beam, to which are attached two foot rings, and a spring-loaded locating block. The foot rings and locating block enable the beam to be held securely in the muzzle of the gun. They are interchangable, and are sized to suit the caliber of the gun. The reticle consists of a ring with a 0.15-mil central dot. The dot defines the axis of the bore at the muzzle end, and there is no internal sight parallax, due to the reticle being erected on the same optical plane as the target image, nor is there any necessity to refocus the eye from reticle to target.

Having completed the normal preparation prior to boresighting, the tank commander inserts the boresight into the muzzle with the locating block in the 12 o'clock position (figure 2). With the gunner operating the elevating and traversing controls, the tank commander sights through the boresight (figure 3) and directs the center dot of the reticle into coincidence with the aiming point, making sure that the final movement of the gun is one of elevation.

At this stage, the gunner refers his *M-32* sight using the boresight knobs, and slips the scales to 4 and 4. The tank commander now insures that the correct referral has taken place. This is achieved by informing the gunner to traverse and elevate off the target, and then use a G pattern to relay his aiming cross on the aiming

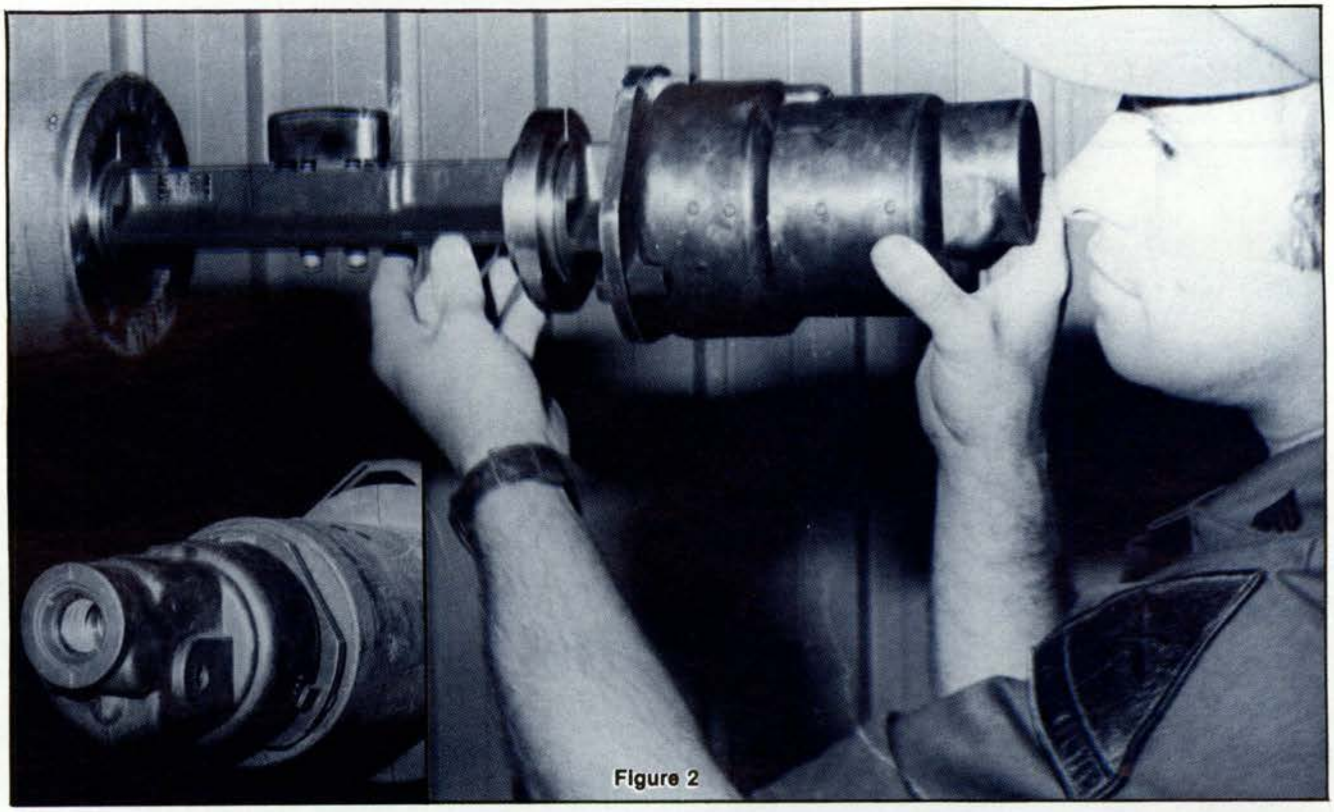


Figure 2

point. If the boresight dot is not on the aiming point, one of the following has occurred:

- The gunner's lay is inconsistent.
- The gunner has made an incorrect adjustment.
- The fire control equipment is faulty.

Once the tank commander has achieved the correct adjustment, the boresight is removed, rotated through 180 degrees, and repositioned in the bore, (figure 4). This will ensure that any eccentricity present will be shown by the reticle dot being displaced from original alignment. This movement of the dot can be due to:

- The instrument being out of adjustment.
- Movement of the reticle on inversion because the muzzle of the gun is oval or bell-mouthed.

Another adjustment is carried out using the previous procedure with the muzzle boresight (figure 4) and will give another set of readings. From these, the tank commander can calculate the mean readings.

	Elevation	Deflection
First Readings	4.0 mils	4.0 mils
Second Readings	3.8 mils	4.2 mils
Mean Readings	3.9 mils	4.1 mils

Note. If the boresight dot has moved more than 1 mil on rotation, the device is outside usable tolerance and should be turned in for adjustment.

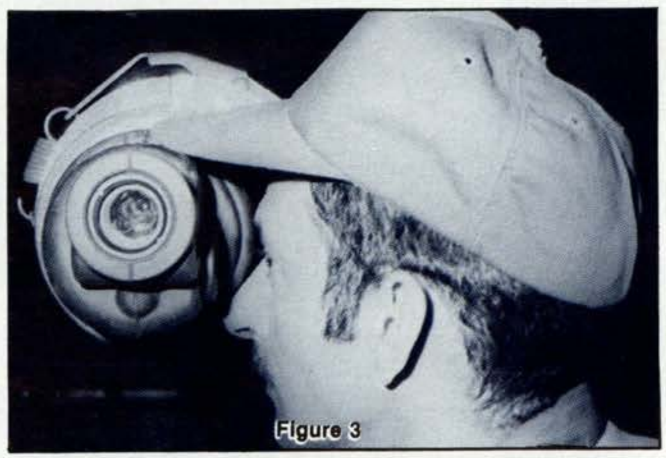


Figure 3

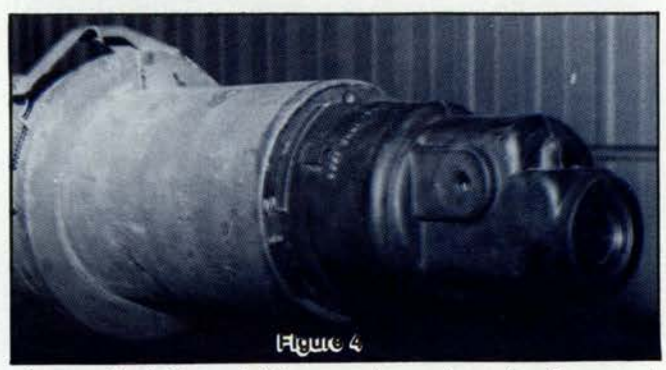


Figure 4

As the movement of the boresight knobs takes place, the tank commander should position himself in such a manner as to be able to note that the gunner is moving the knobs in the correct manner.

This procedure may seem long and drawn out, but the results are worthwhile. Extensive testing by the U.S. Army Armor and Engineer Board at Fort Knox has shown that boresighting, not zeroing, is the most important step in preparing to fire, in order to obtain the best possible hit performance.

Furthermore, the process releases larger amounts of training ammunition to be expended in a manner more supportive of combat proficiency than the individual zeroing process provides.

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 52)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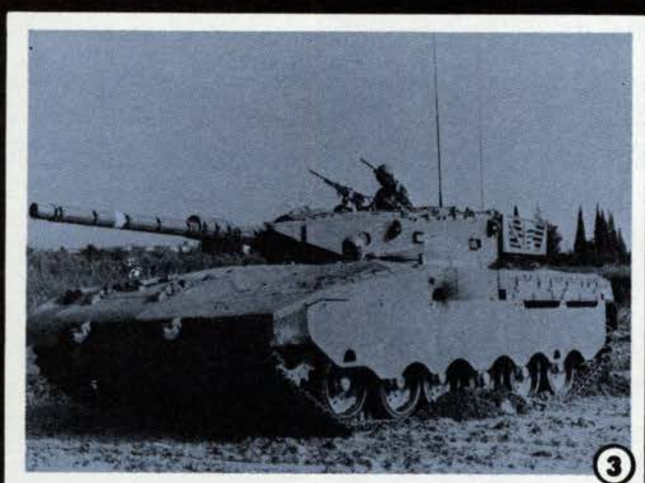
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Abrams Update

by Colonel Frank L. Day
Former TRADOC System Manager for the *Abrams*

The principal objective of the *M-1* tank program is to field a tank system that meets the Threat of the 1980's and beyond. The *Abrams* seeks to do this through major improvements of survivability, mobility, firepower, and RAM-D (reliability, availability, maintainability, and durability). The program continues to enjoy encouraging success.

Today, the *M-1* tank program is in low-rate initial production; if all goes well, it's the last stage before full-scale production and deployment.

The *M-1's* initial operating capability (IOC) was attained with completion of crew training for the first CONUS company-size unit at Fort Hood, Texas, in January 1981; the first institutional training for the *Abrams* began at the Ordnance School in February 1981.

Unfortunately, we've had to set back the training program at Fort Knox and the start of Europe new equipment training, because of tank production delivery delays. Basic Armor training for the *M-1* began at Fort Knox in May 1981. The tanks for the European new equipment training team (NETT) left for Germany in June. The NETT will head for Vilseck in early fall to begin training a cadre at the Seventh Army Training Command's Combined Arms Training Center.

Developmental testing, now about 65 percent complete, includes such sites as Aberdeen Proving Grounds, for major reliability, availability, maintainability, and durability testing; Yuma, Arizona, for desert tests; Eglin Air Force Base, Florida, and Alaska's Cold Region Test Center, for cold room and arctic environment testing; and White Sands Missile Range, New Mexico, for electromagnetic radiation and nuclear vulnerability testing.

Operational Test III (OT III) began at both Forts Knox and Hood in September 1980. The Fort Knox phase of OT III is a 4-tank test designed to obtain data to assess the reliability of the *M-1* tank in an operational environment. Information on availability, maintainability, and powertrain durability is also being collected. The purpose of contractor shakedown tests that preceded the start of Fort Knox testing was to provide early warning of problems in the production process and to allow prompt corrections.

Following a brief modification period for correction of faults found in the shakedown test, the Fort Knox phase began on 15 September 1980. This test was designed in two phases, each accumulating 1,500 miles, included performance of a semi-annual service, and was followed by a 250-mile shakedown trial to verify the completeness of the service performed. A modification period was scheduled to bring the configuration up to date. This test cycle is then repeated.

The Fort Knox test entered Phase Two in January 1981, and was completed in May. As of 8 May, the tanks were driven 12,557 test miles and had fired 2,592 rounds.

The Fort Hood test is designed for a battalion-level operation and concentrates on the collection of data to evaluate firepower, transition training, maintainability, and logistics supportability.

Training was provided at and by the Ordnance School in early 1980 to DS/GS mechanics of the 27th Maintenance Battalion from Fort Hood. Organizational mechanics were trained at Fort Hood prior to the start of the company cycles. This allowed each company to maintain their own equipment during training. A command and staff course was provided to key personnel prior to the start of testing; pre-diagnostic testing and training as required on transferable *M-60* skills was accomplished by the test battalion. The Fort Knox New Equipment Training Team also performed diagnostic testing to establish a baseline for training effectiveness analysis. Crew training was accomplished in company-size units in order to maintain unit integrity.

Individual tank precision firing and platoon live fire exercises were conducted to determine if the tank had lost any performance in going from prototype to production configuration. The emerging results of these firing test are quite satisfactory.

In late March, the third company completed its new equipment training with the qualification of all its crews.

The test to date has accumulated 25,437 test miles, fired 7,583 rounds, and completed a 3-day trial field training exercise. As a wrap-up for OT III, the battalion went on a very demanding 6-day field training exercise specifically designed to measure the adequacy of operational and logistical support of the *M-1* tank battalion.

The *M-1 Abrams* tank has been well-received by the soldiers of 2/5th Cavalry and the 27th Maintenance Battalion. We have not encountered the major system problems we found in OT II. There have been problems with initial delivery vehicles that seem to be due to production quality and process control errors. An intensive management effort orchestrated by the program manager, MG Duard Ball, has achieved significant improvement in tanks received from later production.

A final assessment of the effectiveness of the training program for crews and organizational mechanics is being conducted by the Armor Center and TRADOC System Analysis Activity (TRASANA) to discover and incorporate the lessons learned form OT III prior to export of the NETT package.

Crew survivability has always been the number one priority, and we are quite pleased with the performance of the system in this area. Firepower, as stated previously, has been very impressive. The agility of the tank is, in a word, "amazing."

There are, in fact, only two areas of concern: range and logistic support—specifically the test measurement diagnostic equipment and troubleshooting procedures.

For cruising range, a shortfall of 20-25 miles from an objective of 275 miles has been seen in the production tank. This is generally attributed to the corrective action that reduced the track throwing experienced in Developmental and Operational Tests (DT/OT) Two. Field experience is showing that the soldier can operate the *Abrams* safely at high speeds, and, at higher speeds, the turbine operates more efficiently. It is possible that, by increasing the test speed from 25 mph to only about 27 mph, a 275-mile range would be demonstrated. More importantly, our experience indicates that the tank can meet its 24-hour operational profile with a single refueling. It does require a disciplined use of engine idle time.

We have had problems in the past with test sets and test equipment. Seven unsuccessful OT/DT II test sets were replaced in OT/DT III by three new ones, and these sets and their supporting software are simply not yet mature. High priority programs are underway to improve and debug test set firm ware, to correct the supporting manuals, and to refine training in troubleshooting procedures. A special TRADOC-DARCOM task force has been established to assess and correct this problem as rapidly and thoroughly as possible.

Reliability, availability, maintainability, and durability (RAM-D) continue to attract interest. The RAM-D performance of *M-1* is being measured extensively. The details of each unscheduled maintenance incident is recorded by the tester, assessed and scored by a scoring conference of materiel and combat developers.

The scoring conference met in May and June to assess incidents from the completed operational tests at Fort Knox and Fort Hood, and the continuing developmental test at Aberdeen Proving Grounds.

Based on the March results, of the 13 parameters being assessed, 9 have either been met or are likely to be met by the end of testing. Two parameters are below final requirement. System reliability is 11 points below the requirement of 101 mean miles between failure. However, the recent series of modifications seems to have been very successful, and this parameter may show improvement at the next conference.

Maintenance ratio is about 25 percent higher at this time than the requirement. To a considerable degree, this reflects the lack of maturity in the test sets and troubleshooting procedures. Other factors include lack of experience with the equipment and the procedures for maintaining it. Favorable trends are seen here as our soldiers become more familiar with the equipment and as software improvements are made to the troubleshooting procedures.

Powertrain durability and track life will probably not be met by the end of the test. For powertrain durability, the requirement is to demonstrate a .5 probability that the tank will operate 4,000 miles without requiring replacement of an engine, transmission, or final drive assembly. This is a tough requirement for a new tank system and is equivalent to *M-60A3* with the rise engine, the current world's champ in this category. Although the results to date give only a .27 probability, I believe the *M-1s* coming off the production line today have the required durability. The several early failures have not reappeared, but there are just not enough test miles left to demonstrate the goal in OT/DT III.

Apparently, it is not within the state of the art of track development to meet the track life requirement of 2,000 miles on a vehicle as robust as the *Abrams*. Major emphasis is being given to the development of new track technology, but, if any

of you have promising ideas, I know lots of engineers eager to listen.

State-of-the-art is also of interest to our training developers, but, with Armor devices, we feel more left behind than held back. The driver trainer and turret organization trainer are two state-of-the-art training devices being developed for the *M-1*. These two have recently arrived at Fort Knox for testing.

The driver trainer station features a visual system viewed through the center vision block only. Tank noises and audio instructions are provided through a simulated intercommunication system. The visual display is responsive to the driver's accelerator and brake, but not to steering commands.

This trainer will be used at the institution to teach basic armor trainees normal and emergency procedures of driving.

The trainer has an instructor's console with two instructor positions to control and monitor students; and a capability to print a record of each student's performance. All trainers can be programmed for the same exercise, separate exercises, or through use of an auxillary instructor's station at the rear of the driver's station, one-on-one instruction can be provided as necessary.

The prototype was delivered to Knox in March of this year. OT II is scheduled for June and July. Delivery of the first production model is scheduled for December 1982. Seven trainers will go to the Armor School and one to the Combined Arms Training Center at Vilseck. (Note: Target unit hardware cost is $3.26 million.)

The *M-1* turret organizational maintenance trainer (TOMT) consists of two major parts. The programmable maintenance trainer is a trouble-shooting device with a dynamic simulation display panel of the *M-1* tank turret system. It consists of the display panel master control, visual projection system, computer, printing unit, power supply, and a communication device. The trainer allows the instructor to program a minimum of 35 different system malfunctions. The printer at the instructor's console will print for each particular maintenance task formed, the trainee response, total errors, and length of time it took to perform the task. The device will also enable an instructor to teach a group of students proper maintenance procedures, as well as to demonstrate the system's operation and interdependence.

Part two of the trainer is a simulated turret, configurated like the interior of the *M-1* turret—the tank commander's station, the loader's station, and the gunner's station.

The turret allows a trainee turret mechanic to perform inspection, installation, remove components, and perform other organizational maintenance procedures associated with the *M-1* turret.

Prototype delivery was made to the Armor School in February 1981, and the OT II is scheduled for March through May 1981. The first production unit is scheduled for August 1982, with 16 scheduled for Fort Knox and 2 for Vilseck.

The unit conduct of fire trainer (U-COFT)for *M-1* is blazing the development trail for the *M-60A3*, IFV, and CFV. Chrysler and General Electric are developing prototypes for acceptance testing at Fort Hood, Texas, this summer.

The U-COFT will be used at battalion level primarily to sustain proficiency of gunner and tank commander between annual qualification periods. All trainers will be capable of training the operational procedures of target acquisition/identification and engagements, using both primary and secondary fire control, and all sighting equipment can be simulated. To provide a proper battlefield environment, the modes of operation will include stationary and moving simulation of the firing tank and target, single and multiple target arrays, day and night, reduced visibility conditions, and NBC environments. An instructor station will provide the capability to monitor the crew's performance, induce malfunctions into the fire control system, and provide a hardcopy printout of performance data. Units will be housed in a rigid shelter not requiring elaborate classroom facilities.

Design reviews for the IFV, CFV, and *M-60A3* series U-COFTs were scheduled for July and again in September 1981.

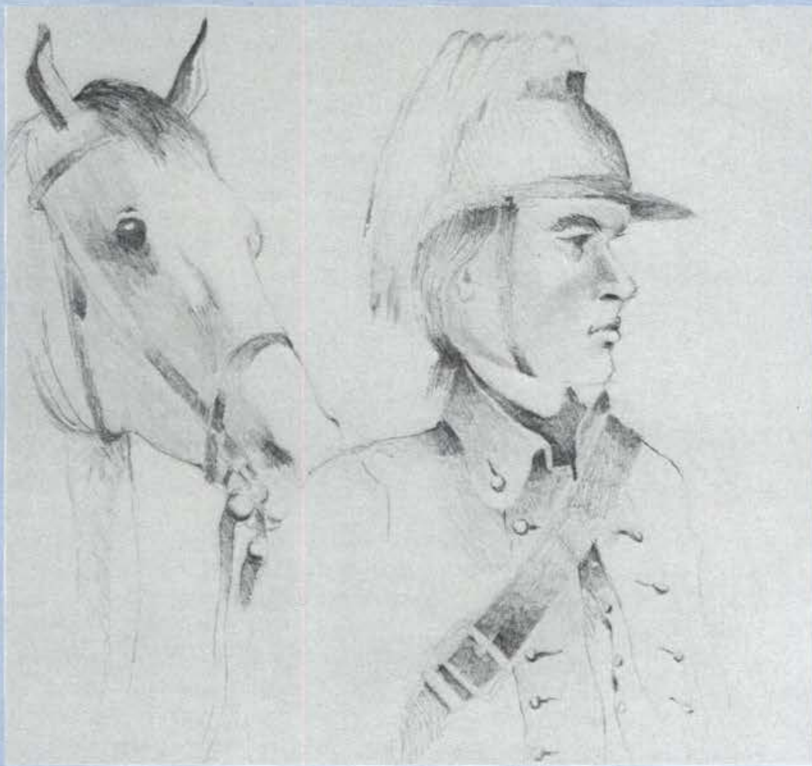
First unit production is scheduled for March 1984. Seventy-eight units are being programmed for the *M-1* U-COFT: 37 in USAREUR, 31 in FORSCOM, and 10 at the Armor School.

The development program for a 120-mm gun version of the *Abrams* is targeted for first production in August 1984. The program is designed to provide the growth potential needed to meet threats likely to evolve in the late 1980's, to do so at minimum cost, at low technical risk, and to achieve interoperability between U.S. and German guns and ammunition. The technology transfer between U.S. and the Federal Republic of Germany, although delayed almost a year, began in June 1979, and has progressed well. In the past year, this transfer has neared completion. Fabrication and testing of U.S. hardware has begun. Sixteen guns manufactured at Watervliet Arsenal have fired more than 2,600 rounds with excellent results. The first of two prototype *M-1E1* tanks was delivered to Aberdeen Proving Grounds in March, and a second was delivered to Chrysler for testing at Centerline, Michigan. These tanks will undergo extensive testing to verify proper system integration and to evaluate the effects of the increased weight on other components of the tank. The hardware development is essentially on schedule. All tests necessary to assure that the 120-mm system meets U.S. requirements are planned for completion prior to starting production.

The goal for *M-1 Abrams* production, as decided by the Army System Acquisition Review in March 1981, is to field 7,050 systems by FY88. The Army expects to start fielding the system in Europe in 1982, along with selected CONUS units.

The *M-1 Abrams* tank is the Army's most tested tank—it probably holds the world record as well. By the completion of developmental and operational testing, nearly 190,000 total miles will have been completed. The program continues to meet its challenges.

From the users' perspective, the *Abrams* tank, even at lower reliability and durability rates than it now demonstrates, has considerably more operational utility and combat effectiveness than our current main battle tank. The continuing quantitative superiority of the Soviet-Warsaw Pact tank and antitank fleet and their growing quality makes it imperative to field the *Abrams* rapidly. It offers the best hope for us tankers to fight outnumbered, to survive, and most importantly, to win the next war.



The Play Sir, Is Over

An account of cavalry action and the surrender of British forces at Yorktown.

by Major Donald C. Snedeker
Art by M. and C. Kaspareck

The fortunes of war were going badly for George Washington and his beleaguered Continental Army during the last days of 1780. Ravaged by irreplacable casualties, disease, and desertions, ill-fed, ill-equipped, and usually unpaid, the American Army and Allied French troops were outnumbered by the 10,000 British and Tory soldiers they faced. So much so that the commander of the French troops, in a letter to the commander of the French naval force, said:

> "I must not conceal from you, Monsieur, that the Americans are at the end of their resources, that Washington will not have half of the troops he is reckoned to have, and that I believe, though he is silent on that, that at present he does not have 6,000 men; that M. de la Fayette does not have 1,000 regulars with militia to defend Virginia. . ."[1]

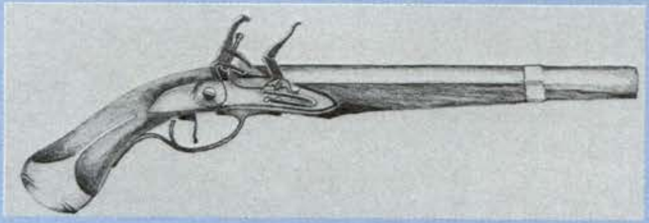
And defend Virginia M. le Marquis de la Fayette must, for Brigadier General Benedict Arnold landed in the Old Dominion in January 1781 at the head of an army of British Regulars and Simcoe's "Queen's Rangers," numbering only 1,200 at the beginning but quickly reinforced to almost 4,000. By May, Arnold had been superseded by Cornwallis and the total British force was over 7,000. La Fayette had been able to scrape together less than half that many.

Although on his first independent command, at the head of a quickly thrown-together force of New Englanders, New Jerseymen, South Carolinians, and Virginia militiamen, and in unfamiliar countryside, the not yet 24-year-old Marquis kept his wits about him. In May 1781, he wrote to Washington that, "Were I to fight a battle, I should be cut to pieces, the militia dispersed and the arms lost. Were I to decline fighting, the country would think itself given up. I am therefore determined to skirmish, but not to engage too far. . ."[2] "Skirmish, but not to engage too far. . ."—mission orders tailor-made for cavalry; screening, raiding, economy of force. Unfortunately, there was one major problem. While the British forces contained a significant number of mounted soldiers, including Tarleton's Legion, up from the Carolinas, and Simcoe's "Queen's Rangers," the paucity of cavalry in the Continental Army haunted de la Fayette in Virginia. Even after "Mad Anthony" Wayne and three Regiments of the Pennsylvania line joined in June 1781, the American force in the field contained just over 100 cavalrymen—60 regulars under Major William McPherson and a somewhat smaller number of French and German volunteers, under Lieutenant Colonel John Mercer.

With the pitifully smaller number of dragoons acting as a nucleus, la Fayette fought a classic rear guard action across the Virginia landscape. Double-mounting each horse, reinforcing mounted patrols with light infantry and independent scouts, he kept his numerically inferior army intact and just beyond the reach of Cornwallis. The French Marquis marched his army on multiple routes with a mixed contingent of light infantry and dragoons well in advance or well to the rear of his main columns. "By keeping his advance parties well up at the rear of the enemy, and by incessant activity in sending his patrols in various directions, so that American troops were almost constantly met with . . . la Fayette succeeded in creating the impression among the British leaders that his force was considerably larger than it was."[3] He skirmished, he raided outposts, he fell back, always one step ahead of the much more mobile British. Simco and Tarleton's vastly superior (about

800) mounted troops pursued the rebels literally all over Virginia, but usually came away empty-handed.

Typical of this campaign in Virginia was the action of 26 June, 1781 at a crossroads tavern called Spencer's Ordinary. Cornwallis, by this time, was pulling his army slowly back toward the coast, on orders from Sir Henry Clinton, his superior in New York. The American Army, meanwhile, was growing in strength with additional Virginia militia, Continentals under von Steuben, and more artillery. La Fayette was emboldened and decided to strike.



On the night of 25 June, several groups of Americans marched all night in order to close with the rear of the withdrawing British Army. At sunrise, light infantrymen were mounted behind each of Major McPherson's 60 dragoons and moved out in search of the enemy's camp. At about the same time, about 100 horsemen and several hundred infantry of Simcoe's Rangers broke camp and moved west on a raiding and foraging expedition. Neither force was aware of the other until they met head on at Spencer's Ordinary, 6 miles from Williamsburg.

In the words of Captain Davis, an American eyewitness: "We mounted a party of infantry (Captain Ogden's) behind lite Horse, who overtook their rear. We had a smart skirmish, Horse & foot in which we took some lite Horse & Cattle & kill'd 30 on the spot with inconsiderable loss."[4]

It should be noted here, however, that Lieutenant Colonel Simcoe, in his account of the skirmish, claimed it as a major engagement, won by his superior leadership. In his own words (spoken in the third person), "Lieutenant Colonel Simcoe did not expect victory, but he was determined to try for it." With regard to the American cavalry, Simcoe was contemptuous. His green-coated Rangers hit them in the flank and "Broke them entirely."[5] Despite his boasts, Simcoe withdrew, the Americans held the field, and Cornwallis continued to move toward Yorktown and destiny.

While these events were taking place in Virginia, momentous decisions were being made in far-away New York and in the West Indies. General Washington and his anxious-for-action French counterpart, Rochambeau, had been disagreeing for several months as to where the next campaign should be directed. Washington believed that the greatest chance for success lay in an immediate attack on Clinton's forces at New York. Rochambeau, on the other hand, felt that Clinton was too well fortified in New York and that a surprise move southward to overwhelm Cornwallis in Virginia was more likely to succeed. They settled on an attack on Clinton in New York in conjunction with an attack from the sea from the French fleet.

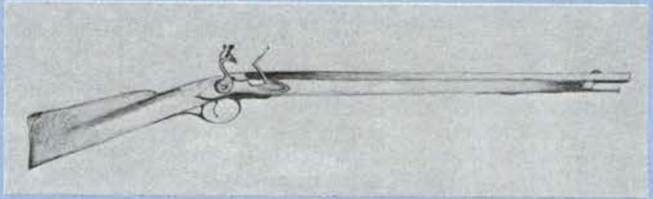
On 14 August, however, their agreement was overcome by events. Admiral de Grasse, grown impatient with decisions of others, sent word that he and 28 ships of the line had set sail, destination the mouth of the Chesapeake Bay and an anticipated encounter with the British fleet headed there to support Cornwallis. Without de Grasse's support, the attack on New York was doomed to failure. As Washington states in his journal, "Matters have now come to a crisis . . . I was obliged . . . to give up all ideas of attacking New York."[6]

Instead of allowing this last-minute change in plans to disrupt his American-French Army, Washington turned it to a distinct advantage. He mounted a comprehensive and extremely effective security and deception plan to deceive Clinton into believing the objective of the attack was still New York.

The French Cavalry of the Duke of Lauzun's Legion conducted raids and demonstrations around the British perimeter. Known agents were fed false information, the allied troops themselves weren't told the actual destination, and great camps with sufficient ovens to bake bread for a large army were constructed in sight of the British outposts.

Clinton and Cornwallis were so involved in their own internal struggle for dominance in the Colonies that neither recognized Washington's change in plans until too late. It only became obvious in early September when de Grasse's fleet suddenly appeared off the Virginia coast, blocking Cornwallis' supply and escape route.

By then, la Fayette was astride the peninsula, and Washington and Rochambeau's soldiers had marched 220 miles in 11 days, virtually under the noses of the British, through Princeton, Trenton, Philadelphia, Wilmington, and were loading boats at Head of Elk, Baltimore, and Annapolis for the trip to Jamestown and Williamsburg. Heavy in artillery and light in baggage, this force would provide the strength to encircle Cornwallis if he obliged by remaining in Yorktown.



Cornwallis, for his part, found himself in a box primarily of his own making. Having moved to the coast to find a seaport from which he could be resupplied and reinforced (although he still outnumbered la Fayette's army), he had chosen Yorktown because of its harbor, not its defensibility. There, he awaited reinforcement from the sea, making only desulatory defensive preparations. When de Grasse and the French fleet arrived, Cornwallis, instead of attacking la Fayette's still inferior forces, waited for the British fleet to defeat the French. In the meantime, however, Washington and Rochambeau arrived with 6,000 reinforcements, and when on 15 September word came that de Grasse had defeated Admirals Hood and Graves at sea. The front door slammed shut. The siege of Yorktown was at hand. There remained but one escape route—the back door, across the York River to Gloucester Point and thence northwestward by land.

The recounting of the siege of Yorktown proves a rather dull affair, with 9 days exchange of cannon fire in which the terrain and size of the artillery favored the Americans and their French allies. The cannonade was accompanied by only a few infantry assaults, never numbering more than 100 attackers. But British strategic blunders enabled the besieging colonial infantry and artillery to close the ring tighter.

Actions across the York River at Gloucester Point, however, provide a much more interesting story. Initially defended by 1,500 Virginia militia under George Weedon, the promontory provided the only remaining avenue of escape for the British Army. Washington recognized this fact earlier than Cornwallis, and reinforced the militiamen with the Duke of Lauzun's 600 legionnaires.

Cornwallis, too, began to realize the significance of this piece of terrain and posted both Tarleton's and Simcoe's legions across the river to Gloucester. This set the stage for the most colorful clash, and the only cavalry action during the siege of Yorktown.

The scene was set on 3 October when Lieutenant Colonel Tarleton lead his Legion on a foraging expedition into the countryside, where he encountered the advance guard of Lauzun's Legion. In the ensuing melee, the Duke and Lieutenant Colonel Tarleton sought each other out. "Tarleton saw me and rode towards me with pistol raised. We were about to fight single handed between the two troops when his horse was thrown by one of his dragoons pursued by one of my lancers."[7] The remainder of Tarleton's dragoons rushed to his rescue to prevent his capture.

The remainder of the skirmish saw each side attempting a traditional mounted attack. In Tarleton's words (in the then-popular third person):

> . . . the whole of the English rear guard set out at full speed from its distant situation, and arrived in such disorder, that its charge was unable to make an impression upon the Duke of Lauzun's *hussars* . . . Tarleton . . . perceiving the broken state of his cavalry . . . ordered a retreat, to afford them an opportunity for recovering from their confusion. At 300 yards from the French squadrons he dismounted 40 infantry . . . the fire of this party restrained the enemy's *hussars* . . .[8]

The French also fell back behind their own newly-formed line of Mercer's Virginia Militia and repelled a second British charge. Much to the disappointment of the Duke of Lauzun and Banastre Tarleton, "no (further) shock, however, took place between the two bodies of cavalry . . .[9] The British thereupon fell back into the fortified area of Gloucester, never to venture out again. This action, although minor in number of participants and casualties, was one of the few direct confrontations between the two sides during the siege of Yorktown—and the only clash between the mounted troops. In fact, it turned out to be the last mounted action of the Revolutionary War.

On the morning of 17 October, a British drummer boy sounded out the request for a parley. Lord Cornwallis, despairing of relief from Clinton in New York, and realizing the hopelessness of the position of his surrounded garrison, asked for surrender terms. Two days later, on a field ringed by Lauzun's *hussars,* 8,087 British and Hessian soldiers and sailors laid down their arms. As the surrender proceedings ended, Marquis de la Fayette said appropriately, "The play, sir, is over."

Thus, did Cavalry compete its first ride into the pages of American history. These unschooled, tattered, mounted riflemen, led by ex-European nobility and Pennsylvania farmers alike, thumbed their noses at the limits of the more traditional roles of European cavalry. Fighting both mounted and afoot, using a unique blend of tactics and weaponry, they set the pattern that still characterizes the U.S. Cavalry. They created a force equally capable of mounted or dismounted action. It was a flexible combined arms team that was prepared to assume any mission at a moment's notice—unhindered by more conservative opinions of what is possible.

Cavalry's mounts and weaponry have changed since the Revolutionary War, but its independent, flamboyant spirit of professionalism remains. *Allons.*

Footnotes

[1] Thomas J. Fleming, *Beat the Last Drum.* p. 80.
[2] Lancaster, *op cit* p. 336.
[3] Charlemagne, Tower, Jr., *The Marquis de la Fayette in the American Revolution,* Vol II (1895), p. 344.
[4] Ibid, p. 344.
[5] Lieutenant Colonel J. G. Simcoe, *A Journal of the Operations of the Queen's Rangers* (1844).
[6] Quoted in Henry P. Johnston, *The Yorktown Campaign and the Surrender of Cornwallis* (1881), pp. 83-84.
[7] Ibid, p. 53.
[8] Lieutenant Colonel Banastre Tarleton, *A History of Campaigns of 1780 and 1781 in the Southern Provinces of North America* (1787), pp. 387-388.
[9] Ibid, p. 388.

MAJOR DONALD C. SNEDEKER was commissioned in Armor from Xavier University in 1969. He has served as a platoon leader, XO, troop commander and in various staff positions in the 3 Armd Cav Regt, 2-1 Cav, and 11 Armd Cav Regt. He is presently assigned to HQ TRADOC as the Program Manager of the German-US Bilateral Army Staff Talks.

Organized Flight

by Captain John D. Rosenberger

Since the summer of 1976, the doctrine of the active defense has been the cornerstone of our military strategy, our force development, and our training. However, many officers in Armor, particularly those in the covering force, regard the doctrine and tactics of the active defense as nothing more than delaying action "triggered by the mere appearance of the enemy on the battlefield."[1] Justly so, because that is in fact what we, the battle captains, are taught to do in the face of Soviet attack. Our principal "How to Fight" manuals, FM 71-1, FM 71-2, FM 100-5, have established doctrine designed to defeat the dogmatic Soviet breakthrough attack and stress "the utilization of successive battle positions in depth, to wear down and weaken the enemy followed by counterattacks."[2] Such doctrine, in this soldier's opinion, is nothing more than "organized flight" from the battlefield which, by definition, concedes inevitable success to the Soviets and has fostered an atmosphere of defeatism in our Armor force today—a "Ho-Hum Attitude," if you will.

Why, in our doctrine, we have adopted the mindset that all Soviet attacks will be overwhelming defies this soldier's comprehension. Granted, the Soviets can generate greater force ratios than we can, but we must not concede them victory for that reason. The history of battle affirms that numbers had nothing to do with the Union Army's defeat on the Peninsula or at Fredericksburg, the *Wermacht's* defeat at the Bulge, Japan's defeat at Midway, or the North Korean defeat at Inchon. We, as a consequence of our doctrine, are entering the next battle with a losing attitude, a mental disadvantage. We must reverse that trend. We must become positive thinkers, totally aggressive in our nature.

Given the defensive strategy of the NATO alliance, we, in the covering force, initially possess very little initiative on the battlefield, so we must have foremost in the minds of our combat leadership the steadfast purpose of regaining the initiative, so we can, in turn, impose our will on the enemy. Initiative allows us to destroy him on our terms. Initiative cannot be regained by forfeiting terrain as we withdraw towards the Rhine. Initiative can only be regained through aggressive manuever and violent execution of a combination of defensive and offensive tactics that completely disrupt the Soviet attack. Only through violent, destructive, offensive operations can we exploit every advantage of Armor and again savor the flavor of our heritage—a heritage of boldness, daring, shock, and speed.

Regaining the initiative presents us with a strategic requirement. We must destroy the first echelons of a Soviet attack prior to any thought of withdrawal. Soviet Army doctrine has left us little choice.

C.N. Donnelly, an expert Soviet Army analyst has succinctly described the evolution of Soviet political and military strategy:

> During the late 1960s, there grew up in Soviet political circles the realization that if for any reason a major war were to start, it was clearly in the interests of the Soviet Union to be able to win it *before* the Western Alliance could reach a decision to use nuclear weapons.
>
> As a reflection of this political realization, the first 2 or 3 years of this decade saw a gradual shift in emphasis in the Soviet military press from a study of the nuclear battlefield to a study of conventional operations, albeit with the proviso that in any major conventional conflict, weapons of mass destruction *might* be used at any moment.
>
> Whether any war, which began in Europe, would remain purely conventional or would involve nuclear weapons, the Russian victory, the Soviets believe, would only be certain if the war could be won quickly.[3]
>
> If for any reason, therefore, the Soviet leaders consider it necessary to use war as a means of achieving their political goals in Europe, it is essential to them that they achieve these goals (i.e. win the war) before it develops into a global nuclear exchange. This means that the war must be won very quickly indeed—before any Western government can resort to strategic nuclear weapons. In addition, the use of battlefield nuclear weapons by either side must increase the escalation, and is therefore to be avoided if possible.[4]

In this light, the immense increase of conventional forces in the Warsaw Pact this past decade seems to be a logical development. As this strategy has filtered into Soviet Army doctrine, we, at the troop or company level, will face Soviet combat organizations tailored specifically for defeating NATO antitank defenses—combat organizations combining mass and speed, echeloned in time, intent upon quick victory.

It is not necessary to rehash the march organizations or employment of a Soviet motorized rifle division or tank division in the advance to contact. That information can be gleaned from our field manuals. The Soviets, in their recent military literature, have not changed their tactics. However, there has been an intense debate in the Soviet Army concerning the best tactics and the best force mix to use in overcoming NATO antitank defenses. It should concern us all that Soviet officers have analyzed our doctrine perfectly.

> The main feature of NATO's mobile defense is said to be the defender's ability to launch counterattacks with his reserves or second echelon forces. In view of this, the defending formation will deploy into its forward zone as small a proportion of its forces as is capable of slowing down the onslaught of enemy armor. Hence, the Soviets say, only reconnaissance and a few motorized infantry units are to be expected in this zone, the main forces being held well back, ready to launch a counterattack or to channel the attacker into "fire pockets" where he can be destroyed with nuclear or conventional weapons.[5]

Even more alarming is the Soviet's recent identification of our greatest doctrinal weakness.

> ...the Soviets identify the most critical point as being the moment when the defenders withdraw—from their first to their second or third line of defense, especially if the fall-back positions are poorly prepared. It is at that moment that the attacker must put in his ultimate effort, keeping back a powerful reserve for the task.[6]

From the tone of Soviet military literature (and ours), Soviet ground forces in the attack are irresistible. The Soviets are ambitious, positive thinkers, and that is a powerful mental advantage. But, the intricate arrangement and deployment of Soviet echeloned forces, the orchestration of a massive attack, and their entire offensive success hinges upon their ability to accurately locate and identify our initial positions, skillfully and efficiently bring firepower and force to bear, and use the right tactics once they have a fix. We must really do nothing more than frustrate the Soviets as they strive to accomplish those tasks.

In the covering force, we have two imperatives—imperatives which, if accomplished thoroughly, will deny the Soviets the quick victory they seek. The *first* thing we must do is conceal ourselves in our initial positions from all Soviet reconnaissance, then destroy the tactical reconnaissance elements of the Soviet division reconnaissance battalions and the reconnaissance companies of the regiments, which will precede the first echelon battalions in the advance to contact. "Soviet sources state quite categorically that only if the enemy's antitank defenses are accurately located and identified can the attack have any hope of succeeding."[7] History is replete with dead soldiers and lost campaigns suffered as a result of going blindly into the attack. If we are well-concealed in our initial defensive positions, we present a formidable fix problem for Soviet tactical reconnaissance patrols. If we then make every effort to destroy Soviet reconnaissance patrols with *indirect* fire, we have further denied them the information theyseek—the exact location of our force. As a last resort, we must destroy reconnaissance elements with direct fire (one tank or TOW round would do nicely). There is a good reason to restrict direct fire engagements. *Direct* fire engagements give the Soviets a place to launch the point company of the vanguard whose task it is to launch an attack on any suspected or known enemy position making every attempt to entice us to use our direct fire antitank weapons. We must blind them!

The *second* imperative we have is the destruction of the first echelon battalions of the regiments involved in the initial meeting engagement—battalions, in particular, because terrain limits the commitment of force to battalion-sized frontages. Now, how the destruction is accomplished is a matter of tactics, executed by the commander on the ground utilizing all available firepower and force. Tactics, of course, differ from commander to commander and will vary with the situation. Total disruption cannot be accomplished by withdrawal from initial battle positions. It's accomplished by blunting the Soviet attack with violent *offensive* actions conducted against those first echelon battalions. It is in the attack that the full weight of Armor can be felt and its every advantage exploited. Aggressive maneuver is the capstone of offensive success—offensive action is the only route to victory.

If we satisfy those two imperatives, we have a new war. The second echelon will lose its sting, because successful penetrations key the deployment of the second echelon or reserve. Only success is reinforced. Given a character of inflexibility and presented with defeat across the board, confusion will run amok. If we can accomplish those two mandatory requirements, we have regained the initiative. With the initiative in our possession, we must attack. We must become the hunter. Where is the second echelon regiment of that division? "Attack along axis from C24 to F36 and seize OBJECTIVE BEAR."

We are training our young officers and soldiers in an atmosphere of defeatism. We are training the offensive spirit from their minds. We concede by our doctrine of the active defense that every Soviet attack will be overwhelming. We have sanctified their inevitable success. Our senior leadership must reverse this trend. We must breed a new generation of American soldiers, trained well, filled with optimism, confidence, and an *offensive* spirit. We as warriors have a sole purpose if our peacemakers fail—kill the enemy until he can no longer wage war against us and our cause, or, until our political leadership reins us in. We must train to do that. The active defense is only one card in our deck—not the ace-in-the-hole.

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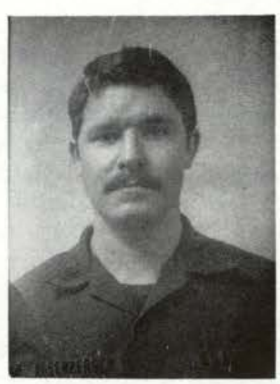

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2. FM 100-5, page 12.
3. Donnelly, C.N., "Soviet Tactical Problems," *International Defense Review*, Volume 11, Number 9, 1978.
4. Donnelly, C.N., "Soviet Tactics For Overcoming NATO Antitank Defenses," *International Defense Review*, July 1979.
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6. Ibid.
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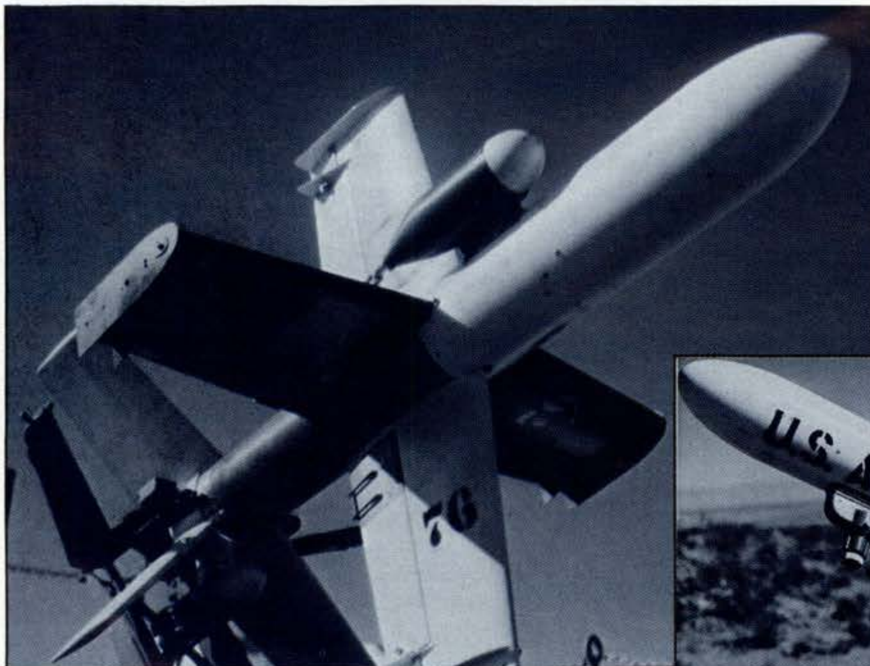


Dart

by Donald R. Kennedy

Joseph E. Backofen's well-researched and well-written series of articles on antiarmor weapons technology appearing in ***ARMOR*** has brought together for the first time a comprehensive history of the art. These articles should prove to be a valuable addition to our reference shelves.

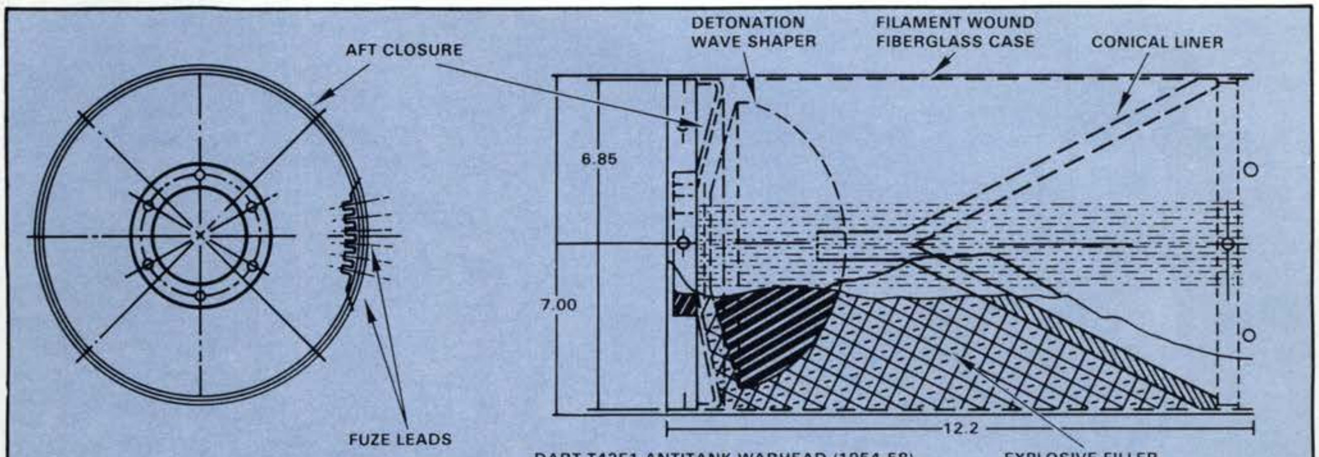
In the September-October 1980 issue ("Shaped Charges Versus Armor—Part II") Backofen compares the tactical and historical characteristics of a wide array of shaped charges. Table 3 of Backofen's article compares various antitank guided missiles, among other things on the basis of measure of effectiveness (MOE). The MOE is based on armor penetration, maximum effective range, and missile weight.

I wish to clarify the issue concerning *Dart,* the first U.S. Army-developed antitank guided missile, which, according to table 3, has the lowest MOE of all antitank guided missiles (ATGM) for which MOE was computed. This makes the missile look rather bad, when in fact it was perhaps one of the more lethal antitank missiles developed to date. The warhead designation was *T-42E1.*

The problem lies in the use of armor penetration *depth* as the criterion, when the real figure should have been effectiveness beyond the defeated armor. *Dart* was based on a different philosophy than most, if not all, of the other listed ATGMs. *Dart* was the first antitank missile to be designed to exploit the results of the research at the U.S. Naval Ordnance Test Station (NOTS) in the early 1950's into the effects of shaped charges beyond defeated armor. The NOTS studies compared various common materials and liner configurations on the basis of mass and angular spread of metal spall, overpressures, thermal effects, and other potentially useful effects. The studies indicated that the principal attribute of copper as a liner material was achievement of depth of penetration in armor, but that the other potentially lethal effects were poor in comparison to other low-cost and readily available materials such as steel, aluminum, and zinc. Aluminum liners were found to produce rather great overpressures and thermal effects, even though the penetration, in terms of calibers depth, was modest compared to that of the more commonly used copper. Copper liners were recommended for all small munitions where the initial objective was to defeat the target tank's armor. Materials such as steel and aluminum were recommended where weapon size was such that the target could be overmatched by the warhead. *Dart,* a 7-inch diameter missile, was designed to employ a high beyond-armor-effects warhead employing the new technology. The penetration requirement was enough to defeat, with ample margin, the heaviest tank armor known—the *Joseph Stalin III* heavy tank. The requirement was to defeat 6 inches of rolled homogenous steel armor at a maximum obliquity of 64 degrees (an equivalent thickness of 13.69 inches), plus an additional amount to ensure adequate overmatch. The warhead was also specified to create the maximum lethal effect beyond that armor.

It should be noted that the state of the art (in 1954) was such that liner materials in addition to copper had been demonstrated capable of defeating more than five cone diameters of steel armor.

The *Dart* system also required the warhead to function at a very short standoff, have a specified weight and length, be a component of the missile fuselage, provide for transmission of electrical fuze signals from the nose to the base-mounted fuze, and have no fragmentation effect lateral to the warhead because it would be fired over the heads of friendly troops. Shortly after development was begun, the missile developer asked that the warhead weight be reduced by more than 40 percent from the original allocation. This required that the designer start from scratch to go well beyond the state-of-the-art. The resulting design was the first nonnuclear warhead to exploit:



DART T42E1 ANTITANK WARHEAD (1954-58)

- A detonation wave shaper device of minimum density.
- Octol as an alternate fill to the baseline Composition B explosive.
- A filament-wound epoxy figerglass case and molded fiberglass base assembly.
- A permanent-mold, centrifugally-cast, aluminum liner used without machining the cone surfaces.
- Flat strips of copper laid up within the fiberglass cast to provide electric fuze signal transmission—the first application of multiple-lead, flat-wire technology in nonnuclear munitions.

The *Dart* warheads were extensively tested against up-armored heavy tanks at Aberdeen Proving Ground. The Ballistics Research Laboratories (BRL), which did not share the design philosophy with the lead laboratory (Picatinny Arsenal),performed extensive comparison testing with more traditionally-designed devices having the same weight, diameter, and explosive type as the *T-42* warhead. The several series of side-by-side tests provided much valuable insight into the tank/antitank interaction and led to recommendations for many design practices to be followed in future tank design.

Dart missile developments were terminated in 1958, mostly because the missile was becoming overly complex and overweight. The desire to add additional capabilities, rather than field a less-than-perfect initial system, eventually proved to be the grounds for the system's demise. No one said, "if you wish to add this, what shall we take off?" These lessons served as the foundations for the later successful development of the *Shillelagh*.

Although the *Dart* warhead technology was not employed in subsequent missiles (*Shillelagh*, TOW, *Dragon, Hellfire*, etc.), it did resurface in the Air Force *Maverick* developed in the late 1960's. The *Maverick* is a very large shaped charge designed to defeat a large array of hard targets. The tank was only one of approximately 11 priority targets in the total target list of some 40 items, yet it is errouneously referred to as an "antitank" missile. *Maverick* is capable of destroying any tank in the world, even in a near miss, but it is akin to using elephants to stomp on mice when smaller weapons are available.

The *Dart* story is but one of the many illustrations of the fact that the warhead design does not necessarily dictate the system design, but, in most cases, is dictated by other system considerations. The system determines the weight, diameter, length, center-of-gravity and other requirements, and it is up to the warhead designer to ensure that the warhead is in compliance. This situation has been the driver of designs for many years. However, as the targets become more difficult and the weight requirements become more severe, the warhead requirements may eventually dominate the system design.

The armor systems' design drive the antiarmor systems, and vice versa. We are now engaged in a vigorous battle of the competing technologies. Armor systems are becoming highly resistant to many of the commonly used antiarmor systems. The antiarmor community is hard at work seeking increased performance of traditional tools and alternative methods to defeat armor.

The studies that led to *Dart* have also shown us that we have other problems to address in the areas of crew and systems survivability. The effects produced beyond armor by the *Dart* warhead may also accompany the penetration of the aluminum armor systems by most of the copper-lined shaped charges fielded today. Now we must address such techniques as spall-suppression liners, crew protective clothing, etc., if we are to ensure survival on tommorrow's battlefield.

Backofen is to be congratulated for bringing to ***ARMOR*** and its readers a proper appreciation of the history and the characteristics of both the kinetic energy and shaped charge antiarmor munitions, many of which are in the present worldwide inventory we may face with our armor.

In closing, this was not intended as a criticism of Backofen's article, but instead as a clarification of an issue of concern to this writer. The point to be made here is that designers respond to the systems requirements and are constrained by the state-of-the-art extant at the time of the design. *Dart* clearly advanced the state of the art.

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The following articles contain the highlights of presentations at the Armor Conference that were not carried in the July-August issue. The presentations have been condensed by the ARMOR staff.

The U.S. Army Training Support Center

BG Robert J. Sunell
CG, USATSC

The U.S. Army Training Support Center (USATSC) provides support for Forces Command, DARCOM, USAREUR, TRADOC, and the Reserve and National Guard units of the Reserve Component. In fact, 56 percent of the work done at the center is in support of the Reserve and National Guard.

One of the larger elements of the Center, The Institute for Professional Development, provides correspondence courses for 266,000 soldiers. A great number of the institute's courses have been approved for high school and college credit by the National Home Study Council. The institute is also the source for promotion points for Reserve Component soldiers enrolled in its courses.

Another major effort of the Training Support Center involves its work with Skill Qualification Tests (SQT). The Center is now developing scoring pamphlets for scoring SQTs that will enhance the first-line supervisor's involvement in the training of the individual soldier.

Training hardware is one of the mainstays of the USATSC mission. Efforts in this area include production of vehicles that resemble Soviet equipment, development of air-to-ground engagement scoring systems, and work with video discs for driver and gunnery training.

M-551 armored/reconnaissance airborne assault vehicles are the stars of the opposing forces (OPFOR) equipment program, and are being converted to what appear to be *T-72s* and *ZSU-23-4s*. These vehicles are being supplied to the National Training Center where they will be used by OPFOR units facing friendly forces during field training exercises.

Realism in training exercises is further enhanced by scoring systems that give real-time results, and USATSC is working to improve the existing ground system (MILES) and is developing a laser scoring system for air-to ground engagements. This system will become standard equipment for the Cobra. As for the MILES system, it is envisioned that it, or a similar system, will be part of the standard equipment of new fighting vehicles when they reach the field. However, money constraints will still limit the amount of "live" training that units can conduct. Therefore, simulation devices are becoming more and more important to the trainer. One promising development in simulation devices centers on the video disc. In gunnery training for example, pictures of personnel dressed in Warsaw Pact uniforms, armed with Soviet weapons, and mounted on Soviet vehicles in a natural setting are recorded on a disc. The disc is then viewed on a simulator that includes a tank's main gun fire controls, and the gunner can "fire" Table VIII or VII before he ever goes down range. What he sees on the simulator is what he will see when targets appear on the range. Additionally, work is being done that will permit the targets to be superimposed on either winter, desert, or jungle backgrounds—a real plus for training units of the Rapid Deployment Force.

As ammunition costs rise, not only simulation, but miniaturization and substitution become increasingly important. Several training strategies are being tested to determine how much ammunition is needed to maintain combat effectiveness. One approach will be to train with only 35 to 50 main gun rounds annually, with the rest of the training being conducted with substitutions and miniaturization. In another strategy, 70 to 90 rounds will be used, and in the third, or full-up strategy, crews will be trained with 210 rounds.

Whatever the results, we must devise a strategy, and come up with a recommendation that will allow us to maintain combat effectiveness. Then we can go forward and say that the results of our testing shows that we can not maintain combat effectiveness without specific equipment or resources. We have not been able to do that before.

That is how the training support picture looks now and for the immediate future, but what is ahead for the nineties, and the year 2000 and beyond? The answer is robotics, and work is already underway in this field. At Fort Knox, for instance, a remotely controlled mine remover mounted on an *M-60A2* tank chassis was successfully tested in mid-July. Such devices are clearly needed. In earlier wars we used big, long bayonets to probe for mines; now, we have little, short bayonets and our hands are closer to the explosion.

The National Training Center

BG James T. Bramlett
CG, NTC

Fort Irwin, CA, was chosen as the National Training Center (NTC) for two reasons. It has ample maneuver room and unlimited airspace. It doesn't look like Germany, but the NTC can be used to practice most of the skills units need to win a European War. The reservation covers 642,000 acres, most of which is good training terrain. The climate is dry, with an annual rainfall of about 1½ inches and temperature ranges of from 20 degrees in winter to 120 degrees in the summer.

The NTC is located in an area of restricted airspace, which means that aircraft can engage targets just as they would in combat without interferring with civil air traffic. Furthermore, Fort Irwin's relative isolation permits full-powered electronic jamming and close air support to be played to the hilt.

The NTC provides tough, combined arms tactical training for battalion/task force sized units on a rotational basis. The center is also a data source for doctrine and systems improvements, including training techniques, and logistical and administrative doctrine.

An operational group is one of the key elements of the NTC with responsibility for developing tactical scenarios, coordinating and controlling battlefield effects, providing field controllers to assist in the training, and collecting data during operations for after-action reviews.

The operational group also provides instrumentation for live and non-live-fire areas. This instrumentation includes the use of MILES, plus position location and event recording of everything that is done within a task force. Instrumentation also provides video input from cameras operated by field teams and from fixed positions. All data is transmitted electronically to the central computer/control center, which has the capability to assemble, display, and edit all computer generated imagery, and video and audio information in real time. This permits highly-trained, tactically-proficient officers to prepare reviews or critiques while training is taking place and have the evaluation ready for presentation when the unit completes an exercise.

Exercise scenarios are tailored so that they provide varying degrees of intensity of action, and they can require either night or daytime operations over either rough or open terrain.

The EW play of the scenarios can be adjusted from no jamming to full-powered jamming just as the Soviets would do it in a particular case. The NBC environment can also be manipulated to cause the unit to go from protection posture 1 to 4.

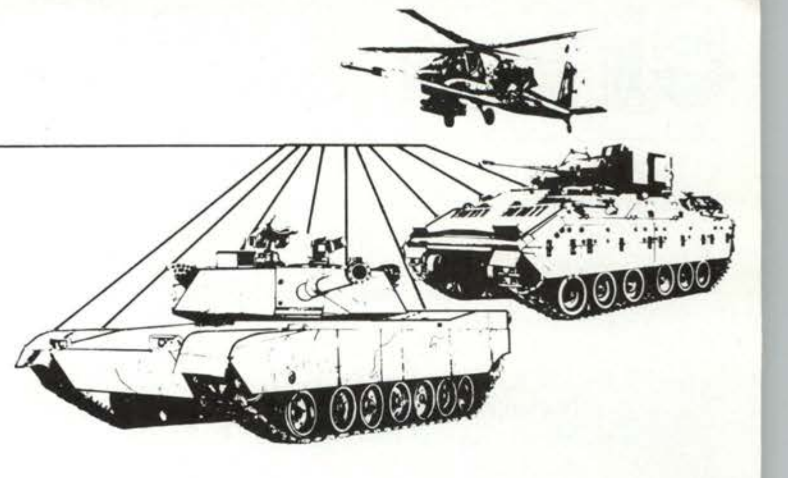
There are 38 scenarios that cover most of Fort Irwin and can set the scene of the training in any type of terrain a unit desires. But no matter what type terrain is involved, training is not time-oriented. Units can take their time and do their training right the first time.

The opposing forces (OPFOR) will be dressed in Soviet-style uniforms, armed with Soviet weapons, and will be trained in and use Soviet tactics. The OPFOR will be made up primarily of one tank and one mechanized infantry battalion stationed permanently at Fort Irwin. The units will be mounted in *M551 Sheridan* vehicles that have been modified to resemble *T-72* tanks, *ZSU-23-4* antiaircraft guns, or 122-mm howitzers. Replicas of the Soviet BRDM and BMP are also being developed.

During live-fire training, safety will of course be important, but it will not dictate how training is done. Those in the chain of command will be the safety officers. There will be no white helmets, no barber poles, or anything of that nature. Battalion and company commanders, platoon leaders, and all noncommissioned officers will be told, "Don't shoot the unit next door. Don't shoot the soldier in front of you, and be careful with your weapons." Then, they will be responsible for seeing that the instructions are carried out—just as they will be in wartime.

Units will rotate to the National Training Center as a brigade slice of about 2,500 troops. Attack helicopters will be provided by the training unit or from FORSCOM assets. Deployment of an armored cavalry troop with the brigade slice is a decision that has to be made by the unit, based on availability and resources.

The brigade slice will be flown to a nearby airfield, transported to Fort Irwin, draw its equipment, and immediately move to the field. The units will draw all



major systems, vehicles, radios, weapons, and the like, from prepositioned stocks just as they will should they be deployed to Europe.

Upon completion of their training, each unit will receive a thorough debriefing and a take-home package of data that was accumulated during the field training. From this data, battalion commanders will be able to determine why one tank or unit did a better job than another, and thereby pinpoint training accomplishments and shortfalls.

Historically, battalion commanders have had to take their units into combat without having the opportunity to train in a realistic environment and in a battle formation that they are expected to fight from in battle. Experimentation has been costly in lives and equipment because the battlefield is a harsh training ground.

Therefore the central idea of the NTC is to train units as they will fight. They will train in a realistic environment in formations from which they will fight, including tactical, combat and combat service units that are deployed, communicating, and operating over realistic distances for extended periods of time.

Through this training experience, the NTC hopes to learn all of the hard lessons of combat during peacetime and to set the standard for unit training. Units will spend only a small fraction of the training year at the NTC, but the training will be so tough that it will impact significantly on both individual training and the unit's combat readiness.

The Army Training System

MG Howard G. Crowell, Jr.
DCS for Training TRADOC

In an era when we are faced with the reality of a come as you are war, come as you are Army, we cannot train as we did in the past. We will not have the time to build up to what we want to do. Today, near-term readiness requirements mean that we have to sustain our training and combat capabilities, and do so in the face of some constraints. These constraints involve money, fuel, ammunition, space, time, personnel turbulence, and an eroded training base.

Those are the problems. Here is how the Army Training System attacks them. There are three thrusts to the training system—instructional systems development, training the trainer, and training support.

Instructional systems development is an analytical process through which tasks a soldier must perform to do his job are identified. Once tasks are identified, the conditions under which they will be performed are described, and standards for performance are established. The system is also applied to collective or unit training in the same manner, with the training culminating in the Soldier Training Test for the individual and the Army Training Evaluation Program for the unit. The system is neat, clean, and philosophically sound. We have the system. Now it is a function of making it work.

That leads to training the trainer. Who is the trainer? Primarily, he is a noncommissioned officer, and we have established skill levels to which he must perform that are related to rank and the rank related to a job or duty. It is a system that is working and getting better.

A similar system is in the works for the officer corps. In the future, officers will be trained to Military Qualification Standards (MQS) I, II, and III. The MQS are under development and MQS I is about complete. The training to meet the MQS will include: a revised officer basic course, which will teach skills needed in an officer's first assignment; changes in the officer advanced course; and attendance at a combined arms and services staff school (CAS^3) at Fort Leavenworth, KS. CAS^3 will be an intense, 9-week course in staff work and operations. There will be no change in the Command and General Staff College or the Army War College. *(The Review of the Education and Training of Officers is discussed in detail in the July-August 1980 issue of ARMOR. Ed.)*

The third element of the training system is support for training. There is a cornucopia of training products ranging from soldiers manuals and training guides to subcaliber firing devices. These products are important, but so are educational, audio-visual, computer, and laser technologies. The first of these, educational technology, is a simple, straight-forward approach to determining what soldiers and units do.

On the other hand the video disc, computer, and laser technologies are anything but simple or mundane, and dramatic advances are being made in all three fields that promise to revolutionize simulators and other training devices.

A 12-inch video disc can store 30 minutes of motion picture film or 54,000 still shots that can be projected onto television screens of various types and sizes.

A hand-held remote control and a simple pushbutton technique, enable the operator to manually program the disc to locate any one of the 54,000 frames quickly. Preprogramming instructions provide a choice of a series of still frames or motion sequences that can be called up automatically.

As the constraints of money, time, space, and ammunition become evermore serious, simulators become critically important to training. Now, computer technology is making it possible to build smaller and smaller simulators to provide training in skills that heretofore had to be conducted on the equipment, in the field or on the range, at great expense. At Fort Rucker, a prototype computer-generated imagery simulator the size of two filing cabinets is being studied as a possible replacement for a flight simulator that occupies a large room. Elsewhere, simulators resembling video games in amusement galleries are being developed and tested for gunnery and driving training. The question is whether or not a soldier can use these simulators and then get in a tank and be able to fire the weapons and manage the systems quicker, faster, and cheaper than he could if he were trained on the equipment using practice ammunition. To find the answer, a number of the video machines are being installed at Fort Knox for the purpose of collecting hard data with regard to transferability of skills learned on a training device to application on the actual equipment.

Great progress is being made in the Army Training System, but it also has some problems. One of these centers around the question of how much training an individual should receive during initial entry training and how much he should receive in the unit to bring him to skill level 1. Commanders say, "Soldiers can't do their jobs when they get to my unit." That is true, but it must be realized that within one MOS there can be 50 different jobs with 50 different pieces of equipment. Therefore, the training base gives him a little bit of knowledge about a lot of things because the training base does not know where the individual will be assigned or what he will be doing. In fact, the initial entry soldier is both undertrained and overtrained. Some things are better taught in the unit because there is always going to be skill decay, and commanders are always going to have the responsibility for individual training. Not just today, but specifically, and especially, tomorrow, when commanders receive billions of dollars worth of sophisticated, complex equipment and have to operate it.

We can no longer train soldiers, then forget about it. We must maintain a state of readiness so that we can go to war when we are asked to, *and win.*

Closing Remarks

MG Louis C. Wagner, Jr.
Commandant, USAARMS

As General Starry said at the outset of the conference, "It is an extremely lethal battlefield that we are going to be entering in the future, and if we are going to synchronize all of the pieces of that battlefield, we have to start working on it, across the board, from the standpoint of structuring, modernization, training, and mobilization. We are working hard on that, but we have a long way to go, and as we do, I like to think of Armor as a way of life, thought, and spirit.

If you are around tankers long enough, you may come to think that the only thing in life is the *M-1 Abrams* tank. That isn't true, particularly at the Armor Center. We think of Armor as a combined arms team. We have tankers, infantrymen, artillerymen, aviators, signaleers, and engineers backed by dedicated soldiers in service support units. And, if all of them don't understand armor doctrine and the spirit of armor, we are not going to have that well-trained team that we must have to be successful in combat.

That is what it is all about when we start training units for future conflicts. It is going to be a tough war,

and if we don't get all of these people thinking together and working together, we are not going to make it.

Some may contend that the Armor Center, because it is the Armor Center, says that first priority has to go to the *M-1* tank. Not so, because if we don't get the *M-1*, *M-2*, *M-3*, and *AH-64*, and all those other pieces of equipment in the right mix, we are not going to be able to do the job. The doctrine and tactics that we are developing for Division 86 that were described by the Directorate of Combat Developments are not going to do us any good if we don't have the right mix. So there are no priorities as such. *(Division 86 was discussed in detail in the November-December 1980 issue of ARMOR. The concept for the tactical employment of the division will appear in a future issue. Ed.)*

We know that we are not going to be able to buy all of those pieces at one time, so there is going to be a transition period, and that is going to be the toughest part of what we are doing. We will have to make that transition and continue to use the older equipment that cannot perform up to the capability of the new equipment. We have to solve that problem, but we can't do it all at the Armor Center. We need help from the field.

"We will take everyone's knowledge, tie it together, and we will be able to ensure that our Armor Force is ready to do its job when that time comes."

As for logistics, I agree strongly with Major General Al Wheeler's view that we have gone overboard on doing away with the support we need for the force. We cannot sustain ourselves on the battlefield if we don't make sure that we have the proper support capability to ensure success in combat. So you will not hear me say, "Trade off support units for more tank battalions." We can't do that unless we expand the size of the Army.

Turning to people, I promise you that, as Chief of Armor, I will work very closely with MILPERCEN to solve problems in the personnel area. But the solutions aren't going to be found overnight. During his discussion of the Military Personnel Center's mission, MG Robert C. Elton, CG of the Center, mentioned the end strength of the Army in relation to the efforts that are being made to solve the problems with the promotion pyramid for CMF 19. That end strength also has a bearing on the utilization of the new equipment we are getting. If we don't increase our strength, we won't be able to operate all of those new pieces of equipment to their full potential on a 24-hour basis with a single crew, without a little backup.

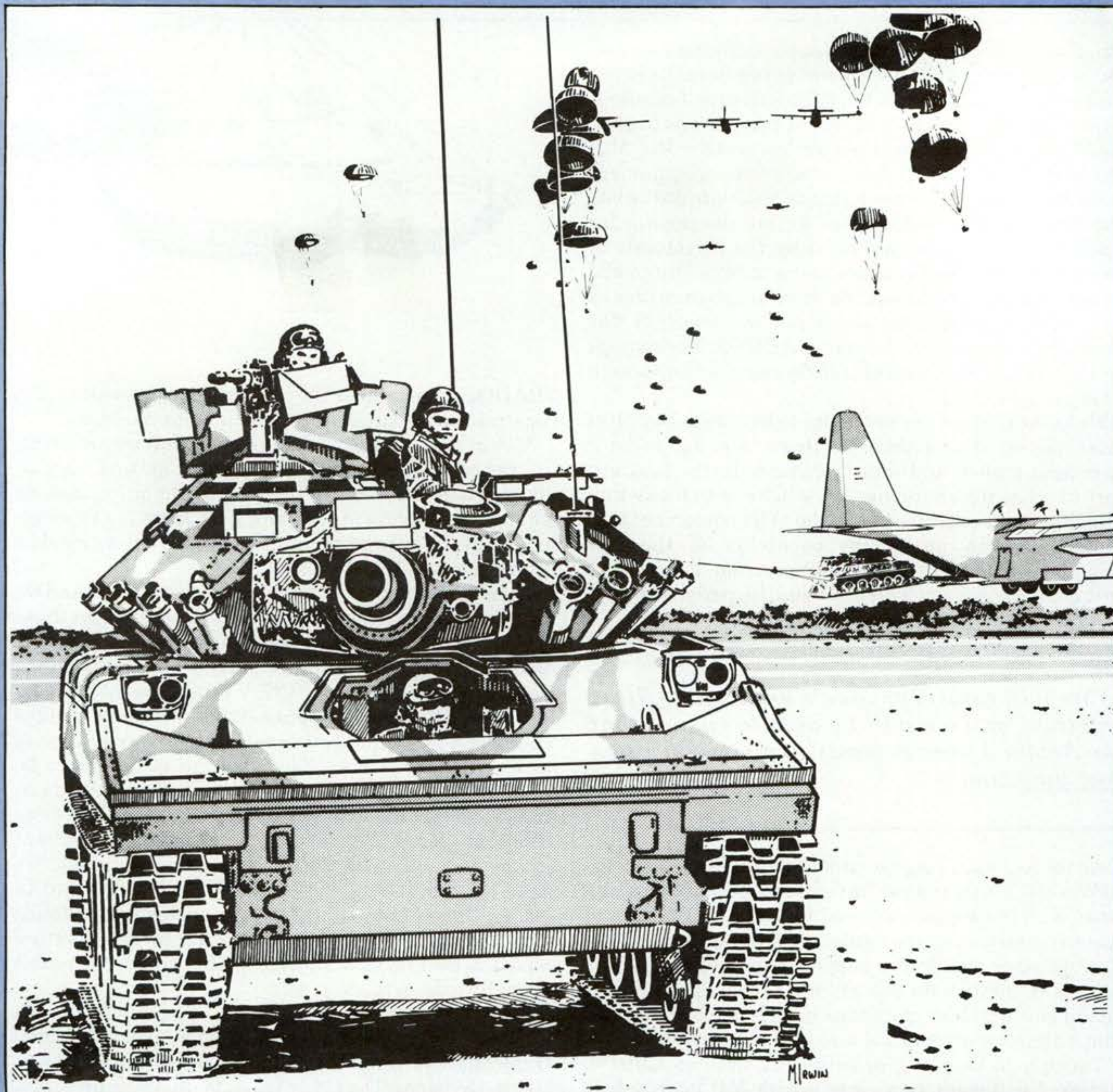
Major General Richard W. Anson, Chief, Army Force Modernization, during his briefing on the functions of his office described modernization as a challenge that we have looked at for too long in a "stovepipe" fashion. We looked at the single pieces from individual standpoints. We cannot do that. The only way to solve the problem is for people in the Department of the Army and TRADOC to establish the proper priorities within the constrained resources to give us a balanced force.

Along that line, the media is saying that we are living in "fat city." We are not. We are just getting back to about where we were. If you look at the price tags on what we are buying in 1981 and 1982, there isn't enough money in the current programs to buy what we need in future years.

There is a limit to how much we are going to get and we have to sell our story better if we are to get more for those systems for the out years that are not covered in 1981 and 1982 programs. That is part of what Lieutenant General Paul S. Williams, CG, V Corps, meant when he told those attending the banquet that, "We have to make up our mind to fight together as a single Army and speak with one voice." If we don't, we are not going to be successful. In the past we have not always been successful because we have spoken with too many voices clamoring for this piece, that piece, and other pieces of equipment, and that has confused the Congress. We have to stick to one story and let General Edward C. Meyer, Chief of Staff of the Army, and his people decide what our priorities are and then back them so that we have the best trained and best equipped army possible should we have to go to war.

That brings us to the matter of mobilization. As Lieutenant General LaVern E. Weber, Chief, National Guard Bureau, and Major General Zack C. Saufley, CG, 100th Division (Tng), USAR, said in their briefings, mobilization planning is just now beginning to take on a serious note. We cannot exist without it. Armor units cannot go to war without the mobilization units that are designated to support them, particularly in maintenance and logistics. Should war start, we will have to have training divisions available at the right strength, with the right equipment, to train the troops. We don't have that yet but we know where we have to go, and with that we have a lot of the battle won and can continue to work on the problem.

Wrapping it up, all of what we have said and done, and all of what will be said and done in the future, is dependent on communication. So I encourage you to communicate with me, my staff, the people in the Office of Armor Force Management, and the directorates and departments in the Armor School. If we do that, we will take everyone's knowledge, tie it together, and we will be able to ensure that our Armor Force is ready to do its job when *that time* comes.



Airborne Armor

by Captain Bob D. Mackenzie

Hey Bo Diddly,
have you heard?
We're going to jump
from a Big Iron Bird!

Everyday, legendary airborne Jody chants like the one above resound through the old World War II barracks that house the only Airborne Armor outfit in the U.S. Army. The chants, like the battalion, are unique and relatively unknown by much of the Armor community. This article will describe the organization, mission, employment, people of the battalion, and its alternatives for the future

In 1969, the 4th Battalion (Airborne),68th Armor received the *M-551 General Sheridan* Armored Reconnaissance/Airborne Assualt Vehicle (AR/AAV) and, thus, became the only airborne armor battalion in the U.S. Army. The addition of "Airborne" in the title also brought a stream of controversy regarding the worth and future of airborne armor in today's Army.

The mission of the 68th Armor (Abn) is "to provide antiarmor protection, security, and reconnaissance to the airborne division. To close with and destroy enemy forces using fire and maneuver and shock effect in coordination with other arms." This mission is augmented by the 82d Airborne Division standing order to "be prepared for

18-hour no-notice deployment to anyplace in the world; arrive, fight, and win." This admittedly difficult mission has promulgated an organization as unique as the airborne.

Organization and Equipment. The battalion is comprised of three line companies each equipped with 17 *M-551A1 Sheridans*, 1 *M-816* wrecker, 2 *M-35A2* 2½-ton trucks, 1 *M-561* "Gamma Goat," and 3 *M-151A2* ¼-ton trucks. The total personnel of each line company is 81 enlisted and 5 officers. There is no combat support company (CSC), but many of its elements are included in the battalion headquarters and headquarters company (HHC).

The HHC includes the normal command group, staff, and other support sections besides a unique element, the battalion scout platoon, equipped with *M-151A2s*. The *Redeye* section was consolidated with the air defense battalion for training, but reverts to armor battalion control as needed during operations.

The 4.2-in mortar platoon was dissolved in 1976. The loss of this platoon was due to a division trade-off with the creation of the brigade TOW companies. It was also thought the infantry 4.2-in and 81-mm mortars would help take up the slack.

The absence of the mortar platoon has been recently polarized with the realization of a possible covering force mission by the battalion. This employment would require the battalion to become heavily dependent on dedicated 105-mm support from the division artillery assets and attack helicopters from the cavalry.

With the exception of the three HHC tanks, the only other track vehicles in the battalion are three *M-577* command tracks of the S-1, S-2, and S-3 sections.

Quasi-independent Armor Companies. Each of the three line companies is aligned to one of the three airborne infantry brigades as part of the force augmentation package. As the brigades progress through the three cycles of activity—support, intensified training, and mission—so does the armor company affiliated wth each brigade. Although technically not an attachment to the brigade, each armor company maintains close liaison with its psuedo-parent brigade. Army Training and Evaluation Programs (ARTEP) and Combined Arms Live Fire Exercises (CALFEX) are administered by division, usually in conjunction with an infantry brigade or battalion exercise. The interface with the particular brigade S-3 and the normal armor battalion staff requires each armor commander to deal with an independence seldom found at company level. Much of the training thrust is diagnosed, planned, and executed totally at company level.

Armor Ready Force. When an infantry brigade enters the mission cycle, the most taxing of the three, the armor company affiliated with it becomes the Armor Ready Force (ARF). Within the ARF, an Armor Ready Platoon (ARP) is designated. This platoon will, under most contingencies, be included in the deployment of the Infantry Battalion designated Division Ready Force 1 (DRF 1). The strain of the 6-week mission cycle is apparent when one considers the requirement to be not more than 1 hour away from the company at any given time.

Also in preparation for the duty as the ARF, the tracked and wheeled vehicles of the armored company are inspected by division maintenance personnel and the troopers and officers process foroverseas movement (POM). All personnel must be qualified on their individual weapons and must be current on the 34-foot tower and jump status. In short, the ARF—especially the ARP—is totally prepared to deploy on no-notice alert. During the mission cycle, a myriad of exercises designed to test the DRF preparedness may be initiated.

In addition to the real-life combat possibility, emergency deployment readiness exercises (EDRE) including "fly-aways" are constantly being conducted.

The *All-American Blitz* is another readiness exercise with a tilt toward a mini-division olympics. After the alert is called, the DRF, with attachments and force augmentation package, are marshalled in a nearby stadium and subunits are required to undergo various events. The events include paraorienteering; physical training (PT) test; a proficiency examination in nuclear, biological, and chemical protective measures; completion of an intelligence reaction course, and many others.

The events, although infantry oriented, were won by elements of the ARP during the past "Blitz." The 4-68th airborne tankers enjoy the competitive spirit and break in the normal routine that it provides.

Airborne Armor Troopers. The same break in a trooper's daily routine that occurs during the *All-American Blitz* can be found during any scheduled airborne operation. Normally, each armor company runs its own airborne operation, including designation of jumpmasters, execution of the "drop" and the tactical exercise that is sure to follow. While most armor battalions conduct daily, monotonous motor stables, the 4-68th can break the cycle by intermittent airborne drops. There is nothing quite as gratifying as "putting your knees in the breeze" after a hard morning at the motor pool! The troops respond to these recurring "breaks" with better morale and a degree of performance not equalled in any other armor unit.

A footnote to the airborne designation "P" on a trooper's MOS is the accompanying stabilized tour that is sure to be implemented by MILPERCEN. This stabilization is, in large part, the reason for the high operational rate of the *M-551A1* in the 4-68th that is unmatched by any armor unit in the U.S. Army. Institutional memory, that benefit prayed for by most armor units, is commonplace in the 4-68th.

So, it is no wonder that the complicated systems of the *Sheridan* pose few problems to NCOs who have dealt with them during much of their military career. Even so, a people problem is developing and may spell the death knell for the battalion. Normal attrition, caused by separations, administrative discharge, and though seldom, permanent changes of station, is slowly but surely affecting the expertise and personnel strength of the battalion. The Armor School halted *Sheridan* training over 3 years ago. Consequently, the few recruits who arrive have to be retrained on the *M-551A1*.

In addition to the crew problem, an acute shortage exists in *Sheridan* turret mechanics. The battalion is currently operating with less than 60 percent of its authorized mechanics. Five of these turret mechanics are scheduled to depart by June 1981. Again, the Armor School stopped training *M-551A1* turret mechanics long ago. Even the *M-60A2* turret mechanic, a suitable substitute, is a rare and endangered species.

In spite of these limitations, the battalion continues to field all of its vehicles and maintains a startling 92 percent operational rate.

Airborne Tank Gunnery. Battalion gunnery, consisting of annual qualification and quarterly sustainment gunnery, is conducted quarterly on Fort Bragg

Ranges 40 and 79. Individual companies are given a great amount of freedom in executing their gunnery programs. With the assistance of the battalion master gunner (another endangered species), the company commander can actually "wire" the Fort Bragg ranges for platoon and company level battleruns during sustainment gunnery.

One company recently went so far as to attach *fougasse*, Hoffman charges, and smoke pots to a remote control console used to orchestrate pop-up tank silhouettes. These preparations enabled the evaluator/controllers to simulate combat conditions, complete with smoke and explosions, during platoon battleruns.

During a recent FTX, one armor company, while in a mission-oriented protection posture (MOPP) 4 conditions, loaded all *Sheridans* with live ammunition at 0200 hours. The company then conducted a tactical movement to a firing range where a company-level battlerun concluded the exercise. The entire operation was completed without a break in the tactical scenario.

In addition to regularly scheduled annual and sustainment gunnery, each armor platoon, on a rotating basis, conducts live-fire exercises and capability exercises with infantry battalions. This comprehensive gunnery program enables each tank crew to remain proficient under conditions approximating those that may be faced in combat, besides providing for imaginative training.

Training. During the intensified training and mission cycles, the battalion is engaged in field exercises, serviceability firing, off-post exercises, evaluations, and numerous other activities. During the support cycle, a company will find one or more of its platoons in the field as an opposing force or friendly armor force in support of brigade or infantry battalion exercises.

Training opportunities exist in the 82d Airborne Division that cannot be found anywhere else in the world. Recently one armor company, with battalion scouts and a support package, conducted operation *Purple Sage* in Camp Roberts and Fort Hunter Liggett, California. *Purple Sage* was an exercise planned totally at the company level with the assistance of the battalion S-3. It proved the ability of an airborne armor company to conduct a parachute assault into a foreign land, draw prepositioned armored vehicles,operate for an extended time with limited parent unit support, and return. The exercise was a total success, even though the *Sheridan* crewmen dealt with main battle tanks (MBT) and the scouts with *M-113s*. *Purple sage* was the first exercise ever conducted by an airborne unit that involved prepositioned equipment configured to unit sets. The exercise not only taxed the leadership and technical skill of the paratroopers, but was accomplished far below the projected fund ceiling of $10,000 allocated for class IX supplies (spare parts)—only $1,350 was spent.

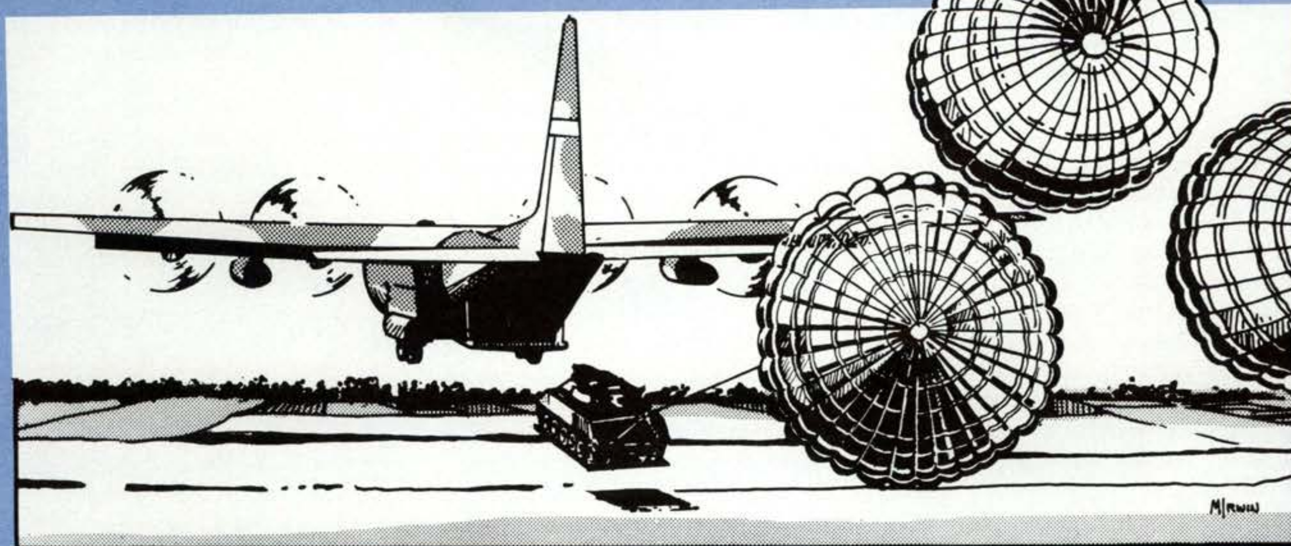
Deployability. Increased emphasis on the Rapid Deployment Force (RDF) has made the realization of limited airframes available for transport a subject of discussion. It will take 20 *C-130 Hercules* aircraft to transport one airborne armor company. Some critics of the armor battalion contend that these airplanes could be better used to carry more light infantry troops to the battlefield. However, the necessity for a fast-deploying, light armor force that can be placed with pinpoint accuracy into the battlezone is apparent. The airborne assault vehicles of the battalion can be dropped with unerring accuracy by the Air Force *C-130's* using the low altitude parachute extraction system (LAPES). The system uses a drogue and three large cargo parachutes to pull the *Sheridan* from the tail of the aircraft as it flies at 125 knots a few feet above the ground.

More than 100 *Sheridans* have been landed by LAPES in 2 years, with 97 being successfully completed. Derigging an *M-551A1* after it has been delivered by LAPES can be complicated and backbreaking work. In spite of this, an armor company recently set a standing record of 7 minutes from *touchdown* to *drive-off*.

It is this speed of employment that can enable the airborne armor battalion to break out from an airhead to form a covering or reconnaissance and surveillance (R&S) force.

The division commander has the capability of tailoring his assault packages to the situation. Under this concept, the armor battalion could well find itself either on the initial aircraft or following the entire division. Fortunately, the current 82d leadership believes the worth of these 20 aircraft will be multiplied tenfold if they carry the firepower inherent in the *M-551A1* and tactical wheeled vehicles of the airborne armor company.

The Improved *Sheridan*. The entire battalion fleet of 54 *Sheridans* recently underwent a product improvement program (PIP), which applied 43 improvements to the vehicle. The *M-240* coax mount was also affixed, and that rounded off the last rough edge of the weapon system. The majority of the maintenance problems that have



plagued the *M-551A1* in the past have been remedied by the program. Completion of the PIP, totalling more than $2 million, signified the permanence of the *Sheridan* in its airborne assault role. Indeed, resolution of the problems indicate that the 15-year-old light tank has finally come of age. The overall worth of the *Sheridan* is further highlighted in terms of recent studies conducted with the *Shillelagh,* TOW, and *Dragon* missiles against the armor of the Soviet *T-72* tank. The old *Shillelagh* missile, with its unerring accuracy, attained catastrophic kills at ranges of 3,000 meters 72 percent of the time. The unimproved TOW and *Dragon* missles lagged far behind, with success rates below the 50-percent mark.

The *Sheridan* Direct Support Team. The value of a viable direct support activity in the maintenance of the *M-551A1* is recognized by all *Sheridan* crewmen. The 82d Airborne Division unit responsible for this mission is the 782d Maintenance Battalion; specifically, its missile, armament, and automotive sections. A *Sheridan* can fight only as long as direct support can provide parts and expertise. The record of the 782d has been an enviable one in this respect.

A dilemma arises when an armor platoon or company is deployed. A sizable slice of the direct support battalion has to be included in parts of the "A" and "B" echelons. Without available direct support maintenance assets, the *Sheridan* cannot be expected to remain useful through more than 72 hours of sustained conflict.

The Recovery Vehicle Problem. The requirement to be totally and easily air transportable has raised serious recovery problems for airborne armor units. The only recovery vehicle currently authorized by TO&E is the 5-ton wrecker. Although the *M-816* wrecker is able to adequately tow a disabled *M-551A1* on flat, surfaced roads, its ability to winch or tow the 36,000-lb vehicle in rugged terrain is seriously degraded. A new MTO&E, effective 16 October 1981, authorizes three *M-578* light recovery vehicles, one for each of the three line companies. This addition, although solving the overall recovery problem, will create new hardships in the area of air transport. The *M-578* can only be transported in the giant *C-5A*, a condition that is unacceptable for the "A" echelon assault forces. These forces would then be totally dependent on the old standby 5-ton wrecker, complete with the same problem.

Maintainability. The record of *Sheridan* maintainability has not been marked by startling success in units other than the 4-68th Armor. The PIP remedied many of the vehicle's automotive and missile system failings. The suspension of the vehicle is considered to be one of the finest ever designed, lending itself to all terrain, be it swampland or desert. It is very rare to see *Sheridan* crewmen replacing a thrown track.

The *M-551A1* is totally amphibious and is used in this role in nearby Fort Bragg lakes. One armor platoon, while conducting a training evaluation exercise, traversed a 150-m water obstacle with all five vehicles in less than 20 minutes.

The majority of automotive failures in airborne armored vehicles involve transmissions, flywheels, and torque converters.

To prove the reliability of the *M-551A1*, the 4-68th battalion commander recently allowed his *Sheridan* to be delivered by LAPES to nearby Sicily Drop Zone, and then drove it directly to Range 40, where he fired Tables VIIIA and B. He scored a first-round missile hit at 2,350 meters and an overall Distinguished rating.

***Sheridan* Employment.** The airborne armor battalion can be employed in all conventional roles, as long as its light armor protection and relatively slow rate of fire are taken into account. The battalion is ideally suited to the pursuit, covering force, and counterattack role. These missions maximize the maneuverability, speed, and offensive shock effect of the vehicle and its 152-mm gun/launcher.

If the battalion were employed intact, it would most probably be placed under the command and control of a selected brigade commander for employment as his covering force. The battalion could also be a division asset, controlled by the assistant division commander for operations or the division commander himself, thereby creating a fourth maneuver force.

Normally, however, the battalion armor companies would be apportioned to each of the brigades maintaining the normal liaison.

The novel airborne antiarmor defense (AAAD) stresses centralized planning and decentralized execution.

The defense seeks to maximize the advantages of each division weapon system; *Sheridan*, TOW, *Dragon,* artillery, attack helicopter, and others. The AAAD delegates command of the battle to a number of armor kill zone (AKZ) commanders, the men who will actually see and fight the battle. The defense incorporates between 6 and 18 AKZ, and stresses mutual support of adjacent, flank units, as well as proper target trade-off.

When the *Sheridan* is used in the AAAD, it is positioned where it can acquire the threat armored formations at the 3000+ m range of its missles. In concert with the other combat elements, the *Sheridan's* missle provides a brigade commander with a surprise punch on the flanks and in the rear. The use of tank hide positions are paramount when planning such a defense in depth.

It is the AAAD that again becomes the controversial focal point, when discussing the worth of the *Sheridan*. Without the offensive power of a unit able to be expeditiously maneuvered from one end of the battlefield to another, the near impotence of light armored troops is apparent. The *M-551A1's* ability to deliver sustained and accurate fire on the threat armored and infantry formations makes it a natural ingredient in any airborne unit's defense.

The armor battalion is hindered in its employment at times, merely because it is unique. It is the only armor force in the elite division, and, at times, finds itself a lonely combined arms proponent. To offset this deficiency, proper employment of the *Sheridan* platoon, company, or battalion continues to be a major training thrust of the division. The interoperability is now such that armor representation is requested in all phases of infantry battalion or brigade planning.

The Future of Airborne Armor. If the Army is to continue support of a unique battalion of 447 personnel and 54 *Sheridans*, or a like vehicle, it must balance the worth of this unit in combat and the current cost effectiveness in peacetime.

A few alternatives regarding the future of the battalion are presented below.

Conversion of the battalion into a TOW or antiarmor battalion.

This alternative would convert the only division tracked asset into a battalion of high-mobility wheeled TOW vehicles. Although viable in terms of TOW resource concentration, and a great deal cheaper in the financial arena, this alternative would deprive the 82d Airborne Division of a large percentage of its offensive firepower! It would take from the brigade commanders the one force capable of getting there "Firstest with the Mostest," especially if we do not control the air. Reliance on a totally unreliable outsized dune-buggy-with-a-TOW, as opposed to the devastatingly effective *Shillelagh*-.50 cal-*M-240* combination, is highly questionable.

Dissolving the armor battalion headquarters and farming the line companies directly out to the brigades. This alternative would return to an organization similiar to the old infantry regiments. It has merit if one takes the consolidated maintainance system into account. The line companies could be collocated in garrison for maintenance and support, but would be directly under the particular brigade command. The interoperability would be enhanced and the air transport could be tailored to the "combat group." Many believe this alternative would preclude the duplication of support activities that now exist. Normal armor battalion support elements would be assimilated into brigade/regimental agencies becoming consolidated and reorganized. This would make, or so proponents contend, total support more streamlined tactically and more cost-effective financially.

The battalion will remain as is until a replacement for the Sheridan is adopted. This formalization of the *status quo* would take us up to the 1986 timeframe, when a light tank is projected to be fielded. It is the direction both TRADOC and 82d Airborne Division are leaning toward at the present time. The alternative has merit, if a new light tank is, in fact, going to incorporate the options necessary for the airborne mission.

The Marine Corps, in tests recently at Fort Hunter Liggett, California, as part of the ARMVAL project, proved the ability of light tanks to effectively kill threat MBTs in mass formation. On one of the formal demonstrations, one light tank, strategically placed, "destroyed" eight threat MBTs before it came under "fire."

Tests such as these indicated that the 4-68th may well be the forerunner of the U.S. armor thrust of the future.

Whatever the future holds for the 4-68th, the designers of tomorrow's Army must recognize the need for highly-mobile, hard-hitting armor that can be tailored to any RDF mission. The potential of the battalion demands its continuance, and in many proponents' views, its expansion. It remains the only airborne armor unit that can deploy in 18 hours or less to any battlefield and confront the enemy with devastating effectiveness.

After all has been said and done, it is up to the armor and the airborne community to demonstrate the battalion's value. The 4th Battalion (Airborne), 68th Armor combines the *elan* of the Armor and Cavalry with the pride and the toughness of Airborne. It is a combination the RDF should not and cannot be without.

The .50 cal talks
and the 240 sings,
I'm a Red Beret Tanker
with Silver Wings!

CAPTAIN BOB D. MacKENZIE completed initial service at Fort Knox and was assigned to the 2d Squadron, 3d Armored Cavalry Regiment at Fort Bliss, TX. While in the 3d ACR, he served as a cavalry platoon leader, transportation section commander, and executive officer of HHT and Troop G. He completed the AOAC in 1978, and was assigned to the 82d Airborne Division. CPT MacKenzie has served with the 4th Battalion (Airborne) 68th Armor since January 1979, serving as battalion adjutant for 11 months. He is a senior parachutist and has commanded Company B since November 1979.

Antitank Mines - Part II

by Joseph E. Backofen, Jr. and Larry W. Williams

Consideration of mines for the present and future inevitably leads to the subject of fuzes. The most common and simplest is the pressure fuze, which is utilized as part of the blast mine, or in an offset device for the other two types of mines. This fuze and its derivatives, such as pressure/pressure-release, glass chemical vial, pressure friction, and pressure/tilt rod, can be found in various configurations, using metallic parts to completely nonmagnetic configurations. It has also been easily hardened against sharp pressure pulses produced by nuclear bursts, artillery round explosions, air drop, mine-clearing explosive chains, flails, rollers, and other short-duration impact by unsophisticated methods such as friction, pneumatic- or hydraulic-delay and out-of-line firing chain.

In addition to the various forms of pressure fuzes, vibration- and magnetic-rate-sensitive fuzes can be found in present antitank mines. These function by recognizing the significant disturbances caused by an armored vehicle, and are usually found employed on the killing mines, such as shaped-charge and Misznay-Schardin mines, so as to gain hits across the belly of the target, without requiring physical contact between the mine and the target.

In addition to the primary fuzes, various additional fuzes can be or have been added, such as the nonsafing fuze on the West German *PZ-Mi-2*, antilift fuze for booby trapping, and the time fuze for self-sterilization on the U.S. *M-56*. These additional fuzes can be mechanical, chemical, or electronic, and can be varied in form and fabrication as much as the primary fuze; and they should all be treated as extremely dangerous. All mines should ideally be left marked for disposal by specialists, such as engineer or explosive ordnance disposal personnel.

Modern high-mobility warfare without rigid fixed lines of defense has demanded more rapid emplacement of mines. The present methods in use include: artillery or rocket-dispersed; air-dropable; air-deliverable-hand-emplaced; and hand-emplaced.[34-39] As discussed previously, a blast mine with an appropriate fuze can be delivered by any means, with the method utilized dictated only by available support and the tactical situation. But the Misznay-Schardin type can also be artillery- or air-emplaced, due to their additional characteristics, which permit them to take advantage of the entire bottom on an armored vehicle as the target.

While much attention has been recently directed toward rapidly-emplaced, artillery-delivered mines because of their anticipated harassing effect and because they can be emplaced around armor without subjecting personnel, aircraft, or vehicles to enemy action,[40,41] a few of their drawbacks should be considered. The first drawback could be overcome, but may not be. Apparently, the entire spectrum of artillery-scatterable antitank and antipersonnel mines will only be 9.3 percent of a

NBC and the Armor Crewman

by Major Donald L. Moffett

The Warsaw Pact forces have tremendous nuclear, biological, and chemical (NBC) capabilities, both offensively and defensively. In a Soviet division, chemical munitions in particular are routinely available to the commander, and hundreds of chemical rounds can be delivered within seconds from a number of battlefield systems. Routine usage of this capability would force our troops to remain in NBC protection postures from several hours to several days. Entire brigade areas would also be subjected to tactical nuclear weapon attacks with their associated prompt radiation, blast, thermal, and electromagnetic pulse effects, plus possible nuclear contamination that could persist for days or even weeks over large areas.

The conventional battle must continue with this NBC equipment superimposed upon it. Warsaw Pact troops fight in pressurized vehicles, have full NBC ensembles that they rigorously train in, and have large-scale decontamination assets available. Such capabilities allow them to rapidly exploit their use of chemical and nuclear munitions and to continue their mission if subjected to NBC environments. Our adversary is better equipped and trained to operate under NBC conditions than we are and could capitalize upon such an advantage in military operations.

Today's armor crewmen, both air and ground, face a difficult but critical task—continuing their mission with minimal degradation under NBC conditions. Warning times are often inadequate or too late; false alarm rates are high; many detection devices require the operator to leave his vehicle; and low, yet casualty producing levels of many hazards are below the detection threshold. Current U.S. armored vehicles are leaky, and warning may occur after NBC contaminates have infiltrated. Once contaminated, vehicle exteriors and interiors remain so and may require the continued use of protective equipment, such as masks and clothing. This equipment is hot, uncomfortable, cumbersome, and limits vision. Many tasks such as the sighting and firing of weapons, maintenance, resupply, eating, and eliminating wastes are difficult at best. Heat buildup from physical activities or warm weather may be excessive and cause overheating within minutes.

Though many missions are best performed with open hatches, crews may have to be "buttoned up" to minimize interior contamination and will be subjected to noxious fumes that cannot be filtered by the ventilated facepiece system, such as carbon monoxide from weapons firing. Thus, the ventilation blower must be on, increasing interior contamination.

Attack and scout helicopters in air cavalry and attack helicopter units have similar problems. The aircraft do not have overpressure systems so the crewmen must wear a complete ensemble of protective clothing. The limited space, bulkiness of the protective gear, and numerous and extensive tasks that the crewmen must perform degrade their effectiveness as members of the combined arms team. Furthermore, the units are subject to NBC attacks on the ground and, even when airborne, have many support personnel and ground vehicles that face the same problems as tank and armored cavalry units.

To remain in a fully protected NBC posture for any length of time obviously stresses, perhaps even prohibits, mission execution. In particular, command and control is stressed to the fullest. Also severely stressed are support activites such as rearming, refueling, maintenance, and medical evacuation. These are more difficult to perform and require continual NBC monitoring and frequent tedious decontamination. The ability to conduct continuous operations is certainly diminished.

In essence, today everyone has to do most everything in the NBC field. Individual or vehicle alarms, radiacs, and dosimeters; individual protective measures; and individual decontamination are the norm. Furthermore, most are time-consuming and only provide limited, local decontamination; this is not compatible with the need for rapid, mobile operations by units. Units must fight and operate in NBC environments, not just individuals or separate systems. Thus, with an area-type hazard like NBC, the development of unit level capabilities, particularly for warning and decontamination, would allow individual crewmen and systems to better perform their conventional mission.

Ideally, units should avoid NBC effects and contamination. Given those situations where this isn't reasonable, they need warning and protection; given contamination, they need a limited decontamination capability.

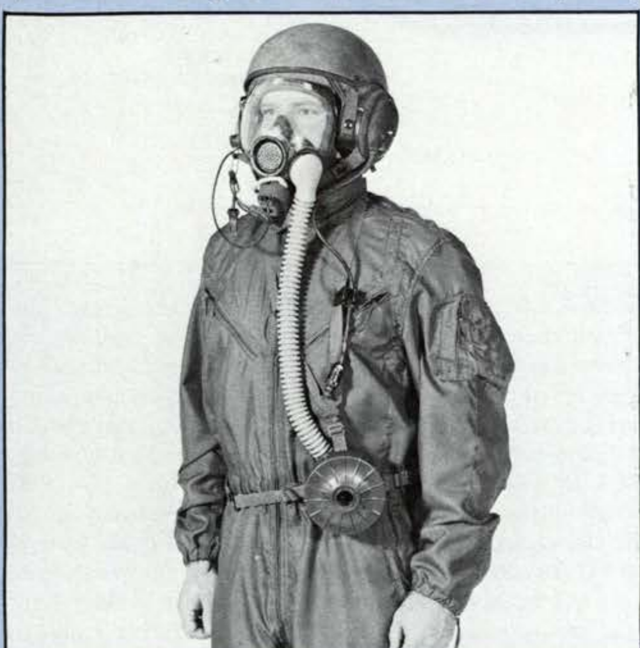
Small improvements are being made with warning devices. In some cases, a new item of equipment replaces two old items; e.g., the *M-256* chemical agent detector kit will replace both the *M-15* detector in platoons and companies and *M-18* detectors in battalions. Others are simply improvements over existing devices such as an improved Tactical Survey Meter and Vehicular Radiac System *AN/VDR-1* and an improved tactical dosimeter *IM-185/UD*. *XM-9* paper detectors to put on clothing to detect liquid agents will also be available soon. Devices being fielded over the next few years will offer quicker, more reliable warnings and longer shelf lives; will be easier to use and maintain; and will be smaller in size. The portable *M-8* and *M-10—M-18* series of chemical agent alarms are being fielded. Product improvements are being developed to further increase sensitivity and to reduce false alarm rates. New alarms are also being developed for liquid agent detection.

Most warning improvements in the near term may likely come from specialized units under the new Division 86 organizations, such as the NBC reconnaissance platoon in the divisional cavalry squadron and the NBC company in the armored cavalry regiment. Consolidating warning assets and training in the technical mission of locating, marking, and reporting NBC contamination will facilitate unit level warnings and enable commanders to learn where contaminated areas are. Development is currently underway on the *AN/ADR-6* Aerial Radiac System for use on scout helicopters.

Early warning of contaminated areas is a mission ideally suited to air cavalry units.

The most likely near-term improvements will be in the protection area. Combat systems operating in rearward areas or whose missions allow closed-hatch operations may receive positive pressure systems. However, armored combat vehicles frequently require open-hatch operations; crew exit and reentry for maintenance, supply, or reconnaissance; ventilation blowers; and breech openings during firing, all of which reduce pressure. Furthermore, these inherently leaky combat vehicles increase the weight, space, power, and cost penalties for adequate positive pressure.

Thus, these vehicles will likely be equipped with a hybrid collective protection system consisting of a partial positive-pressure type collective protection unit and a ventilated facepiece collective protection unit for open-hatch operations. (Even in the open-hatch mode, using mild overpressure could add significant protection.) An environmental control system for heating and cooling should be an integral part of such a system, because restrictive air flow and increased heat stress hampers crew functions, particularly under full NBC protection with temperature and humidity extremes. State-of-the-art options include using the vehicle exhaust heat and expanding



the bleed air of a turbine engine for cooling.

The *Abrams* and all other current U.S. tanks have a ventilated, facepiece-type, collective protection unit (figure 1). A hybrid system has been approved for the *M-1 Abrams* produced after August 1984. A hybrid system is being examined for the *M-3* cavalry fighting vehicle (CFV). The intent is to "modularize" as much as possible to allow integration with a number of vehicles. The Army's Chemical Systems Laboratory has determined the amount of NBC contaminants that get inside the *Abrams,* where the hazards are distributed, and what the vehicle purge and ventilation rates are. In non-contaminated environments, the hybrid system may be used as the ventilation system by simply bypassing the gas-particulate filters. The *Abrams* has been nuclear hardened. Built-in features are also being provided in some areas, such as a 2½-gallon internal water stowage.

The CFV crewman will be provided a ventilated facepiece like his counterpart in the infantry fighting vehicle and possibly a hybrid system. The hybrid system is being studied and prototypes will be tested. An environmental control system may be included to lessen overheating problems. If a hybrid system is fielded, it is 5-6 years away. Although the CFV is not nuclear-hardened, a study is ongoing to determine how it can be. It does have some built-in NBC features, such as internal stowage for all NBC gear and water (10 gallons). Rations could also easily be stored inside.

Helicopter systems have many of the same problems as the ground vehicles, and a tri-service agreement for aviation NBC on the integrated battlefield is addressing them. Some of the biggest problems are heat stress, the interface of the protective mask with the optics and avionics on the aircraft, and the bulky gloves that make it difficult to operate switches and instruments.

Lightweight, air-permeable materials and better designs for individual protective clothing are being developed to lessen heat stress and efficiency degradation. Other improvements include overboots and butyl rubber gloves to replace the glove and sock set and the *M-2* leather dressing kit. Even though a vehicle is "purged" of most contaminants and pressurized, crews will likely have to remain masked for long periods. Thus, a new, more comfortable *XM-30* series multipurpose mask is in development and will replace the *M-25* (tanker), *M-24* (air crew), *M-17* (field), and the *M-9* (special purpose) protective masks. The mask has a large, flexible plastic lens that is compatible with most gun and observation sights; has two voicemitters for easier and clearer talking; is easier and faster to put on; has a NATO threaded external filter; and allows drinking and mouth-to-mouth resuscitation. The filter remains a hazard with nuclear contamination, in that it forms a "hot spot" of radioactivity. Making the lens resistant to scratching and visual obscuration is still a prob-lem, and both silicon-coated and molded urethane lenses are being evaluated. The new mask also causes visual distortions for the crews of the *AH-64* and *AH-1S* helicopters. The initial operational capability for the new mask is 1984.

Several concepts are being investigated for a microclimate cooling system so that a crewman can be heated or cooled individually with a dismount capability (portable battery pack with 6 hours of operation).

Decontamination requirements include vehicle exteriors, interiors, and personnel. Limited decontamination for combat vehicles, now done with the *M-11* decontamination apparatus, will be improved with the new *XM-13*, 14-liter (3.7 gallon), portable decontamination apparatus. An improved *M-258* personnel decontamination kit is being fielded. It contains foil-wrapped decontamination towelettes which can be used three times rather than the current, one-shot plastic bottle version. Concepts are being tested for more rapid, large-scale decontamination of vehicles and personnel, e.g., whole units.

While the NBC company of the armored cavalry regiment under the new Division 86 organization has a decontamination platoon of four squads, each with decontamination apparatus, the normal decontamination rate for the platoon is abour four trucks or 80 personnel per hour. Within a few years, a jet exhaust powered decontamination system similar to what the Soviets already have may be fielded to enhance large-scale decontamination. The prototype is a jet engine mounted on a hydraulic turntable on the back of a 5-ton truck. A nozzle ring

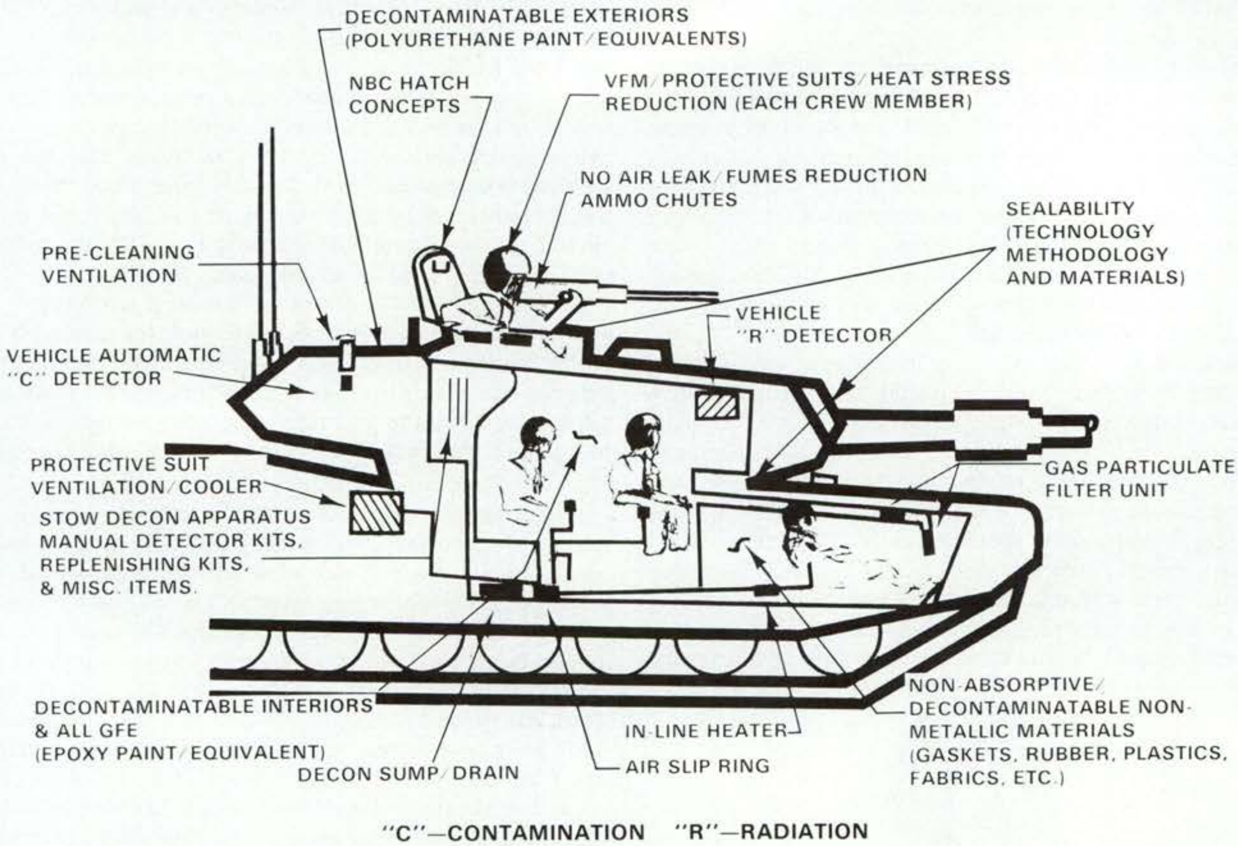


Figure 1. Individual/ventilated facepiece-type mask for vehicle crew protection—the complete systems approach.

at the engine's exhaust injects water or decontaminating solutions into the exhaust air stream. Contaminated vehicles would be slowly driven between two such systems positioned about 50 meters apart, rapidly decontaminating vehicle exteriors.

Development is also ongoing for an aircraft decontamination, deicing, and cleaning system that can clean and/or decontaminate helicopters. The unit will use high pressure or a scrubber, and will be compatible with the internal washing requirements of existing turbine engines.

A related issue is the vehicle paint. Current alkyd-based paints tend to hold agents and are incompatible with some decontaminants. Impermeable (agent-resistant), urethane-based paints have been developed that, though more expensive, are longer lasting and much easier to decontaminate. All armor combat vehicles will have this paint applied externally when it is approved. While the removal of thickened agents or agents in "traps" on the vehicle may present some problems, a large-scale decontamination system and impermeable paints should prove very beneficial. Helicopters, however, have a rough-textured, IR suppression paint that the aircraft decontamination system discussed above must be able to handle.

However, interior decontamination remains a difficult task. An epoxy paint developed for interior surfaces will facilitate decontamination. In addition, interior components are being redesigned or modified to reduce absorption and to permit decontamination with soap and water. Nonetheless, the array of electrical systems, optics, rubber, plastics, seals, and oil present in the interior of combat vehicles severely hinders adequate, reasonably rapid, interior decontamination. Stowage compartments and increasingly complex systems further compound the problem. No practical means for rapid interior decontamination that is nondestructive to components has yet been developed, although a heat system for decontamination is being investigated. The special composite materials in helicopters for weight reduction contribute to an extremely difficult decontamination problem.

Given that the developments discussed above produce fielded equipment, there is still much to be done. In some cases, the technology is currently premature; others are complex and/or expensive; some require incorporation into the initial design stages of follow-on systems; and some simply require a decision. A few of the more significant things that need to be done to enhance the armor crewman's ability to fight and survive on an NBC battlefield are discussed below.

Warning still needs much improvement. Since chemical and nuclear hazards, in general, require similar protective measures, NBC alarms and sensors should be integrated to make full use of miniaturization and commonality to reduce current weight and space problems. A step in this direction is the work on an integrated, inexpensive, light, compact multipurpose radiac device to ultimately replace all current radiac equipment. The capability to remotely sense from mobile vehicles does not yet exist; however, knowing of an NBC hazard before it is encountered would allow greater response times. Initially, the crew doesn't need to know the level or type of hazard, e.g., vapor or aerosol, persistent or nonpersistent; they simply need to know an NBC hazard is there in order to take protective measures and continue their mission. They could then be told the level, type, and changes in protection levels as the situation allows.

A related unit-level problem is being knowledgeable of crew and individual exposures, e.g., as multiple exposures occur and casualties are replaced, various levels of performance degradations within crews and within units may occur. More sophisticated equipment to sort the types and levels of contamination would likely occupy more space and constitute a highly technical mission that selected vehicles within larger unit levels might be "dedicated" to perform. Concepts referred to as NBC reconnaissance vehicles are being examined as a means for units to be warned of large area hazards. Whereas much of today's equipment requires the crew to leave their vehicle, these concepts consider performing the entire mission of detecting, warning, surveying, and marking hazard areas in a minimum time while remaining onboard to avoid/minimize contamination. The Soviets have fielded the *BRDM-2 RKH*, which allows such a reconnaissance.

Contamination detection is important not only before but also during and after decontamination. State-of-the-art detection does not currently measure low levels (below lethal threshold). However, crew exposure to these levels over periods of minutes to hours could become significant. Such a capability is needed to allow appropriate lower protection levels.

Unit sustainability in contaminated environments is still a problem. In particular, rearming and refueling will contaminate crewmen and vehicle interiors and require time-consuming decontamination. While the development of a tracked armored forward area rearm vehicle (AFARV) is underway, the archaic interface with the vehicle and crew, e.g., passing one round at a time throghu the hatch, remains. An interface that allows crews of both vehicles to remain onboard and protected is needed. Refueling in a contaminated environment could be easier to accomplish using existing technologies such as drogue or probe, high-pressure, closed-circuit refueling techniques that are used to refuel aircraft. Helicopters, however, also have contamination problems with personnel and equipment, particularly during rearming.

Ways are needed to reduce leakage, thereby minimizing NBC infiltration and lowering weight, space, and power requirements for positive pressure modes, especially for helicopters. Heat-burden and fatigue associated with NBC protection over extended periods necessitates an integrated environmental control system. In recent years, our society has developed environmental control systems, particularly for commercial aircraft, using technology that should produce similar systems compatible with armor's weight, space, power, and efficiency requirements.

The crewman's protective clothing, in addition to being lightweight and reasonably cool, must withstand rough use with minimal maintenance; offer thermal, flame, and spall protection; be readily decontaminated and reusable; and give an indication of when it is no longer effective to preclude premature disposal. Clearly, we are far from achieving this, but the need and operational impact of a true "battle dress" for the armor crewman fighting on the integrated battlefield is great.

Survival in a protected posture also demands the ability to eliminate wastes, including the toxic wastes and fumes from weapon systems, food and ammunition packaging, and human wastes. Evacuating weapon fumes separately or isolating the crew or weapon may handle the first, and the aerospace program has taught us much about food and biowastes. Even the camping and backpacking industry offers a number of cheap, simple techniques for these problems.

Medical evacuation and treatment is another weakness. Conventional casualties can also become NBC casualties, and contaminated medical facilities can rapidly lead to more casualties. There is no practical method today to rapidly decontaminate casualties in forward area. Although the *M-51* shelter is being fielded, it can only protect 10 occupants, given they are decontaminated before admission. Clearly, medical evacuation vehicles and aid stations, both with fast and efficient decontamination assets, are needed.

A simple, rapid way to decontaminate vehicle interiors is also needed. It should preferably use non-special solutions (for logistics and safety reasons) and be able to neutralize NBC contaminants on mud, rubber, and oil, yet not damage electronics, fire controls, and optics.

In summary, the armor and aviation crewman is facing a very real and extensive NBC threat; his capabilities to operate and survive in such an environment are currently questionable; a number of developments are being pursued that will improve his situation, and a great deal still needs to be done. The integration of alarms and sensors, coupled with new specialized NBC organizations to use this protective and decontamination equipment, will be one of the greatest near-term benefits, by reducing the training and logistics burden on maneuver units. The new protective mask should also facilitate training and interoperability. Finally, the potential for rapid, large-scale exterior decontamination with the jet system may enhance training in this vital area. However, other than these three developments, there isn't much the armor crewman will see fielded in the next few years that will dramatically improve his capability to operate under NBC conditions.

Many of the developments discussed in this article can and will be placed on fielded systems as product improvements, and others will be incorporated into new systems. Some developments, in order to realize their full benefit, must be treated as an integral, essential aspect of follow-on systems from their initial design, so that we don't find ourselves in this situation again in the future.

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TOW 2 Is On The Way

by Captain Robert R. Sigl

The US Army is developing an improved model TOW to increase the TOW's effectiveness against enemy armor. The TOW improvement program is being accomplished in two stages. The first stage has been completed with the issuance of the Improved TOW in Europe. The second stage will result in the fielding of the TOW 2 in the future. The Project Manager TOW has provided much of the information in this article.

The TOW Weapon System Product Improvement Program (PIP) was initiated in 1978 by the Army to develop and field improvements to the existing TOW weapon system to defeat the postulated armor threat of the 1980's. The primary objectives of the TOW PIP are to increase lethality to defeat the postulated Armor threat; and provide guidance link improvements to harden the TOW weapon system. Increased lethality is being realized through the development and fielding of the Improved TOW with an improved 127-mm (5-inch) warhead section *(M-207E1)* which provides increased terminal effectiveness compared to the basic warhead. The TOW cannister is 6 inches wide, allowing the TOW 2 missile to incorportate a full caliber 152-mm (6-inch) warhead with greater terminal effectiveness than the improved 127-mm (5-inch) warhead. To compensate for the added weight of the TOW 2 warhead, a more powerful flight motor is being developed for the TOW 2 missile. The remaining development effort will provide guidance link hardening through modifications to both the TOW 2 missile and launcher.

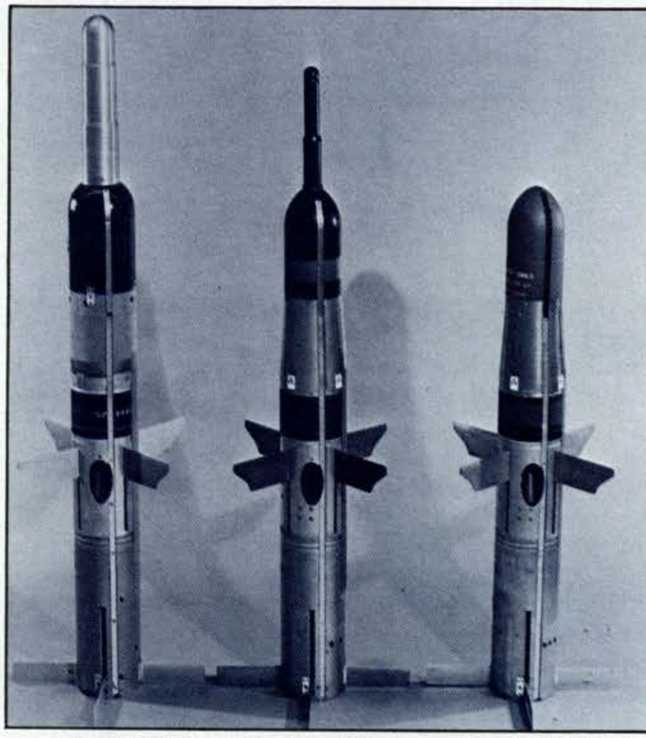
The TOW 2 System Developmental Test and Operational Test II (DT/OT II) was conducted at Redstone Arsenal. The test program was conducted using pre-production prototype TOW 2 launchers and TOW 2 missiles. The primary objective of the test program was to verify that all performance and tactical suitability requirements have been met and that planned TOW 2 modifications should enter into the production phase. The final test report has not yet been released.

Improved TOW (ITOW) Missile

The only difference between the Basic TOW and the ITOW is the improved warhead section. The ITOW 127-mm (5-inch) shaped-charge warhead contains an LX-14 explosive filler with a dual-angle liner. This shaped charge is detonated at a standoff distance of 3 caliber diameters (381 mm or 15 inches) by means of a crush switch on the tip of an extendable, cylindrical probe, which is housed in the warhead cavity. Additionally, a redundant ogive crush switch can also cause detonation of the warhead. Prior to launch, the probe is collapsed and stowed within the cavity. Subsequent to clearing the launch tube and prior to flight motor ignition, the probe extends and locks into position.

TOW 2 Missile

The TOW 2 (152-mm or 6-inch) warhead and probe are essentially scaled-up configurations of the warhead and probe developed in the ITOW 127-mm (5-inch) warhead improvement program. The TOW 2 warhead/probe weighs approximately 5.9 kg (13 pounds) compared to about 3.6 kg (8 pounds) for the basic warhead. The TOW 2 flight motor uses the basic missile motor case, but replaces the propellant with a case-bonded, cross-linked, double-base propellant, increasing the total motor weight by about 1.25 pounds. Total impulse of the TOW 2 reloaded flight motor is approximately 30 percent greater than that of the basic flight motor. A new thermal beacon is mounted in the aft end of the missile opposite the existing xenon beacon. The associated beacon eletronics package is installed forward of the left-hand wire dispenser. The thermal beacon and associated electronics adds about .68 kg (1.5 pounds) to the missile. Application of all modifications will



cause the TOW 2 missile to weigh approximately 3.6 kg (8 pounds) more than the basic TOW missile.

Modification of the Basic TOW missile to the TOW 2 configuration will be possible through application of modification kits at depot level. This will involve replacement of the 127-mm warhead section by a full-caliber (152-mm) warhead, replacement of the basic flight motor with a reloaded flight motor and the addition of a new thermal beacon to the aft end of the missile. These modifications are illustrated in Figure 1.

All TOW missiles are compatible for launch from any of the current launch platforms. The TOW 2 program does incorporate a number of significant modifications as outlined below.

TOW 2 Ground-Mount Launcher

Ground launcher modifications are shown in figure 2 and include modifying the night sight (AN/TAS-4) to permit thermal beacon sensing for video thermal tracking (VTT), a new Digital Missile Guidance Set (DMGS) to incorporate VTT and the capability to select either VTT or optical tracking modes.

The TOW 2 launcher system will be compatible with, and capable of, firing all three TOW missile configurations.

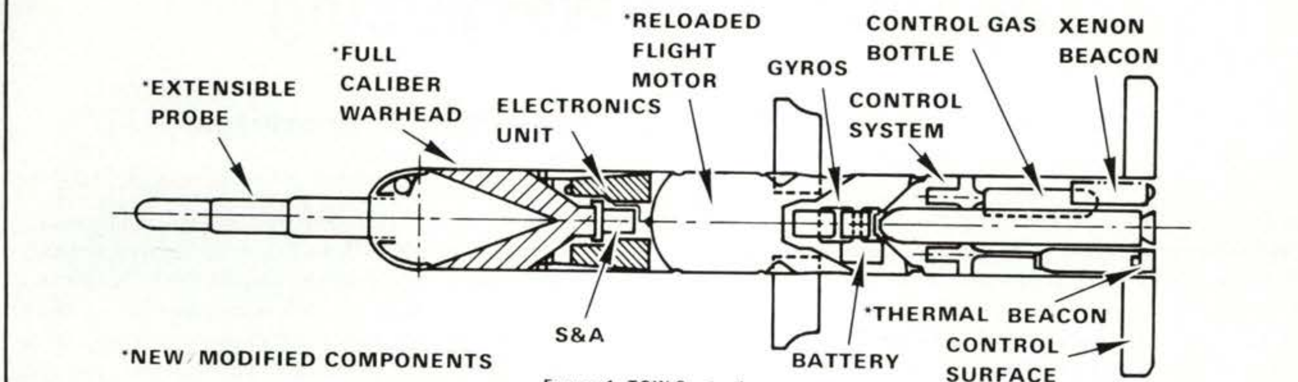


Figure 1. TOW 2 missile.

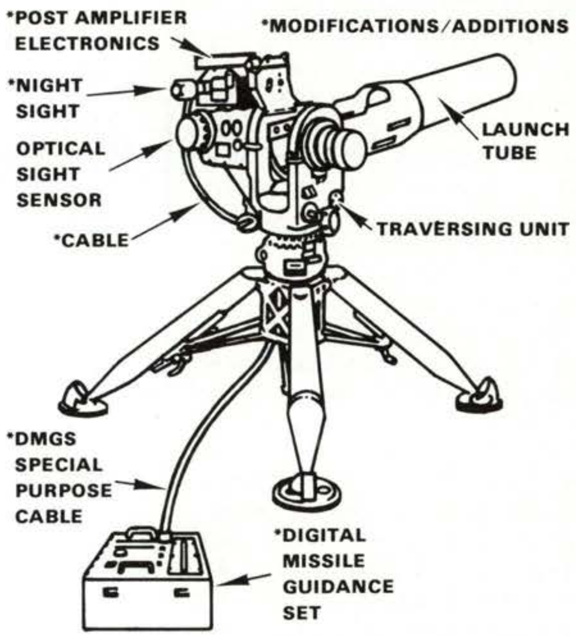


Figure 2. TOW 2 launcher system.

Hence, automatic determination of the type of round loaded is made in order to select and execute appropriate built-in guidance equations. With the TOW 2 missile, the thermal beacon will be used to sense missile deviations when environmental conditions preclude and/or degrade sensing of the xenon beacon. Under degraded visibility conditions, the gunner will use the night sight for target tracking and engagement.

Improved TOW Vehicle (ITV) *(M-901)*

Integration of TOW PIP to ITV consists of two concurrent programs. The program manager (PM) of TOW missiles manages the program that covers changes to components common to all TOW launchers. This includes addition of modifications to the thermal sight, exchange of analog for new digital modules in the Missile Guidance System and replacement of cables. PM ITV manages the program that covers ITV-unique changes, such as elevation assembly and cables. PM ITV will also arrange for installation of those common components provided to him by PM TOW. The work is planned to be accomplished by factory or depot contact teams.

Modifications will take approximately 49 hours per ITV. It is expected that a contact team will install modifications at unit field locations. Two ITVs have already been completely retrofitted to TOW 2 platforms and were used as the primary launch platform during the DT/OT II at Redstone Arsenal.

Infantry Fighting Vehicle/Cavalry Fighting Vehicle (IFV/CFV)

The PM of Fighting Vehicle Systems (FVS) and the PM TOW have developed a program outlining the integration of TOW 2 to IFV/CFV. A full test program will accompany the integration of TOW 2 to insure reliability, maintainability, and logistical supportability.

Test, Measurement and Diagnostic Equipment (TMDE)

Modifications and/or additions to the basic TOW Test, Measurement, and Diagnostic Equipment (TMDE) are required to accomodate TOW 2 system modifications and consist of the following:

- Digital Missile Guidance Set (DMGS) Test Display
- Post Amplifier Test Set
- Traversing Unit Test Control Set (TA-20/16)
- Umbilical Breakout Tube (Electrical Circuit Tester)

The purpose of the DMGS Test Display is to verify proper functioning of the DMGS/Launcher or to isolate DMGS faults to a replacable subassembly. The Post Amplifier Test Set is used to isolate faults in the Post Amplifier assembly to the board lever, to balance video channels, and to aid in reticle alignment in the night sight. The Traversing Unit Test Control Set is used to check continuity in the traversing unit and to test traversing unit and post amplifier cables. The Umbilical Breakout Tube simulates a missile (electrically) and is used to break out signals sent to and from the missile, to aid in verifying DMGS operation, and to exercise squib circuits.

The TOW 2 Program is well on its way to success

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The Rebirth of Wargaming

by Colonel John D. Borgman and Major Richard L. Hooverson

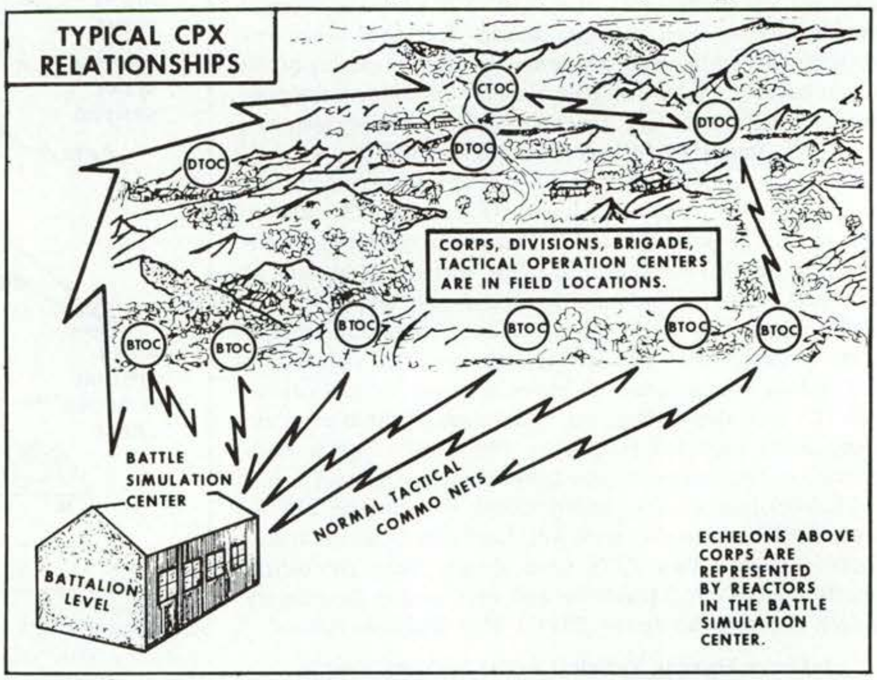
In the mid-1970's, the American Army rediscovered war gaming and hailed it as a new and wonderful panacea for staff and leader training at all levels. In a great burst of enthusiasm, we charged into computer-assisted map maneuvers simulation (CAMMS), *Dunn-Kempf, Pegasus, War Eagle, First Battle, Firefight,* and others. By 1978, however, the Army had become somewhat disillusioned and war gaming became a now-and-again training event.

Why the decline in popularity of a valuable training tool? The answer is simple. Commanders felt the time, and effort, required to set up the war games was too costly. Attempts to field computer-assisted games became bogged down in a bureaucratic battle to get input devices, money, and leased lines. War games became "too hard" to execute.

At Fort Hood, the war game was headed for the dinosaur boneyard. It became apparent that commanders at all levels felt that time and resources could be better spent on other training activites. The III Corps G3 Section, was telling units that war games were available if they wanted them, but was doing little to help them. It was obvious that the installation had to offer assistance to companies, battalions, brigades, and divisions. To this end, III Corps set out to rebuild an old World War II gym as a battle simulation center that could also double as a deployment center. This center would provide all levels of games from *Dunn-Kampf* at squad level to *War Eagle* at corps level. The key was providing units with a game of their choice that would be set up in advance for them.

Further, all they had to do was arrive with the TO&E equipment necessary for a command post (CP), including *M-577* CP vehicle, coordinate their arrangements, and provide unit-level simulators. In other words, the Corps G3 took the hassle and bureaucracy out of war gaming, and it was well received by the units.

As with all great ideas, a test of both the physical plant, and the plan and service was needed. The toughest command post exercise (CPX) we could envision was one involving a three-division corps with its attendant combat support and combat service support units. During the past year, the Corps has enthusiastically entered the CAPSTONE program, which, in III Corps' case encompasses 267 Active Army, National Guard, and Reserve units. All units under CAPSTONE are targeted to the Corps' wartime mission in Europe. Further, the realization that U.S. Army Forces Command desired the 1st, 4th, and 5th Infantry Divisions (Mechanized) and 3rd Armored Cavalry Regiment to participate in two corps-level operations a year under the CORTRAIN program added impetus to using the corps-level game.



The test for III Corps war gaming plan began in January 1981 with GOLDEN SABER III, a Corps multiechelon CPX, using *War Eagle/First Battle* rules. The player units operated from tactical operation centers (TOC) in field locations, and the controllers worked out of the Simulation Center. Senior U.S. and NATO officers served as the key controllers at echelons above corps to add realism to the European scenario.

In preparing for the exercise, careful attention was given to the development of an enemy situation that would enable the CPX to follow the desired scenario. For example, during the counterattack phase, the situation provided a combat ratio over the enemy that logically allowed for an offensive action, and provided friendly units with some chance for success on the battle boards. Careful calculation of the overall enemy strength, including air support, and the terrain were accomplished as part of preexercise planning. Corps-sized simulations were conducted for 72 hours to establish sufficient enemy order of battle in the initial intelligence situation.

The key battle managers were at the focal point of the CPX in the battle simulation center. Simulators in the center provided the link between the battle boards and the TOC's. The simulators also portrayed subordinate Blue and Orange units by receiving orders, making decisions, rendering reports and impartially applying the game rules. Blue Force simulators on each battle board represented three to five battalion task forces, including supporting artillery. During the CPX, 11 battle boards were used, each having 1:25,000-scale maps with sufficient coverage for any breakthrough or exploitation that might have occurred.

Before the CPX, Blue Force simulators were provided with key information for each unit, such as operations orders and overlays, task organization, authorized personnel and equipment, and initial status reports. Based on this information, they made unit counters and tally sheets for each company-sized unit.

During a typical game turn, an intelligence situation provided enemy information that the simulators would normally expect to have in combat, and it was used for targeting purposes. Movement values on each counter indicated the number of grids that the unit could traverse in a 30-minute game turn. Counters of both forces were moved to tactically sound locations on the battle boards. On the separate division/corps rear board, and on an opposing forces rear board, counters were displayed for units that were not on the forward boards. Several hundred counters were displayed in the Simulation Center, representing the entire corps troop list. The tally sheets were placed under plastic document protectors, assembled in binders, tabbed for quick reference, and used to account for loss of weapons due to indirect fire, direct fire, and close combat. The simulators "maneuvered" and "fought" the units in realtime.

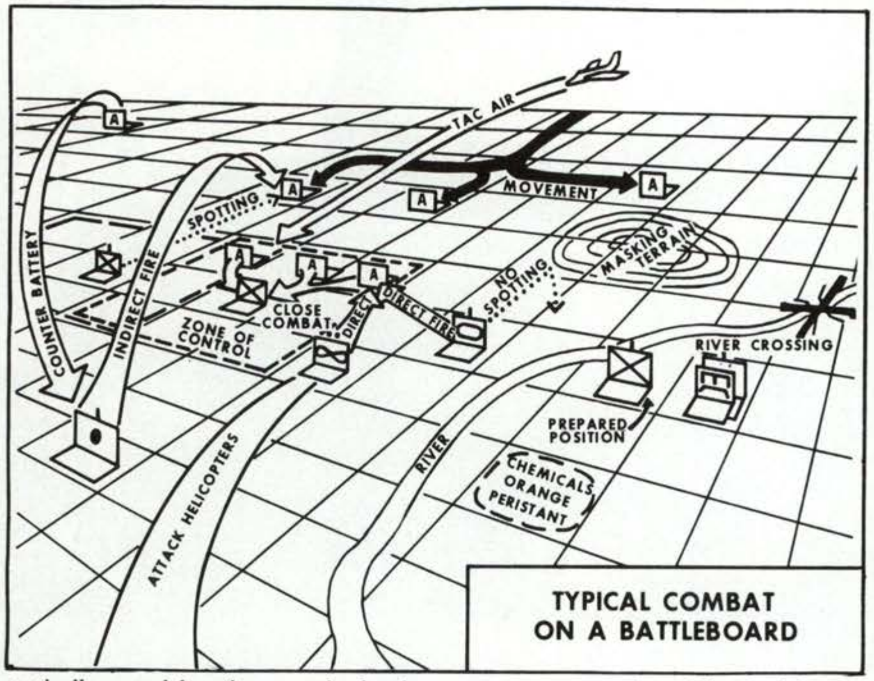
Blue companies fought Orange Battalions. As the simulators attempted to gain specific objectives, they usually used each unit's full capability during the game turn. Then at the end of the turn, they again could move, shoot, communicate, and engage the unit in combat up to the limit of its remaining combat strength.

Unquantifiable "real life" factors were incorporated into the role of the dice, which were used to generate random numbers. These random numbers were used to enter combat results tables that contained probabilities of success or failure for specific types of combat activity. Unit combat strength was determined from the tally sheets, the die was rolled, and the various tables were consulted to determine the victor.

Resolution of close combat was based on the relative force ratios of "attackers" compared to "defenders." Simulators took action as they would in actual combat. For example, if Orange used preparatory fires, Blue had the opportunity for employing counterfires. When Orange moved, Blue observed and initiated direct fire, using attack helicopter or close air strikes. Orange continued to move and/or returned fire. When a unit was attrited to its ineffectiveness mission level, the counter was removed from the board.

Troop leading steps for simulated units did not take place in detail, and written orders were not prepared. Battalion-level situation reports were based on a "snapshot" of the battle boards and were transmitted to the brigade TOC. Reports subsequently flowed from brigade to division, and then to corps, using normal communications systems.

In summary, war games are a manpower-intensive, controlled exercise of tactical play. The near future offers computer solution to cut down the "butcher's bill" for controllers and simulators. However, today installations can provide a war game facility that cuts the red tape for the unit. Due to the lack of time and money to run expensive field training exercises, war games are the key to training leaders and staffs from company through corps level.



TYPICAL COMBAT ON A BATTLEBOARD

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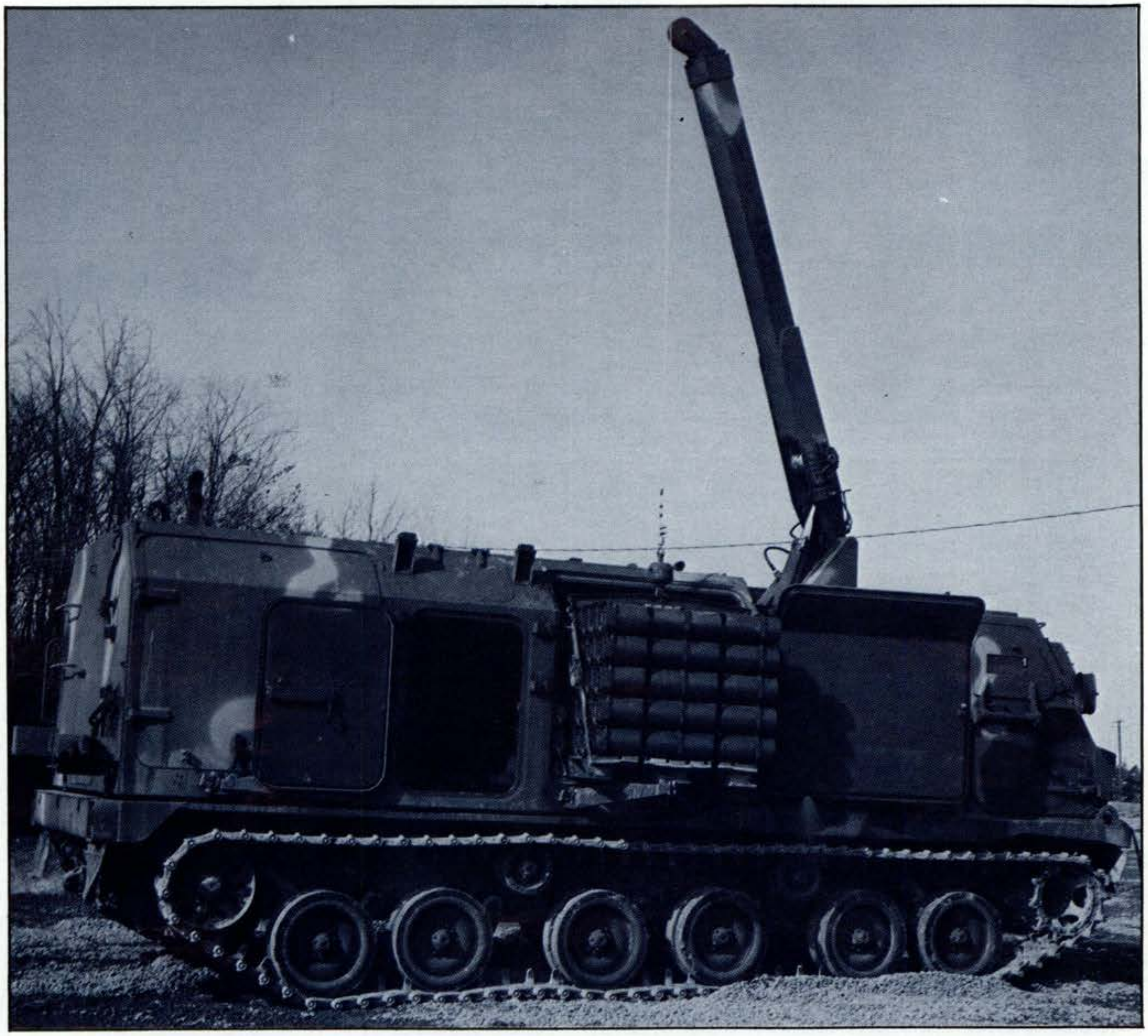
MAJOR RICHARD L. HOOVERSON is currently assigned as Battle Simulation Officer, III Corps and Ft Hood, Texas. He has planned and participated in 13 large-unit CPX's, using expanded battle simulation techniques. Previous assignments have been in logistics plans and operations with the 8th Infantry Division (Mechanized) in Germany, the 1st Infantry Division in Vietnam; and as a training developments officer on the faculty of U.S. Army service schools.



An Armored Vehicle for Rearming Forward

by Captain Judd Squitier

It is an accepted fact that if combined arms operations are to succeed on the modern battlefield, combat service support (CSS) elements must rearm, repair, and refuel the combat maneuver forces as far forward as possible. Yet there are no tracked vehicles in the inventory that provide mobility, survivability, and payload capabilities for performing these essential CSS tasks—particularly rearming and refueling. This deficiency will force combat vehicles to withdraw to rearm, and combat power will be lost. The importance of battlefield sustainment and organic forward CSS was an important topic at the 1981 Armor Conference at Fort Knox, Kentucky. (See *ARMOR* July-August 1981.) Forward-area rearming is a critical area to both CSS units and the combat arms, and solutions to the problems in this area are of paramount importance. There are few in the Armor community who would disagree with this assessment. This critical deficiency in the capability to rearm, refuel, and repair well forward is likely to increase with the integration of the newer weapons systems, such as the *M-1* tank and the *M-2/3* fighting vehicles.

A solution to the problem of rearming during combat is the Armored, Forward-Area, Rearm Vehicle (AFARV). Although the AFARV concept is not new, past prototypes have lacked the armor protection, load capacity, and mobility needed to operate in a forward area. An example of an early concept is shown in figure 1. Newer AFARV's are under development and may soon join the family of combat vehicles in the Division 86 structure. A design that underwent testing is shown above. The hull of the vehicle is the *XM-987* Fighting

Vehicle System (FVS) carrier which is employed by new vehicles such as the Multiple Rocket Launcher System (MRLS). The vehicle has a hydraulic crane with 2¼-ton capability for lifting palletized ammunition from trucks or an ammunition supply point to its internal stowage compartment. Pallets can be offloaded by crane also. The AFARV has the additional capability of offloading single rounds directly into a tank with a single-round conveyor. An *M-60* tank, for example, can be fully uploaded with the conveyor in approximately 15 minutes (figure 2).

The AFARV is slated for use at battalion and squadron level and 700 are projected for production. Fielding is planned for 1986. The mechanized infantry battalion and cavalry squadron will employ 8 AFARV's each, and the tank battalion 7. The vehicle carries tank main gun ammunition as well as TOW's, *Dragons*, LAW's, and machinegun and rifle ammunition. The AFARV will operate between the combat trains and the forward line of troops. Wheeled vehicles will transport ammunition from the ammunition supply point (ASP) or an ammunition transfer point (ATP) to the combat trains or a forward location, where it will be transferred to the AFARV. The actual rearming of the combat vehicle will be at the platoon battle position or nearby. The AFARV also has the speed and mobility to accompany the fighting elements during offensive operations, and to provide expeditious ammunition resupply capability well forward, thus maintaining the momentum of the force.

There are, however, some minor problems of total integration of the AFARV concept into the force structure. The most challenging of these problems involves ammunition packaging and storage containers. A project is underway to improve ammunition containers to allow swift unpacking, yet continue to meet safety requirements (figure 3). Pallets, or modules, of prepackaged ammunition, utilizing a high tensil fiber honeycomb design, would provide quicker ammunition breakdown capability not only for the AFARV system, but also at the ASP or tank range. Additionally, a system on the tank to permit quick mechanical loading from AFARV to tank will be needed in the future to use the full potential of the vehicle.

The AFARV is the solution to one of the CSS problems of forward area—that of rearming—and development work is underway on armor-protected repair and refueling vehicles.

CPT JUDD E. SQUITIER was commissioned in Armor as a Distinguished Military Graduate of Syracuse University in 1977. He has served as a platoon leader and adjuctant in the 5-33d Armor, as a project officer for the *M-1 Abrams* Tank Operational Test (OT) II, and as squadron S-3, 6th Cav Sqdn, 1st AIT/OSUT Bde (Armor), Fort Knox, Kentucky. He is currently attending the Armor Officer Advanced Course, and will be assigned to 3-64th Armor.

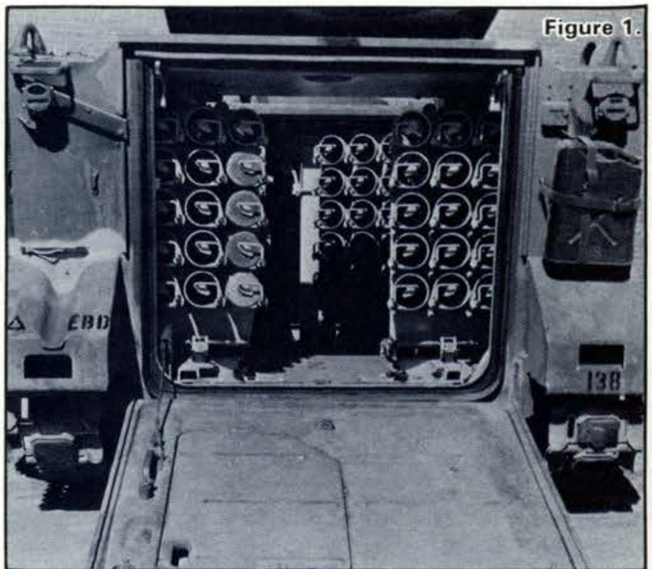


Figure 1.

Figure 2.

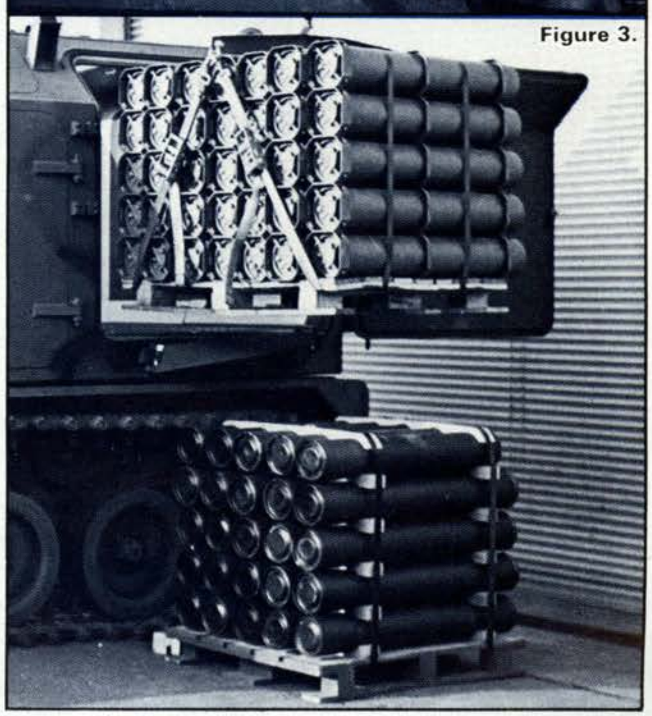


Figure 3.

Army Needs a Replacement CP Vehicle

The *M-577* Command Post (CP) Vehicle needs to be replaced because it is inadequate for command and control activities on the modern battlefield. Its visual signature makes it conspicuous, its armor is insufficient, and it has no armament for defense of the CP area.

Staffs of higher level units could continue to use the M-577, but small units need a vehicle that matches the armament, armor protection, and communication equipment of the new tanks and fighting vehicles that are now entering service.

M-2/3 fighting vehicles provide the infantry and cavalry with an armored mount that will not only take them *to* the battle, but *into* and *out* of it as well. So why not give these vehicles the added role of serving as company or troop CPs?

With a few modifications, an *M-2/3* could become an adequate, armor-protected, mobile CP. This hybrid *M-2/3* CP track would offer several significant advantages. It would

- Utilize a vehicle that is already in service
- Not require any special logistical support
- Provide a measure of firepower for defense of the CP
- Blend in with other vehicles on the battlefield, thereby eliminating the distinctive visual signature that now marks the *M-577* as a command and control vehicle

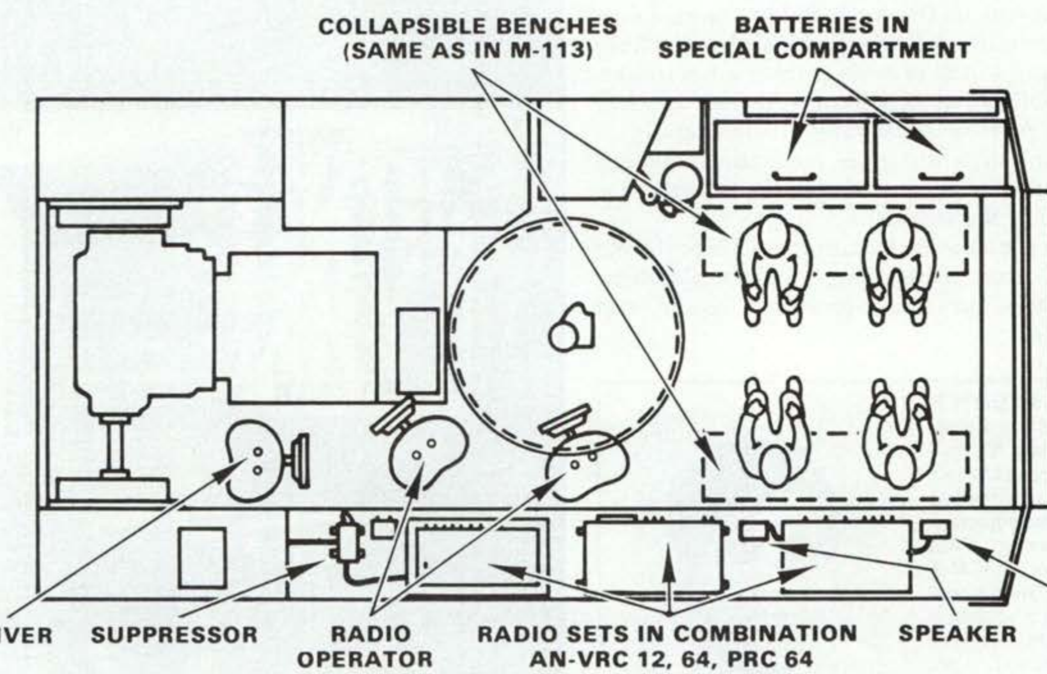
External modifications to the vehicle would include the removal of the TOW launcher, installation of additional antenna bases and an auxiliary power unit on the back deck, and the addition of a stowage rack at the back of the vehicle above the ramp. Internally, it would be necessary to:

- Remove TOW stowage racks
- Limit 25-mm ammunition stowage to 400 rounds
- Afix mounts to the left side of vehicle for radio equipment
- Install two swivel seats on the left side for radio operators
- Install two retractable bench seats on each side aft of the turret basket

Considerably more room for command and control equipment and personnel can be obtained by removing the turret and arming the vehicle with a cradle-mounted .50 caliber machinegun on a race ring for 360 degree traverse.

The suggested modifications for coverting an *M-2/3* fighting vehicle to a mobile CP are shown in figures 1 and 2.

A small-unit commander equipped with an *M-2* or *3* Command Post Vehicle will be able to move about the battlefield with ease and relative safety. He also will have the capability for better control of his maneuver elements and firepower for defending his CP.



Note: Turret would be deleted from the M-2 command post version and replaced with a M-113 cupola.

Figure 1

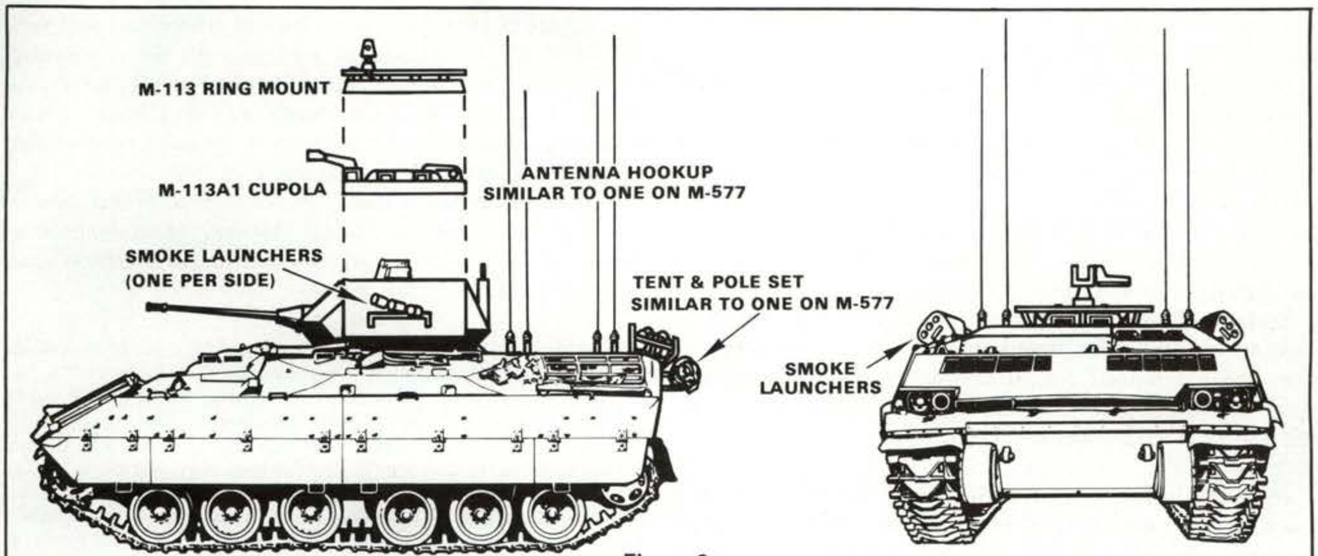


Figure 2

CRAIG C. MOSHER
Staff Sergeant

Human Nutrition and Waste Elimination

One of the gravest threats facing the U.S. Army today is the capability of Threat forces to saturate an area with persistent chemical agents. Individual protective ensembles offer a soldier chemical protection against this hazard, but only at the expense of severe physiological stress—overheating, thirst, hunger, and difficulty in passing bodily waste. Commanders are forced to compromise between troop protection and operational effectiveness, following a graduated scale of options termed Mission Oriented Protective Posture (MOPP).[1] Other than MOPP, the only doctrinal solutions offered are to frequently rotate units in contact, withdraw units, or utilize collective shelters. These "solutions" seriously degrade the defense and are far from what can be termed acceptable.

A partial solution to\ thirst is found in the design of the *M-17A1* protective mask: A coupling attachment allows the consumption of water without sacrificing protective integrity. Particularly perplexing, though, is the problem of feeding troops encapsulated in protective equipment and the associated problem of fecal elimination. Natick Laboratories performed a study of garrison and tactical feeding concepts for use in the next 2 decades, but they dismissed this particular problem with the statement, "Food service operations will be curtailed in any NBC contaminated area."[2]

Although the Quartermaster Branch may be unable to cope with the problem, the Medical Corps already possesses a potential solution—liquid diets. Such diets are standard fare for many hospital patients. Furthermore, the public routinely consumes liquid meals marketed as either nutritional supplements or low-calorie dietary substitutes. Since the *M-17A1* protective mask provides a means for consuming fluids, its application for liquid nutriments is readily apparent.

While any liquid diet will assist in reducing fecal bulk, there are products designed expressly for that purpose. These low-bulk elemental diets are used for treating various ailments of the alimentary canal and in preoperative bowel preparation. Examples of such products include Sustacal, Isocal, Vivonex, Precision LR, and Flexical.

The defecation reflex is triggered by the accumulation of a critical volume of bulk in the large intestine.[3] Because elemental diets are almost entirely absorbed within the small intestine, there is a marked decrease in stool frequency.[4] Studies demonstrate that defecation can be reduced from an average frequency of one bowel movement each 1.1 days (conventional food) to one movement every 1.5-5 days (elemental diet).[5] Not much imagination is required to ascertain the advantages of an elemental diet in a contaminated environment.

However, elemental diets are not without their drawbacks. Several side effects to elemental diets have been experienced, including headaches, sweating, weakness, and diarrhea. These have been attributed to a reactive type hypoglycemia that, it has been suggested, could be relieved by decreasing the speed of consumption and by drinking water following the meal.[6] This should not prove a hurdle in the proposed application, for the protective mask limits the flow rate and flushing the mask with water after the meal should be standard procedure. (If the mask intake tube is not flushed, nutritional residue may build up and provide an undesirable bacteria culture medium.)

While some experimental subjects have made the adjustment to liquid nutriments with little complaint,[7] others have fully rejected such diets, but only after a monotonous 11-day regimen.[8] Such rejection is probably insignificant, for 11 days is well beyond the expected duration of single unit chemical operations.

Additional clinical testing should no doubt precede field testing; thus the initiative for selecting an adequate low-bulk elemental diet lies with the Army Medical Corps. Other factors beyond nutritional and physiological effects must also be considered, such as troop acceptability, flavor variety, cost, packaging, and shelf life.

Both powdered and premixed liquid forms of elemental diets are available. The premixed requires no further preparation and has a shelf life of approximately one year. The powdered form has the disadvantage of requiring mixing, but the logistical advantages of lighter weight, less bulk, and a 2-year shelf life.

Once an adequate diet has been selected, the application and use of the diet must take place in doctrine and training, particularly as an integral part of MOPP. Anticipation of imminent chemical attack might well prescribe not only the donning of protective clothing but also the self-application of enemas and a conversion to the low-residue elemental diet. If we are serious about our ability to cope with the chemical threat, such measures cannot be ignored.

While viewed as a mundane topic by many, such a perspective will not be shared by those who find themselves faced with the problem. As if modern warfare were not frightening enough, chemical warfare holds its own unique terrors. In fact, once the physiological problems are solved, it may well be psychological stamina that determines the duration a soldier can perform under chemical stress.

The author wishes to thank Mr. Timothy J. Friday, Senior Technical Associate, Nutritional Division, Mead Johnson & Company, for providing many of the technical references used in the preparation of this article.

Footnotes

[1]Field Manual 21-40, *NBC (Nuclear, Biological and Chemical) Defense*, Headquarters, Department of the Army, Washington, D.C., 14 October 1977, p. 5-5.

[2]"A Proposed Combat Feeding System for the Army of 1990" (Draft), dtd 29 December 1978, NARADCOM, Natick, Massachusetts.

[3]Bounous, Gustavo, M.D. and Devroede, Ghislain J., M.D., "Effects of an Elemental Diet on Human Fecal Flora," Gastroenterology, 66:210-214, 1974, p. 213.

[4]Dickman, M.D., Ph.D., Chappelka, A.R., CPT MC USN; Schaedler, R.W., Ph.D., "Evaluation of Gut Microflora During Administration of an Elemental April 1975, p. 377.

[5]McCammam, Sarah, R.D., M.S.; Beyer, Peter L., R.D., M.S.; and Rhodes, James B., M.D., "A Comparison of Three Defined Formula Diets in Normal Volunteers," *The American Journal of Clinical Nutrition*, 30:1655-1660, 1977, p. 1657.

[6]Ibid., p. 1658-1659.

[7]Ibid., p. 1658.

[8]Dickman, *op. cit.*, p. 379.

JOHN DREBUS
Captain, Armor

Equipment Changes for the Tank Company

The article on Division 86 in the Nov-Dec issue of *ARMOR* discussed the organization of the tank company and platoon for the mid-80's and beyond. I strongly support the four-tank platoon concept. However, I believe the fighting capability of the tank company can be further enhanced.

The company commander must be forward to see and control his unit effectively. The current command vehicle, one of the two tanks in the company headquarters (HQ) section, provides the necessary survivablilty but requires the commander to also function as a tank commander (TC). Additionally, the tank offers limited communication capabilities. The commander is normally more concerned with controlling the battle than he is with fighting in the battle. This concern precludes his tank's effective participation in the direct fire battle. His attention is focused on the tactical situation and he and his vehicle can easily become casualties through his failure to detect a threat.

It is impossible for a commander to have his fire support team (FIST) chief available due to the limited space in a tank. A forward observer, or FIST chief, can ride in the loader's hatch, but then his duties as a loader conflict with his job of adjusting indirect fire. Under current doctrine, the FIST chief rides the other HQ section tank or whatever vehicle he brings from his parent unit. This separation from the company commander means all communication is by radio or on-the-ground meetings. Radio is susceptible to EW and can compromise positions. Face-to-face conversation requires that both individuals stop their vehicles — an undesirable requirement in mechanized warfare.

The commander needs a vehicle realistically suited to his needs. The command vehicle must offer survivability, adequate communication, mobility, access to the FIST chief, and the ability to maintain the same cross-country speed as the new *XM-1 Abrams* tank. As previously stated, the commander is primarily a leader and manager and not a fighter. The HQ section tanks in current tank companies seldom contribute their fire to the company effort because the TCs, the company commander and the FIST chief, are busy running the battle. The commander normally locates himself in a position which lends itself to communication with the company and the battalion, gives the best view of the battle, and provides some cover from direct fire. In view of this lack of participation, the command tank should be replaced by a more appropriate vehicle. The *M-2/3* family of vehicles provides the answer. These vehicles are fast, have adequate interior space for radios, carry antitank armament, and are somewhat smaller than a tank. Their distinctive silhouette can be offset by terrain driving and reverse slope positioning.

Similar arguments can be applied to the second HQ section tank. The FIST chief needs a vehicle compatible with his duties in the battle. The FIST concept has provided such a vehicle by allocating an *M-113*-type vehicle. The introduction of the FIST concept has obviated the need for the so-called "FO tank." The FIST vehicle will come from the supporting artillery unit. Another option is to add a vehicle similar to the company commander's and make that vehicle part of the company TO&E. In either case, if the FIST vehicle does not appear, becomes nonoperational, or is lost in combat, the commander would have room in his vehicle to accomodate his forward observer.

The changes outlined in this article would delete the HQ platoon tank section along with the dozer blade kit mounted on one of those tanks from the TO&E. This deletion is not the loss it appears to be. The blade kit, as currently designed, is mounted on the tank with the hydraulic system and the shifting linkage on the exterior of the vehicle. This exposure results in damage during cross-country movement and will probably result in battle damage from direct or indirect fire. The damage resulting from the exterior mounting and the system design itself gives the blade a poor operational ready rate. The blade severely limits the cross-country capability of the tank on which it is mounted. Since the blade is normally mounted on the FO's tank, and that tank is with the CO somewhere behind the platoons, the company earth-moving equipment is not where it is readily available. Additionally, such engineer-type equipment will be a high-priority target in any future conflict. Realistically, the blade, because of its prime mover's role and its inherent drawbacks, does not and probably will not serve a useful function for the company and can be eliminated from the tank company TO&E.

The mine roller, when fielded, is scheduled to be issued one per company and the mounting kit is to be installed on a tank in the HQ platoon tank section. Since the dozer blade is already on one of the HQ tanks, the only vehicle available for the roller is the commander's tank, (assuming the tank section is retained in the HQ platoon). What will the commander do when his tank is needed to clear mines? Will he remain on board or will he switch to his other vehicle, the "combat" *M-151A2?* Where will he go if and when his tank is lost to mines or AT weapons that will almost certainly cover a minefield? From the foregoing, it is apparent that mounting the mine roller on the CO's tank will adversely affect the commander's mobility and survivability.

If the foregoing proposals were to be adopted, the company commander would no longer divide his attention between fighting his tank and managing the battle. His command vehicle would posses a slightly smaller (although distinctive) profile, maneuverability, survivability, adequate communication equipment, and the space for the indirect fire coordinator to be close at hand. The HQ platoon would lose 2 tanks, 2 AN/VRC-12 radios, and a dozer blade and kit. The company HQ would gain 1 command vehicle of the *M-2/3* family, 3 RT-524 radios mounted in the command vehicles, and 1 FIST vehicle with appropriate radios. The RT-524 radios provide the commander with RT capability on both company and battalion nets and leaves one RT radio available for the FIST chief. The FIST vehicle may be assigned or attached.

The proposed equipment changes will alter the amounts of protective masks, basic issue items, and prescribed load lists. It is possible to predict that the suggested changes would be cost effective in terms of dollars but the amount of savings will vary. Prices will almost certainly rise as inflation continues and the introduction of the *M-1 Abrams* tank will "up the ante" for a tank company considerably.

The Armor Community must devise progressive, viable answers to the challenges of the modern battlefield. We must change for the better and we must change now — "later may be too late."

ROBERT A. SNEDDEN
Captain, Armor

On Becoming an XO

Recently, an abundance of valuable information has been published providing the troop or company commander and platoon leader with better ways to do their jobs. But what of the young lieutenant who assumes the duties of troop or company executive officer (XO)? Very little has been written to assist the new XO in adjusting to his important, yet often neglected, position.

To the lieutenant who has left the security of his platoon, undertaking XO seems ominous. Often, he receives a limited briefing of what is expected of him; then, he is sent on his way to fend for himself. There are no other XOs in the unit to offer assistance or advice. Without proper guidance, it takes at least 3-4 months before the XO begins to feel comfortable with the many facets of his position.

Having been the XO of an armored cavalry troop, I want to offer some thoughts on how to make the initial transition into the job. These are not "secrets to success," but merely a common sense approach to help you, the newly-assigned XO, orient yourself to a unique position that will prove valuable in your professional development from platoon leader to troop or company commander.

- First, get a thorough briefing by the troop or company commander on current and future activities of the unit. Be sure that you understand what the commander expects from you. Ask questions if you are uncertain.
- Ask the commander what additional duties you will have. Most XOs find themselves occupying additional duty positions, such as troop or company motor officer and supply officer. Again, get as much guidance and information from the commander as you can as to what he expects in each area. Feel free to go back to him at a later time for more assistance.
- Locate and read as many of the unit's SOPs as possible. You need not do intensive reading, but do try to familiarize yourself with as much information as you can. These SOPs will help you understand the basic procedures and minimum standards used in the unit.
- Attempt to get a copy of each SOP that pertains to your primary and additional duty areas. These are the documents

that helped guide your predecessor and his subordinates. They are a good starting point in determining where you fit into the overall operation of the unit. However, it is a good idea to wait and see how the unit follows a particular SOP before making changes.

• Similarly, it is important to understand certain squadron or battalion SOPs, such as those for maintenance, logistics, and communications-electronics. You will find that, unlike the platoon leader, you constantly work with many key individuals outside the unit, and these SOPs will become increasingly important.

• Visit key subordinates within the unit, such as the motor sergeant, supply sergeant, communications chief, mess team leader, unit armorer, etc. These individuals will be looking to you for guidance. Ask them what internal procedures and methods they are presently using, and see what specific problems they have in each area. Refer to the SOPs you have already read. Get an update on such things as the maintenance deadline rate, ongoing supply actions, or status of weapons cleanliness and serviceability.

• Talk to fellow XOs in other units. The advice they provide can be valuable and informative. Remember, though, they can only tell you what works in their units—the same procedures may not pertain to your unit's unique situation. Other XOs can be extremely helpful in explaining the recurring reports required by squadron or battalion agencies or in outlining squadron or battalion maintenance procedures that affect the units.

• After you've "picked the brains" of other XOs, visit squadron or battalion staff officers with whom you will be working. Start with the squadron or battalion XO. Unit XOs and the squadron or battalion XO have a unique relationship and network for exchanging information and giving or receiving guidance. A similar situation exists with the squadron or battalion maintenance officer. Visit him and ask how his maintenance operation interacts with your own maintenance operation. The S-4 and the support platoon leader are also important people to get to know. Find out how they can help you in garrison as well as in the field. Obtain a copy of their SOPs during your visits.

• Most troop and company commanders like to use their XOs in a secondary role as the unit headquarters platoon leader. Personnel in the combat support MOSs who make up the unit headquarters are important, yet often neglected, soldiers. The variety of skilled personnel in the headquarters requires the application of different leadership skills than those used by a line platoon leader. For instance, you must be more mobile to get to the members of the headquarters because of their varied work locations. Also, you must become familiar with Soldier's Manual tasks relating to many different MOSs. The headquarters is a diversified element that is rarely recognized for its efforts as a group. As the headquarters platoon leader, it becomes part of your job to hold them together, guide their activities, and provide or obtain the recognition that is often forgetten.

• Check with the training officer or NCO to see how the troop or company is conducting training for the combat support personnel. If it has been ignored, you may have to consider designing your own training program.

• Perhaps the most important thing you can do in orienting yourself on your new job is to spend a few weeks as an observer. Tell the commander that you intend to use this time to get your feet on the ground. After a period of evaluating and analyzing the unit, you can begin to make modifications to the operation as necessary. Be prepared for initial resistance to some changes and for the old cliche, "This is the way we've always done it!" Once your NCOs and soldiers see that your intensions are sincere, the resistance will decrease. Above all, avoid making hasty or undue changes, since these can adversely affect morale and operations.

There may be additions to the list, but the key to making a successful transition from platoon leader to XO is making a good estimate of the situation. From there, choose a logical course of action that will help you gather the information you need to determine how you can effectively improve the combat readiness of your unit.

GUY C. SWAN III
1LT, Armor

Recognition Quiz Answers

1. **M-60A1**, U.S.—The *M-60* series went into production in 1962 and was originally ordered by the United States, Austria, France, Iran, and Italy. It is equipped with a 105-mm main gun, a 7.62-mm coaxial machinegun, and a 12.7-mm machinegun mounted in the commander's cupola. The *M-60* has many variants and is in use throughout the world today.

2. **Sherman MK.51HV (Super Sherman)**, Israeli—A variant of the U.S. *M-4*, this tank was designed by the French for the Israeli Army in the early sixties. The original 75-mm main gun was replaced by the French *D-1508* l05-mm gun. The locking assembly and hydraulic controls were replaced by a new SAMM *CH-23-1* (the same system used by the *AMX-13*). The main gun antitank ammunition will penetrate 360 mm of armor. The original engine was replaced by a 460 hp American Cummins Diesel.

3. **Merkava**, Israeli—The main battle tank went into production in 1977. It is powered by a Teledyne Continental V-12 diesel that generates 900 hp. The *Merkava* weighs approximately 58 tons and has a hydro-pneumatic suspension. All *Merkava* tanks currently fielded mount a 105-mm main gun, but are designed to accept a 120-mm gun. There are three machineguns—one mounted coaxially and two on the turret. The *Merkava* has an 85-round basic load for the main gun and is equipped with an NBC and Spectronic explosive suppression system. The hull has a space filled with diesel fuel and a subsequent interior layer of armor, thereby adding protection from HEAT and ATGWs. The fire control system incorporates a Hughes laser range finder with a range of 8,000 m.

4. **PT-76**, Soviet—This light amphibious tank is powered by a V-6 in-line diesel that gives it a road speed of 44 kmh and a water speed of 11 kmh, with a road range of 250 km. Its armor is 11-14 mm thick, and it has a 76-mm main gun for which there are 40 rounds of ammunition. First seen in 1952, the *PT-76* is being replaced by the *BMP-1*.

5. **Mi-8 Hip E**, Soviet—This utility helicopter mounts eight rocket pods, each carrying 16 rockets. It can also carry a light vehicle or 32 fully equipped troops. Two 1,500-hp turbine engines, give the *Mi-8* a maximum speed of 161 mph, and a combat radius of 237 km.

6. **BOV-1**, Yugoslavian—This antitank vehicle is a brand-new piece of equipment, but it is not yet in production. It carries 18 missiles, 12 of which are in firing pods. The missiles have a minimum range of 400 m (suggesting quite a firing signature) and maximum effective range of 3,000 m. The missiles are probably wire-guided and will penetrate 400 mm of armor. The system is capable of firing two rockets per minute. The *BOV-1* has a maximum road speed of 60 kmh.

This quiz was prepared by Lt. James Halbleib and SP4 Clifford C. Jones, 517 MID, A&P Section, Ft. Knox, Ky.

OPMS-EPMS

Armor Branch Reestablished

I am honored to have been selected as the Armor Branch Chief, and I will do my best to align the needs of the individual officer, Armor Branch, and the Army.

These are challenging times. Armor Branch now affects the assignments of Armor Officers from second lieutenants to lieutenant colonel. We are moving toward a point where the Commandant, USAARMS, will become the proponent for the Armored Force. As such, he will assume overall responsibility for assignment and professional development. Commanders are now taking an active part in the professional development of their officers.

I will continue to write in *ARMOR* Magazine to advise you of important developments.

I encourage you to seek professional guidance from your commanders, and to call Armor Branch if you have any questions. Again, it is an honor to serve you.

Norm Beatty

LTC Norman E. Beatty
Armor Branch Chief

LTC Jerry D. Malcolm
Colonels Division

LTC Kendall M. Lemley
Lieutenant Colonel Assignments

MAJ Israel R. Anderson
Major Assignments

CPT John H. Daly, Jr.
Captain Assignments

MAJ James E. Quinlan
Captain Assignments

CPT Joseph G. Pallone
Advanced Course/Advance Assignments

CPT Craig B. Whelden
Lieutenant Assignments

These AUTOVON numbers serve the branch
221-9696/9658/6340/6341
221-7982/7983 (Colonels Division only)

Civilian Staff Members

Ms. Janice P. Boyce
Ms. Diana D. Lueker
Ms. Gloria R. Johnson
Ms. Maureen Neal

DA Selection Boards

The following is a current list of DA Selection Boards involving colonels which are scheduled to convene in CY 81.

SSC Screen	14 Jul-14 Aug
SSC Selection	9 Sep- 9 Oct
Colonel Command, Cbt Svc Spt	9 Oct-30 Oct
Colonel Command, Cbt Arms	13 Oct-30 Oct
Colonel Command, Cbt Spt Arms	13 Oct-30 Oct
Brigadier General	Nov/Dec

Any special desires of officers in the zone of consideration should be brought to the attention of the Armor colonels assignment officer.

Intensively-Managed Specialties

The following specialties are underaligned or have unique priority requirements and are intensively managed by a specialty manager. This applies regardless of whether it is an officer's primary or additional specialty.

Specialty	Manager	AUTOVON
21 Engineer	LTC Harrell	221-7870/71
27 Comm/Elec Engr	LTC Bashore	221-7870/71
37 Elec Warfare Cryptology	LTC Foley	221-7874/77
43 Community Acty's Mgmt	LTC Singsank	221-7869/78
48 Foreign Area Officer	LTC Goetz	221-7875/77
49 ORSA	LTC Harrell	221-7870/71
53 ADP Mgmt	LTC Bashore	221-7870/71
72 Comm Elec Material Mgmt	LTC Bashore	221-7870/71
73 Missile Material Mgmt	MAJ(P) Joseph	221-7876/79
95 Transportation	MAJ(P) Salyer	221-7876/79
97 Procurement	LTC Ward	221-7869/78

Officers with specialties other than those listed above will be managed within Colonels Division, MILPERCEN, by the specialty manager for the officer's primary specialty.

MAAG, Mission, and Attache Assignments

There is a continuous need to fill MAAG, Mission, and Attache assignments worldwide. When contemplating reassignment, COL and LTC(P)s are urged to consider these unique duties and discuss their interests with their specialty managers.

ROTC Instructor Duty

Officers interested in being assigned to ROTC instructor duty in the spring and summer of 1982 should contact Armor Branch by October.

Requirements for ROTC instructors are normally passed to MILPERCEN through the different ROTC regional headquarters by the Professor of Military Science (PMS) of a college or university. The PMS frequently asks for an officer by branch. Requirements are distributed to the branches by the Joint and Special Activities (JASA) section of MILPERCEN. Requirements "branched" to Armor are then available to Armor officers.

Officers are selected for ROTC duty IAW AR 621-101. Generally, captains who have completed the advanced course and commanded a company will be considered if their manner of performance supports such an assignment. Some schools require instructors to have advanced degrees. An officer's undergraduate academic record is carefully examined. Criteria vary among schools.

The situation is approximately the same for majors. Officers should understand that they will usually spend about 5 years at O-4; during these years, they should serve with troops, complete C&GSC, and work in their additional specialty (ADSPEC). A 3-year assignment with ROTC would likely preclude one or more of these assignments. However, some ROTC positions are coded for SC 28 or 54 ADSPEC, and these assignments would count for ADSPEC experience in those specialties. Should a major not be selected twice for resident C&GSC, he should enroll in the nonresident or USAR C&GSC.

Many officers express an interest in obtaining an advanced degree while serving with ROTC. Recent indications are that this is difficult at most schools, since instructor after-hours duties have become increasingly demanding. This is a matter of individual PMS policy.

The Advanced Degree Program for ROTC Instructor Duty (ADPRID) is designed to upgrade the academic qualifications and provide greater assignment stability for officers assigned to ROTC instructor duty. Officers already possessing a masters degree are assigned directly to a 3-year ROTC assignment. Applicants not possessing an advanced degree are sent to school (normally the institution of ultimate assignment) for up to 15 months to complete degree requirements at the masters level at their own expense, while receiving full pay and allowances, and travel pay. Schooling will be followed by a 3-year ROTC assignment. The program of study must be in an Army Education Requirements Board (AERB) validated shortage-discipline and align with the officer's specialty(ies) under OPMS.

Utilization of ADPRID officers is ROTC duty, as opposed to the normal AERB utilization. AR 621-101 governs the ADPRID program.

Enlisted Evaluation Report

The Army's Senior Evaluation Report (SEER) form will be replaced this fall by a revised form which is simpler to prepare and easier to read.

The simplified EER has been developed for easier preparation, copying, and filing. The mark-sense blocks have been totally removed from the format, and the contents have been reorganized to better portray the evaluation of the rated soldier's professionalism, duty performance, and potential. The narrative blocks have been expanded to encourage more complete duty descriptions, more specific comments on performance, and more detailed recommendations on schooling, assignments, and leadership potential.

The scored portions of the report have been modified slightly, but the total possible report score still adds up to 125 points. Thus, when implemented, the simplified EER scores will fit into the Army's EER Weighted Average (EERWA) system, which maintains a five-year cumulative average for each rated soldier.

news notes

New ATGM Configuration Seen in East Germany

A recently published photo in an East German magazine (*Volksarmee*, No. 50, 1980, pg. 8) showed a new antitank guided missile (ATGM) arrangement on the modified *BRDM-2* used to carry *AT-5* missiles. The configuration showed 2 *AT-5/Spandrel* missiles on the outside launch positions and 3 *AT-4/Spigot* missiles on the 3 interior launch positions. Since November 1977, specially-modified *BRDM-2s* have been seen with 5 *AT-5* missiles on the launcher platforms. This new arrangement gives the ATGM gunner the option of using either a 4,000-meter missile (the *AT-5 Spandrel*) for long range engagements or a 2,000-meter missile (the *AT-4 Spigot*) for a close-in engagement.

Use of both missiles on the BRDMs should allow the Soviets to carry a mix of missiles in one vehicle. Because the *AT-4 Spigot* missile is a smaller missile, they should be able to carry more missiles to use at the shorter ranges commonly found in Western Europe.

	AT-4	***AT-5***
NATO Name	*Spigot*	*Spandrel*
Length	1200 mm	1300 mm
Diameter	120 mm	155 mm
Max Range	2,000 m	4,000 m
Min Range	100 m	100 m
Max flight time to max range	10-13 sec	Less than 20 sec
Launch Platform	ground/vehicle	vehicle

Armor School Library Marks 40th Anniversary

From the very beginning, the founders of the Armor School recognized the importance of a reference library. The library, along with a bookstore known as the Armored Force School Book Department, was officially opened on 16 August, 1941, near the site of the present Richardson Hall.

Originally a collection of manuals, a few books, and newspapers, the library now maintains a large specialized collection of materials to serve the information needs of the Armor community. Concentrating on military subjects, but with good representation in the fields of education, management, and history, the library collection has well over 20,000 volumes, more than 200 journal subscriptions, technical and historical documents, and DA publications, all augmented by the latest computerized information retrieval systems. Materials needed but not in the library are made available through Interlibrary Loan, a cooperative system among libraries that gives the Armor School access to the largest and most comprehensive library collections in the United States.

Contracts Let for New Vehicles

AM General Corporation, a wholly-owned subsidiary of American Motors Corporation, has been awarded a contract from the U.S Army Tank-Automotive Command (TACOM) to deliver 11 prototypes of a newly designed 1¼-ton tactical wheeled vehicle.

The new vehicle is designed to meet the military requirement for a family of versatile cross-country vehicles capable of performing various combat and combat-support roles. One version is an antitank missile carrier, another would serve as an ambulance, and others would be used in reconnaissance, fire support, communications, and command roles. The U.S. Army's plan is to selectively replace certain existing vehicles in the ¼ to 1¼-ton range, which are less mobile.

Detroit Arsenal Tank Plant is 40

The Detroit Arsenal Tank Plant (DATP) recently turned 40, is still at the same site where the first combat tanks were built at the start of World War II.

On April 12, 1941, the DATP presented the first two models of the *M-3* Combat Tank to the U.S. Army.

Today, the Army-owned, Chrysler-operated plant remains active as the assembly facility for the *M-60* Series Main Battle Tank under contracts that are scheduled to run through the end of 1982.

During 1982, the DATP will become the second assembly and test site for the new turbine-powered *M-1* Abrams Tank. Chrysler's first *M-1* production models rolled off the line at the Lima, Ohio, Army Tank Plant on February 28, 1980.

The DATP also built the 11-pilot tanks used in the *M-1* development test program. The vehicles were delivered between February and July 1978.

The 1,098,000 square-foot DATP has already produced more tanks than any other manufacturing facility in the United States. Since 1941, the plant's assembly lines having turned out more than 39,000 tanks, ranging in weight from 27 to 60 tons.

All tanks built up to then were either handbuilt or limited-production models.

New Army Training Magazine

A new publication, aimed at helping to train the Army's trainers, is being started by the U.S. Army Training Support Center.

The new quarterly magazine, *The Army Trainer,* is targeted to those soldiers in grades E-5 through 0-3 who are involved in training—from platoon sergeants through company/battery commanders—along with training developers.

The publication will provide an Armywide forum to identify, integrate, and explain the use of the many and varied parts of the Army Training System. The goals of the magazine are to improve training and combat readiness; publicize new training ideas, techniques, and products; translate training policy into action; stimulate interest in the training system; and create a medium for the exchange of information and ideas.

According to Jim Christensen, acting editor-in-chief, the first issue will be distributed in September 1981.

The Army Trainer is anxious to receive articles dealing with unit/collective training, experience with new training methods/devices, and features articles dealing with trainers, that its audience would find useful.

For further information, or to inquire about submitting articles, contact:

Editor, *The Army Trainer*
U.S. Army Training Support Center
ATTN: ATIC-AET
Fort Eustis, VA 23604

The telephone number is (804) 878-5475/5893: AUTOVON 927-5475/5893.

An *M-1 Abrams* tank of the 2-5 Cavalry, 1st Cavalry Division, moves onto a ribbon bridge raft during Operational Test III conducted at Fort Hood, TX. Two of the tanks were ferried across Belton Lake on a raft made up of two ramps and five interior bays. The ribbon bridge was also used successfully in a river crossing operation. (Photo by Major Patrick H. Neary, Fort Hood, Tx.)

French *VBC-90* Reconnaissance Vehicle

The *VBC-90* reconnaissance vehicle will replace the *AMX-13* tank in the French Gendarmerie at Satory.

The 6-wheeled *VBC-90* is powered by a 6-cylinder, 220-hp, diesel engine, and is equipped with a 5-speed torque converter. Its maximum road speed is 95 kmph and it has cross-country mobility equivalent to a tracked vehicle. The vehicle's main armament is a 90-mm gun that fires armor-piercing, fin-stabilized, discarding-sabot ammunition as the primary antitank round.

Personnel Directory
for
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U.S. Army Armor School

Telephone prefixes: AUTOVON 464- Commercial (502) 624-

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Army-Wide Training Support (AWTS) Branch

Chief	Mr. Phillip B. Coolidge.......2914
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Smoke Generator for Armored Vehicles

The vehicle engine exhaust smoke system developed by Chemical Systems Laboratory (CSL) of the U.S Army Armament Research and Development Command has been adopted by the Army as a standard smoke-generating device. It will provide a low-cost, repeatable-use, onboard, smoke-generating system to complement the smoke grenade launchers mounted on armored vehicles.

The system is driver-actuated and can be operated continuously or intermittently upon command to provide a screen capable of blocking vision through near infrared detection, acquisition and tracking devices including laser range finders.

CSL is also completing engineering development of the *XM-825* 155-mm screening smoke projectile, designed to provide a significant improvement in visual ground screening effectiveness over the Army's current standard projectiles. The *XM-825* is an artillery-delivered projectile.

Armor Association Contributes to Memorial

The United States Armor Association has contributed $1,000 to the Vietnam Veterans Memorial Fund as a tribute to the sacrifices and faithful service rendered by the thousands who served their country in Vietnam. Many of those were members of the Association.

The memorial will be located on the Mall in Washington, D.C. near the Lincoln Memorial and will be inscribed with the names of the 57, 962 Americans who gave their lives during the conflict.

Individual donations may be forwarded to the Vietnam Veterans Memorial Fund, 1110 Vermont Ave NW 308 Washington DC 20005.

BOOKS

AMERICAN SEA POWER IN THE OLD WORLD: THE UNITED STATES NAVY IN EUROPEAN AND NEAR EASTERN WATERS, 1865-1917 by William N. Still, Jr.,Westport, CT: Greenwood Press, 1980. 291 pages, notes, illustrations. $29.95

This book is number 24 in a series *Contributions in Military History,* offered by the Greenwood Press. This one is a scholarly text depicting the ups and downs (and there were plenty of the latter!) of the US Navy operations around Europe between the Civil War and World War I. That was apparently a fairly long dry spell in a humdrum environment occasionally enlivened by social activities and punctuated by clumsy attempts at gunboat diplomacy. The story portrays the evolution of the Navy from its wooden hulls and canvas sails to steamers to ironclads and finally to steel warships, and describes the numerous but feeble efforts to influence foreign powers through displays of ineffectual force. Professor Still notes: "To most members of Congress, it seemed that the Navy evidently could carry out its assignments, including distant cruising, without significant increases in appropriations." The result unfortunately was a shabby, undermanned, ill-trained and poorly-equipped Navy of obsolescent ships.

Scholarly this book is: the research is impressive, the notes meticulous. But interesting reading it is not; it reads too much like a diary of repeated minutia.

This may be because the focus is narrowly drawn, with a resulting imbalance to readers used to broader scales. Much attention is frequently given to relatively trivial local events, while historically-momentous actions that occurred outside this geographical area get short shrift. For example, 195 words are used to describe the parties aboard the *Lancaster* and *Wabash* at Villefranche, but the distant battle of Manila Bay and its impact across the Navy merit only 25 words.

There is little discussion on evolving changes in Navy operational philosophy, tactics, training, personnel procedures, or the like that took place during this period. There is a chapter on logistic support and an early but short-lived attempt to implement a resupply/tender concept.

On the other hand, there is extensive coverage of the often antagonistic relations between various admirals and their collocated ambassadors and consuls. Additionally, considerable attention is paid to the remarkable political influence of American missionaries, particularly those in Turkey, and their impact on Navy operations. Indeed, they were often the driving force.

This book is suggested for the serious Navy history student or collector, and for reference libraries.

JOHN R. BYERS
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CERTAIN VICTORY: HOW HANOI WON THE WAR. Denis A. Warner, Sheed Andrews and McMeel, Inc. (Universal Press), 6700 Squib Road, Mission, Kansas 66202. 295 pages; maps, acknowledgements; index; $9.95.

Six years ago this April 30, a tank from the II Corps, North Vietnamese Army, rolled down a deserted Saigon street and smashed through the iron gates of the Independence Palace—marking the end of the second Indochina War. Since that time, or even since the 1973 Paris Agreement, Americans in general have blotted out both memories and careful consideration of that divisive war and its aftermath. In a sense, subsequent events in Asia have served to silence both supporters and critics of the American experience in Vietnam. The continuing Vietnamese Communist conquest of Southeast Asia must appear to all but the most doctrinaire "dove" to resemble the Domino Theory debated so long ago. By the same token, "hawks" continue to be silenced by events that bear witness to the military and foreign policy paralysis inflicted by lack of success in that war.

Denis Warner helps us remember and provides new perspectives on the Vietnam War and its aftermath. As an Australian journalist and war correspondent, Mr. Warner was at Dien Bien Phu in 1954 and was present when Saigon fell in 1975. His personal acquaintance with many of the leading actors in this Asian tragedy offers a unique opportunity to view the events from the inside. For those of us who saw Vietnam through the sights of a machinegun, his descriptions are invaluable, and as colorful as Asia itself. Enter Le Van Vien, for example, chieftain of the Binh Xuyen bandit army—living behind the Arroyo Chinois and guarded by two crocodiles and a leopard. Visit the Hall of Mirrors in Cholon—with 1200 girls, the largest brothel in Asia. Follow the progress of the NVA engineers' construction of the Ho Chi Minh "trail"—from trackless mountain passes to mule bridges dangling over mountain torrents to 12,000 miles of highways and 5,000 kilometers of oil pipeline.

Mr. Warner's account provides many professional insights as well. The disastrous withdrawl from the Central Highlands following the loss of Ban Me Thuot is described as a necessary shortening of the ARVN supply lines. This retreat that became a rout was doomed by hasty planning, the need to withdraw soldiers' families (and most of the civilian population), and the surprising mobility of the NVA forces. The book outlines the NVA battle plan that conquered South Vietnam in a lightning 51-day campaign and the plan's gifted architect, Senior General Van Tien Dung. The story of General Dung's rise from textile worker to 36-year old chief of staff for General Giap in 1953 to audacious commander of the final campaign in 1975 is masterful. Drawing heavily on General Dung's own writings, the author vividly details the aggressive pursuit, its responsive support from the Hanoi leadership, and the *dich van* (psychological warfare) campaign in the United States. It is a classic case study worthy of a military school's curriculum. These strategic moves are no less spectacular than the 1,000 mile forced march by the NVA I Corps to participate in the battle for Saigon or the NVA tank-artillery attack on Phang Rang that captured the defending ARVN commanding general and his deputy Air Force commander. Food for thought is in abundance.

Certain Victory outlines the tantalizing "what ifs" of the Vietnam experience in a most engaging way: what if Bao Dai had chosen the Buddhist nationalist Phan Quang Dan to lead the nation after Dien Bien Phu, rather than the insular, Catholic Ngo Dinh Diem; what if General Westmoreland's controversial post-Tet request for 200,000 troops had been vigorously fulfilled, allowing a perhaps decisive counter-offensive when the Viet Cong cadre system was destroyed and NVA reserves depleted; what if General Dung's lightning pursuit had been delayed two weeks, when the rainy season would make tank/artillery maneuver extremely difficult and time for political accomodation would have been available...?

Denis Warner's journalism background and personal knowledge of Asia provide vivid images of the winners and losers in 35 years of war. General Fred Weyand is characterized as "the most able American general who ever served in Vietnam," whose foresight played a considerable part in saving Saigon during the 1968 Tet offensive. Other Americans, especially those who became victims of their own propaganda, fare less well. The picture of Le Duc Tho, Nobel prize-winner and Henry Kissinger's fellow peacemaker, stepping off a motorcycle to organize the Battle of Saigon, is poignant, ironic, and a lesson for us all. All losers were not American, however. As Mr. Warner describes the bizarre economic warfare campaigns in Cambodia, where China supplied VC/NVA troops through the Port of Sihanoukville and Royal Cambodian Army depots, the reader wonders how the Chinese and Cambodians view their policy decisions in light of subsequent events.

Two minor defects of the book spring from its strengths. As an Australian, Mr. Warner exaggerates Australian influence upon events — although it is instructive to learn of the early 1960's Australian interest in luring the United States into a defense commitment to the "land-bridge of Southeast Asia." By the same token, the author's Australian perspective has a detachment few Americans can muster effectively. Also, a book published so soon after these cataclysmic events loses the historical context so necessary for a balanced view. Here again, however, the defect is questionable; the author's "personal account of...Hanoi's ultimate victory" requires freshness. History, someone said, has a way of making everything inevitable.

Certain Victory's enduring contribution, however, is to chronicle the final tragedy of the second Indochina War and to signify the beginning of the third. Tragedy abounds — from the South Vietnamese officials abandoned (Supreme Court justices, secret agents, Phoenix program officers, etc.) to the inability of the United States to influence events, as, quoting General Dung, "The U.S. Ambassador had to crawl onto the roof of the Embassy building to escape." This, of course, was the ultimate American tragedy — as the U.S. executive branch, paralyzed by Watergate, watched an irresponsible Congress remove whatever chance there was of Vietnamization succeeding. As the book's subtitle indicates, however, the Politburo in Hanoi had much to do with achieving certain victory. As their military machine continues the conquest and the insurgency in Thailand intensifies, these events must be remembered. According to the author's quotation of Douglas Pike, "the most important thing about Vietnam is to understand it."

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WAR ON THE EASTERN FRONT, 1941-1945: THE GERMAN SOLDIER IN RUSSIA, By James Lucas. Stein and Day Publishers, New York. 1980. $16.95.

June 22, 1981, is the 40th anniversary of the opening of the greatest and most significant military campaign in history, the German attack on the Soviet Union. Because the scope of this great struggle is so vast, most histories tend to concentrate on broad military aspects and the political and economic history to the almost total exclusion of the story of the individual soldier. That is not the case with this book.

Author Lucas gives reasonably extensive coverage to the grand events of the war, but concentrates on the effects these events had on the individual German soldier. We are shown the mud, the cold, the terror of a midwinter ski attack, and above all, the terrible toll in lives that this campaign took before it ended, nearly 4 years after it began, in the smoking rubble of Berlin. The word-pictures of campaigning in the East are well and vividly painted; you can almost feel what it was like to be a *Landser*.

The descriptions of conditions, the alternating summers with their choking dust, the spring and fall with its gelatinous, all-conquering mud, and finally the frozen hell of a near-arctic winter are well done. Combat against partisan and regular Soviet units in theforests is particularly well done. The best part of the book is, however, the style with which Lucas manages to present his facts and data in an easy, almost painless, way, while telling a very superior story.

Several things are jarring about the book. Perhaps the worst problem is the almost total lack of information about Ivan, the ubiquituous Russian. This is not the fault of the author, he specifically tells us that this is the story of the German soldier, but something is still lacking. The Soviet soldiers are no more than shadows in this book, and that perhaps unwittingly conveys the true experience of the German soldier in the East. By their actions, the Germans managed to convert an inactive population or even an eagerly helpful population into an actively hostile enemy, as implacable as their ancestors who helped to drive Napoleon from the soil of Russia; the Soviets appear as shadows because the German soldiers managed to isolate themselves almost totally from their surroundings,and that was perhaps their biggest failure, the failure that would cost them ultimate victory.

Considerably the lesser problem is the lack of unit identifications that occurs with a fair regularity in the book. To a military historian or buff, this lack is painful, but does not detract from the book's good points all that much. What is considerably more annoying, though, is the lack of footnotes when what appear to be direct quotations are used; no matter what the reasoning, no author likes to be ignored in such a cavalier fashion, even when he is himself writing anonymously as was the case in certain of these passages that I recognized.

All in all, though, Mr. Lucas has broken new ground in authorship in a specialized field. His book is probably the best of its type to appear recently and will become one of the standards by which other volumes of the genre will be judged.

I recommend this book highly; it is well worth the $16.95 cover price for anyone with an interest in the Second World War in general and the Eastern Front in particular.

ROBERT C. SMITH
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DOUBLETALK: THE STORY OF THE FIRST STRATEGIC ARMS LIMITATIONS TALKS, By Gerard Smith. Garden City, NY: Doubleday & Company, 1980. 556 pages. $17.95.

Billed as an insider's account of SALT I, *Doubletalk* delivers both less and more than it promises. The author, a veteran arms controller, served as chief of the U.S. SALT delegation from the time that the talks began in 1969 until the signing of the ABM treaty and interim ICBM freeze of 1972. Many readers will find his long narrative as unexciting as one of the innumerable unproductive encounters with the Soviets that Smith himself endured. Others will disagree with the author's assertion that, given the paramount importance of prevailing nuclear war, the U.S. should pursue the goal of disarmament regardless of the vagaries of Soviet-American relations generally. Thus, in the context of recent events, Smith would not have permitted the Soviet invasion of Afghanistan to interfere with the ratification of SALT II.

Yet for the persevering reader, Smith

provides important insights. For example, he performs a useful service in illustrating the technical complexity of arms negotiations—a problem aggravated in this particular case by the asymmetry of the Soviet and American nuclear arsenals. Smith is most effective in depicting the diffuculty of conducting sensative negotiations against the backdrop of a political system in which power has become so diffuse. No less important than the Soviet response to any U.S. SALT proposal were the reactions of the various department, agencies, and interest groups in Washington with a stake in disarmament. On their support would depend final approval of any agreement. Hence, whenever at the conference table, Smith and his colleagues spent a good part of their time peering over their shoulders toward home.

Yet, *Doubletalk* is no self-congratulatory memoir explaining "how I negotiated SALT I." Although he signed on with the Nixon administration with expectations of a meaningful role in the negotiations, Smith admits that he played only a marginal role in securing the 1972 accords. His real mission proved to be the cosmetic one of maintaining the desired public image of an administration sincerely devoted to disarmament. But while Russian and American delegates wrangled fruitlessly in Helsinki or Vienna, secret negotiations joined—unbeknown to Smith—in a "back channel" linking Henry Kissinger, the president's national security adviser, to senior Soviet officials. As a result of what he calls Kinssinger's "duplicitous diplomacy," Smith found himself in the humiliating position of having spent months advocating to the Soviets White House proposals that he knew they could not accept, while the real business of reaching agreement was being conducted on different terms behind his back.

Dr. Kissinger's disdain for bureaucrats is well-known. *Doubletalk* provides an intruguing glimpse—from the victim's point of view—of how Kissinger alternately used and circumvented the national security bureaucracy. Yet, given SALT I's triumphal conclusion, is Smith's account simply sour grapes? Not entirely so. For in analyzing the agreements themselves—as well as the opportunities missed during the course of negotiations—the author argues persuasively that the fruits of SALT I were dubious indeed. The national interest, Smith believes, would have been better served by leaving diplomacy to the professionals. Overall, he does a good job of pointing out Kissinger's shortcomings. He leaves the reader skeptical, however, as to whether professionals such as himself possessed the imagination and boldness tempered with good sense to do better.

ANDREW J. BACEVICH, JR.
Major, Armor
USACGSC

THE CAMPAIGN FOR NORTH AFRICA by Jack Coggins. Doubleday & Co, Inc., New York, 1980. 208 pages. $15.00.

Jack Coggins' latest book is another splendid companion volume to his earlier work on World War II military history, *The Campaign for Guadalcanal* published in 1972. Profusely illustrated and crammed with several penciled maps and drawings of arms and equipment, *The Campaign for North Africa* is a welcome addition to resources on the desert war in North Africa.

The author concentrates on small unit action down to the combat command and *panzergruppe* level. An in-depth, detailed analysis is provided for the background of desert warfare, but the book's main focus is the period between the Allied forces' landing in French-held North Africa on November 8, 1942, and the final Axis surrender in Tunisia on May 13, 1943. Commanders' personalities, the swiftly changing strategies and tactics, and the effect the campaign for North Africa had on the grand strategy of World War II as a whole is presented. The author claims the war in the desert was fought as a sideshow, sidetracking men and material where they could have been used on more critical fronts. If this was the case, then the German High Command achieved the greater victory in North Africa, for the desert war delayed the commitment of Allied forces to the planned invasion of the continent of Europe. It also gave Germany its greatest war hero—Field Marshal Erwin Rommel.

There are a number of shortcomings in the organization and coherency of the book. The first chapter or prelude to *Operation Torch*, the Allied landings in Morocco, consists of a mere synopsis of the previous month's actions during the desert war. The chronology is confusing, and the black and white pencil drawings are often cluttered. There is a 2-year gap from the prelude chapter to the second chapter, and some of the most important desert battles during this period are skimmed over. For a book entitled *The Campaign for North Africa,* this is inexcusable.

The landings in Morocco, in contrast, are covered in great detail with exacting historical reporting. Over 250 extensive charts and diagrams, convoy listings, and landing forces' orders of battle are stuffed into this book. Coggins puts forth some interesting observations about the *Torch* landings. He comments on the French adherence to orders and chain of command which caused the military resistance to the Allied landings in Morocco to satisfy military honor and *la gloire,* but at a cost of over 4,000 Anglo-American casualties. In addition, the Allied leaders might bitterly question the Gallic logic that prompted the French to oppose the Allied landings, which consisted of mostly Americans, while, at the same time, allowing the uncontested occupation of Tunisia by Germans and Italians.

The last chapter of the book deals with the North African naval resupply and the necessity for the Axis to transport by sea every man, tank, gun, bullet, and shell. In particular, the Mediterranean island of Malta figured largely during this colossal resupply effort, as it served as an Allied "unsinkable carrier" obstructing the Axis naval supply routes. As one of Rommel's officers, Von Ravenstein, had stated, "the desert was the tacticians paradise and the quartermaster's nightmare."

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NEW FOUNDATIONS FOR ASIAN AND PACIFIC SECURITY. Edited by Joyce E. Larson. Transaction Books, New Brunswick, NJ, 1980. 260 pages. Price $8.95.

In the last few years, the proceedings of several Asian security conferences have been published as edited collections. Yung-hwan Jo's *U.S. Foreign Policy in Asia: An Appraisal* (1978). Herbert Passin and Akira Irye's *Encounter at Shimoda: Search for a New Pacific Partnership* (1979), and Richard H. Solomon's *Asian Security in the 1980's: Problems and Policies for a Time of Transition* (1980) are three examples. This book comes from a December 1979 conference sponsored by the National Strategic Information Center (NSIC) and several Asian international relations organizations and held in Pattaya, Thailand.

The essays consist of addresses by public figures, conference papers by public officials and academics, and reports and recommendations of committees. With the exception of the editor's prefaces, a brief foreword by NSIC Director of Studies Frank N. Trager,and a policy paper by American Southeast Asia expert Douglas Pike, all the other contributors are Asian.

The book, as was the conference, is divided into four sections: Political/Military Dimensions of Security in Southeast Asia, Political/Military Dimensions of Security in Northeast Asia, Economic Dimensions of Security in Asia and the Pacific, and Policy Proposals and Asian Pacific Security.

Books such as this are difficult to review. It may be a cliche to remark that the contents vary greatly, but it is quite true. This edition is a collection of politicians' speeches and some insightful essays. No great disagreement surfaces among the participants; their views complement each other. A concern for the security of the area is the common theme.

The book contains a fair amount of information and has some value for the interested layman. However, it contains litle new, and scholars who keep abreast of periodical literature will find the essays rather uninspiring and already dated.

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GAVIN: A Biography of General James M. Gavin, by Bradley Biggs. Hamden, CT: Archon Books/The Shoe String Press, Inc., 1980. 182 pages, illustrations, notes. $17.50.

This short book is the story of a leader. It really doesn't qualify as military history for, among other things, it is openly subjective and deals with both General Gavin's military and civilian careers. Bradley Biggs has known General Gavin in and out of the Army, and this story reflects Biggs' obvious admiration. But Gavin was a leader most soldiers admired, and his willingness to think an issue through and then stand up and be counted placed him often in the forefront—as well as in the limelight. The controversial issues are all here too, from World War II through the Vietnam War. The reader may even find himself occasionally disagreeing with Gavin's position, especially on some aspects of the Vietnam War.

The important thing to learn here is Gavin's unwillingness to equivocate, to vacillate, or to deviate from his principles. He took on tough issues, he made hard decisions, and he stuck by them. Many times he seemed to stand alone, and many times, later, facts would prove him right. He carried this trait on into the business world as head of A.D. Little, and later into diplomacy as our ambassador to France.

The serious student of military history, in search of detailed coverage of airborne operations, may prefer the official *Cross-Channel Attack* by Harrison, or McDonald's *Siegfried Line Campaign,* or even Ryan's *The Longest Day* and *A Bridge Too Far*, but the soldier who wants to learn about leaders will enjoy this book.

JOHN R. BYERS
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Armored Combat in Vietnam, by General Donn A. Starry. Arno Press, Inc., 1980. 250 pages. $15.00

No, General Starry has not authored a new book, If you read the Department of the Army's Vietnam Studies series, *Mounted Combat in Vietnam,* you've read this book.

Since Army publications are not copyrighted, anyone can reprint them. *Armored Combat in Vietnam* is such a case.

Unless you want a hard back edition of *Mounted Combat in Vietnam,* save your money and order from the Government Printing Office.

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Lieutenant Colonel, Armor
PAO, The Armor Center

FROM HALF-TRACK TO LEOPARD 2 by Walter J. Spielberg. Munich: Bernard & Graefe Verlag, 1979. $65.00.

For many years, Americans who are stationed in Germany but do not read German have admired the excellent drawings and pictures about the technical aspects of the military. Many have wondered exactly what was said in the magazine. At last, a book is available that incorporates many of those drawings and pictures concerning postwar tank development in Germany. *From Half-Track to Leapard 2* was apparently produced as a promotional effort by the firm Krauss-Maffei AG, one of two companies co-producing the *Leopard* series tanks, the other company being MaK of Kiel. This type of book is fairly common in Europe. What is unusual is that two separate versions of the book exist, one in German and one in English.

The book opens with a history of the Krauss and Maffei companies which merged in 1931. Previously, they both manufactured trucks and locomotives. During World War II, Krauss-Maffei produced heavy half-tracks used as artillery prime movers or other heavy transport duties. Krauss-Maffei only produced prototype tanks during World War II.

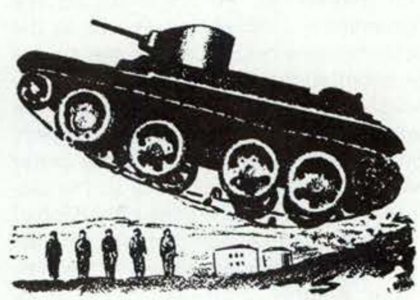
After World War II, Krauss-Maffei produce buses and track for the Hotchkiss APC. In 1957, development of a standard European tank started as a Franco-German-Italian cooperative effort. From this effort came the *Leopard I* and the *AMX-30* main battle tanks. In 1962, Krauss-Maffei entered a program to select the General Contractor for the *Leopard* production and won the contest in 1963. It has since remained the general contractor for the *Leopard 2*.

The book has an outstanding description of not only the production models of the *Leopard 1 and 2*, but on the preproduction tanks, modifications, and complete details on production. Also included are details on training devices, armored recovery, engineer, and bridgelaying variants. A short description of the Gepard antiaircraft tanks is also given.

Of special value to the interested reader is a complete history of the German participation in the joint US-German development of the *Main Battle Tank 70* program. Previously unseen in the US is a short chapter on how the initial development of the *Leopard 2* began. It appears that developments of the *Leopard 2* began in 1967 while the *MBT-70* was under development. In 1968, Krauss-Maffei began the experimental program that was to culminate in the *Leopard 2*. The book discusses not only *Leopard 2* development but the testing program as a competitor for the *M-1* program. There is also a short chapter on the *MBT-3* or concepts for a follow-on to the *Leopard 2*.

The book's strong points are its exhaustive technical data on the *Leopard* tanks and the superb line drawing. Weaknesses include very little on the role of the MaK in the development and production of the *Leopard* tanks or any discussion of the very high costs of the *Leopard* series tanks. Because of the high cost of the book, it cannot be recommended to the average reader for purchase. It is a must for any library that supports the Armor community or any serious student of tanks.

GERALD A. HALBERT
Captain, Military Intelligence
DCD, The Armor Center



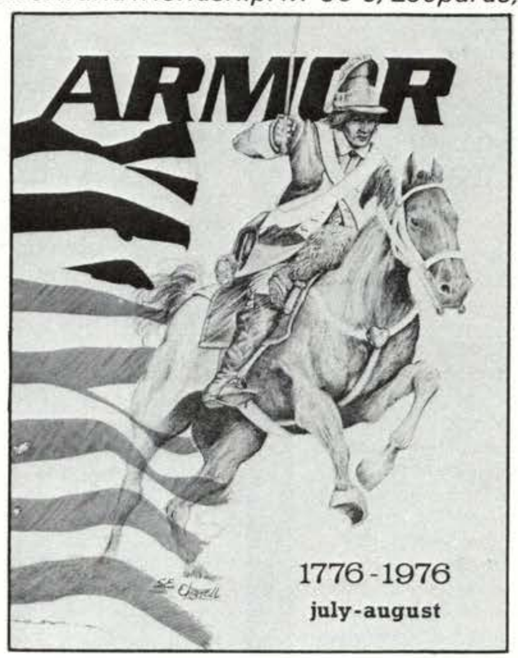
STEEL ON TARGET

Yorktown, October 1781. Lord Cornwallis surrenders to General George Washington, marking the end of combat in the long, bitter struggle for American independence. "The play, Sir, is over."

The last cavalry action in that battle, though neither large nor decisive, was significant because it established a heritage of combined arms teamwork—a heritage that extends to the present day concept of the air land battle. The heritage of teamwork has been a fundamental precept for cavalry and armor and has evolved over the decades. The concept was formalized almost 150 years after Yorktown when the Mechanized Force was formed in November 1930. The Mechanized Force was composed of tank, machinegun, engineer, and ordnance companies; an armored car troop, field artillery battery, antiaircraft and chemical detachments, a quartermaster repair unit, and headquarters elements. The force's organization recognized the imperative that close coordination among many branches was necessary for success on the battlefield.

Today, that imperative even extends across national boundaries. The protagonists at Yorktown—American and French, British and German—could little imagine the spirit of cooperation that now exists between those same armies. Armor and Cavalry units of these formerly warring nations stand ready today to meet the threat in a spirit of teamwork and friendship. M-60's, Leopards, Chieftains, and AMX's are the tangible signs of the intangible—the iron will of the tankers and cavalrymen of each nation who man those vehicles, and who will, if necessary, place steel on target. The Spirit of Yorktown is the Spirit of Victory. ARMOR salutes the cavalrymen and tankers of each of those armies who strive everyday to insure that the "play" never resumes. But if it should, the Spirit of Victory in American, British, German, and French forces will prevail.

So, with this issue, ARMOR closes the celebration of the Nation's Bicentennial that opened with the cover of the July-August 1976 edition. Good Shooting!



Symbolism

The colors, blue and white, associate the regiment with the infantry. The lion symbolizes the power of a tank regiment. The anchor, a symbol of support, stands for service during World War II with the 4th Marine Division at Saipan and Tinian for which the Presidential Unit Citation streamer (Navy) was awarded. The flukes of the anchor, simulating arrowheads for assault landings, are red in reference to the heavy casualties sustained in those actions. The lightning flash alludes to the speed and firepower of armor organizations. The fleur-de-lis is for service in France and the taeguk for service in Korea. The blue and white base represents the shores of Europe, the Pacific islands, and Korea.

Distinctive Insignia

The distinctive insignia is the shield and motto of the coat of arms.

68th Armor

Lineage and Honors

Constituted 1 October 1933 in the Regular Army as 68th Infantry (Light Tanks). (1st and 2d Battalions activated 1 January 1940 at Fort Benning, Georgia, by redesignation of the 1st through 7th Tank Companies [organized in 1918] as companies of 68th Infantry. 1st Battalion inactivated 5 June 1940 at Fort Benning, Georgia.)

68th Infantry (Light Tanks) redesignated 15 July 1940 as 68th Armored Regiment and assigned to 2d Armored Division. Activated (less 2d Battalion—already active) 1 August 1940 at Fort Benning, Georgia. Inactivated 8 January 1942 at Fort Benning, Georgia, and relieved from assignment to 2d Armored Division. Activated 15 February 1942 at Fort Knox, Kentucky, and assigned to 6th Armored Division.

Regiment broken up 20 September 1943 and its elements reorganized and redesignated as follows: Regimental Headquarters and Headquarters Company and 2d Battalion as 68th Tank Battalion, an element of the 6th Armored Division; 1st Battalion as 773d Tank Battalion and relieved from assignment to 6th Armored Division; 3d Battalion as 15th Tank Battalion, an element of the 6th Armored Division; Reconnaissance Company as Troop D, 86th Cavalry Reconnaissance Squadron, Mechanized, an element of the 6th Armored Division; Band, Maintenance and Service Companies disbanded.

68th Tank Battalion relieved 19 July 1945 from assignment to 6th Armored Division. Inactivated 29 December 1945 at Camp Patrick Henry, Virginia. Redesignated 21 August 1950 as 68th Medium Tank Battalion and assigned to 6th Armored Division. Activated 5 September 1950 at Fort Leonard Wood, Missouri. Inactivated 16 March 1956 at Fort Leonard Wood, Missouri. Relieved 1 July 1957 from assignment to 6th Armored Division.

773d Tank Battalion reorganized and redesignated 27 October 1943 as 773d Amphibian Tank Battalion. Reorganized and redesignated 10 January 1944 as 773d Amphibian Tractor Battalion. Inactivated 15 April 1946 at Yokohama, Japan. Redesignated 24 December 1946 as 56th Amphibian Tractor Battalion. Redesignated 18 April 1949 as 56th Amphibious Tank and Tractor Battalion. Activated 10 May 1949 at Fort Worden, Washington. Inactivated 15 December 1954 in Japan.

15th Tank Battalion relieved 19 July 1945 from assignment to 6th Armored Division. Inactivated by elements 22-25 February 1946 at New York Port of Embarkation, New York. Headquarters and Headquarters Company, 15th Tank Battalion, redesignated 1 August 1946 as 15th Tank Company and activated at Fort Riley, Kansas. Inactivated 6 November 1946 at Fort Riley, Kansas. Activated 1 May 1947 at Duino, Italy. Inactivated 1 December 1949 in Europe. Redesignated 21 August 1950 as Headquarters and Headquarters Company, 15th Medium Tank Battalion. Battalion activated 5 September 1950 as an element of the 6th Armored Division at Fort Leonard Wood, Missouri. Inactivated 16 March 1956 at Fort Leonard Wood, Missouri. Relieved 1 July 1957 from assignment to 6th Armored Division.

Troop D, 86th Cavalry Reconnaissance Squadron, Mechanized, inactivated 19 September 1945 at Camp Myles Standish, Massachusetts. Redesignated 21 August 1950 as Company D, 86th Reconnaissance Battalion. Activated 5 September 1950 at Fort Leonard Wood, Missouri. Inactivated 16 March 1956 at Fort Leonard Wood, Missouri.

Maintenance Company and Service Company, 68th Armored Regiment, reconstituted 1 July 1957 in the Regular Army.

68th and 15th Tank Battalions; 56th Amphibious Tank and Tractor Battalion; Company D, 86th Reconnaissance Battalion; and Maintenance and Service Companies, 68th Armored Regiment, consolidated, reorganized and redesignated 1 July 1957 as 68th Armor, a parent regiment under the Combat Arms Regimental System (Headquarters and Headquarters and Service Company, 68th Tank Battalion, redesignated as Headquarters and Headquarters Company, 68th Armor).

Campaign Participation Credit

World War I
St. Mihiel
Meuse-Argonne

World War II
Normandy
Northern France
Rhineland
Ardennes-Alsace
Central Europe
Western Pacific
(with arrowhead)
Ryukyus (with arrowhead)

Korean War
Korea, summer 1953

Decorations

Presidential Unit Citation (Navy), Streamer embroidered *Saipan* and *Tinian* (773d Amphibian Tractor Battalion cited; DA GO 73, 1948)

ARMOR

The Magazine of Mobile Warfare

November-December 1981

United States Army Armor School

"To disseminate knowledge of the military arts and sciences, with special attention to mobility in ground warfare, to promote professional improvement of the Armor Community, and to preserve and foster the spirit, the traditions, and the solidarity of Armor in the Army of the United States."

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November-December 1981 Vol. XC, No. 6

FEATURES

DEPARTMENTS

COVER

"You all know we've got to get to those men in that town. All you've got to do is keep 'em rollin' and follow me." With that simple order, Company C, 37 Tank Battalion, led by Lieutenant Charles Boggess, moved out—with tracks squealing and guns blazing—in the final drive to break through to Bastogne. Beginning on page 12, military historian A. Harding Ganz describes the ensuing battle.

LETTERS

Disagrees with Soviet Armor Article

Dear Sir:

I found the article "Soviet Armor—Past and Present" in the July-August 1981 issue of *ARMOR* interesting and provocative. It touched on a number of aspects of Soviet armor development that are little discussed in public, but unfortunately mingled together truth, half-truths, and legends. All of this distracted from the challenging hypothesis that the so-called *"T-80"* is the first "new" tank since the *T-34*. This is certainly not the case since there has been a considerable amount of change from the first *T-34* to the current *T-72*. Soviet weaponry development is essentially conservative and evolutionary in nature, although there are often unforeseen revolutionary jumps. This is due to a desire to avoid risks, with all of the ramifications they imply both to individual careers and to the security of the U.S.S.R. Part of the problem for the outside observer is that he rarely is shown the failures of the R&D process and thus must judge from the successes or supposed successes.

In spite of the authors' accusation that Western analysts have a habit of numbering "new" tanks instead of new models of old tanks, I can assure them that a very great effort is made to distinguish between minor modifications, evolutionary developments, and radical changes. Ultimately, however, they are dependent on Soviet official nomenclature since it is used once it becomes known. Sometimes it makes no official distinction in spite of significant changes and therefore provisional Western nomenclature must be used here as in cases where Soviet nomenclature is as yet unknown. I was long enough involved in this business to appreciate the problems faced by analysts past and future who must identify changes and give the "beast" a name so that proper reporting can take place, even before the full nature and/or impact of these changes can be analyzed.

Burniece and Hoven are absolutely wrong in stating that the *T-72* was totally unexpected following the appearance of the *T-64*. Based on a wide range of evidence available over 10 years ago, and knowing the Soviet penchant for creating multiple designs for testing in quantity in the field, it was long expected that two or three new Soviet medium tanks would appear, and did already exist in prototype. Two, at least, have been widely tested and the *T-72* seems to have been accepted for large scale Warsaw Pact issue and foreign sales. This did not preclude the *T-64* from being issued on a rather large scale and from it being further developed as the future *"T-80."* With the demise of the Soviet heavy tank we may now see two medium tank design bureaux competing strongly for standardization. Regardless of the ultimate winner I doubt if the nomenclature *"T-80"* will be used since it was already applied to a light tank during World War II, and the Soviets have not as yet been known to repeat a "T" number.

To gain an improved insight into Soviet armor R&D I suggest that the authors read a recent significant study *The Tank Builders: A History of Early Soviet Armor Research and Development*, by Major (now Lieutenant Colonel) Gregory G. Govan, Student Research Report, U.S. Army Russian Institute, APO NY 09053, dated June 1979. It is a splendid example of first-class analysis based on original Soviet materials covering the period up to 1945, but with vital lessons for today and tomorrow.

It is erroneous for the authors to state that the *T-62* engine was rated at 700-hp before an example fell into Western hands. One only has to turn to page 147 of USAREUR Pam 30-60-1, *Identification Guide (Ordnance Equipment) Warsaw Pact Countries* (UNCLASSIFIED), 7th revised edition, 31 July 1968, to read that the powerplant of the *T-62* was listed as a 580-hp, V-12 cylinder engine, a fact long known at that date.

Careful perusal of Soviet publications would also have saved the authors from making a series of misleading statements on the *V-2* series of tank Diesels. It is true that the *V-2* series is reaching the limits of its development and that future armored vehicles will need something better. Nevertheless, Soviet publications have identified the *T-72* engine as the *V-46* multifuel powerplant of 780-hp, a modification of the *V-44* (used in the *T-62* and *T-55*). This does not at all distract from the conclusions that the *T-64* may have a new engine that still has teething problems, or that more careful manufacturing could improve existing models.

Statements about other automotive components are also erroneous and misleading. Contrary to the statements of the authors the *T-34* was the *last* Soviet tank with a Christie suspension. Beginning with the *T-44* all mediums (with the possible exception of the *T-64*) have had torsion bar suspension. On the other hand the large size Christie type roadwheels have been retained. Nevertheless, a change has been taking place in the past few years in the track components of the *T-54/55/62* tanks. This retrofitting probably is connected with the introduction of new elements in the *T-72*. In my article "Standardization in the Warsaw Pact," *ARMOR*, March/April 1979, I drew attention to this development.

The authors seem overly impressed by the Soviet ability to field bigger guns than any other country, although they also dismiss the 125-mm gun as "simply an upscaled version of the current 115-mm gun." Larger caliber does not necessarily mean improved armor penetration.

It is only within the past 25 years that Soviet designers have been able to field truly high-performance, armor-penetrating guns and ammunition.

Although I agree with the authors that the *T-64* may well be the possible clue to the so-called *"T-80,"* it is not unusual for the Soviets to introduce weapons of similar characteristics on a rather large scale and then withdraw some of them from first line units once a decision was made which were more acceptable. The post World War II shell game with the *T-34-85*, *T-44* and *T-54* was typical.

I know that I have savaged the authors of the article rather badly, but since this is not a personal attack I would appreciate it very much if you would forward a copy of this letter to them should you not see fit to publish it in full in *ARMOR*.

DR. ARTHUR G. VOLZ
Charlottesville, VA

The full text of Dr. Volz letter has been forwarded to the authors. Ed.

NVA Armor Operations

Dear Sir:

As an Armor officer I am writing to compliment you on another fine issue (July-August 1981), and to question the officer corps. Of all the authors, only two appear to be in the U.S. Army; all the others are civilians or former military. Can't Armor Branch field officers who are capable of writing? Considering that the magazine is perhaps the best way to keep people in the field informed, perhaps you should publish some sort of department featuring a "Field Expedient of the Month," devoted to items to which a company grade officer could relate.

Virtually every item of military hardware started as someone's crazy idea, or some Rube Goldberg field expedient that worked. The most important factor is the exchange of ideas.

My real reason for writing, however, is to comment on Lieutenant Stacy's article on North Vietnam armor operations. The author has done a great deal of research, has written an excellent article and it should be read by all armor officers. I do take issue with his comments about inaccurate intelligence assessments. He should have done a little more research and said a little more on that subject.

I arrived in Vietnam in Sept 1967. I had a background as an Ordnance tank maintenance officer and had done considerable personal research on Soviet armor operations. After a brief period in Saigon, I went to the field and served as Lieutenant General Rasson's staff technical intelligence officer. It was obvious to most of us that the North Vietnamese Army was improving its operations, upgrading weapons, and bringing in armor. We recovered many components from *PT-76* and reconnaissance tanks damaged at Long Vey, and I advised intelligence personnel of the probability of *T-54* tanks coming in. One has to only read the book "Self Destruction" to begin to understand why the 1972 offensive was a surprise.

WILLIAM L. HOWARD
Major, Armor, USAR
Largo, FL

Reserve Component Tank Table

Dear Sir:

The "Master Gunner's Corner" article, "New Tank Table Proposed for Reserves" by Major William E. Brass has been read with great interest at Forces Command Headquarters. Major Brass makes several excellent points that highlight the challenges faced by a Reserve Component (RC) armor unit as it progresses through its annual gunnery program.

I agree that an 8- to 10-month period between main gun firings will produce some decrement in the skills required for proficiency in tank gunnery. Even with full use of available subcaliber devices and scaled ranges, and even if the unit commander is allowed the luxury of dedicating all 38 training days a year to nothing but tank gunnery, there will probably be some adverse effects on tank crew performance, due to both the absence of main gun realism and the basic RC environment that provides for a noncontinuous training period (12 weekend drills of inactive duty training (IDT) a year and 2 weeks annual active duty training (AT)).

The proposed tank table, if adopted for use, would certainly solve many of these problems, but would undoubtedly create other problems for the RC commander. This table might be adopted for sustainment gunnery, but if used in lieu of Table VII for annual qualification, would create a disparity between what constitutes qualification for the AC versus the RC and would not be in consonance with the U.S. Army's Standardization Program. If used for sustainment of gunnery proficiency, several other questions must be addressed.

Where is the RC unit going to fire this table? Existing and planned tank ranges will continue to be located a significant distance from the RC units' home station. This geographic separation creates movement problems during the AT period. Is the author suggesting that the RC unit reposition to a main gun tank range during IDT? The cost, time, and efforts involved in doing this might far outweigh the obvious advantages already discussed in the article.

The logistics system supporting tank gunnery Army-wide is already strained to capacity in supporting the meager allocations of main gun ammunition currently available. In fact, extraordinary efforts and reallocations of main gun ammunition in Fiscal Year 1981 were necessary in order to provide the bare minimum required to permit crew qualification in the RC. With force modernization efforts drawing needed funds away from ammunition procurement in the future, the suggestion that an additional seven rounds per crew be allocated is not logistically supportable. Even in the most optimistic case, rounds saved in firing Table VI and VII (due to increased proficiency from firing the proposed table) would not provide the seven additional rounds required to support the proposed table. Under current policies, it must be noted, that any rounds saved on Table VI and VII should be used on Table IX.

The existing tank gunnery training program for the RC has been designed to permit achievement of realistic standards of proficiency in peacetime while recognizing the real world constraints of available time, resources, and range facilities. The postmobilization training requirements for RC units recognize the need for additional gunnery training to prepare the RC Armor/Cavalry unit for war and, upon mobilization, the RC unit will have the opportunity to upgrade proficiency before deployment.

DONALD B. SKIPPER
Major, Armor
RC Training Division,
ODCSOPS, FORSCOM

Comments on New Tank Table

Dear Sir:

In reply to Major William E. Brass' article in the "Master Gunner's Corner" in the July-August 1981 issue of *ARMOR,* we feel obligated to comment on what we believe is a somewhat misleading article on Reserve Component (RC) Tank Gunnery.

It must be pointed out that a tank table already exists that accomplishes the goals Major Brass established for his "new" tank table. This table is Tank Table VI and is outlined in FM 17-12-2, C2, which has established the task, condition, and standards for tank gunnery. In FM 17-12-2, C2, Table VI is described as a ". . .table that employs a defensive combat range that teaches the crew conduct-of-tank-fire using main gun, battlesight, and precision engagement techniques against stationary and moving targets."

This appears to be the same aims Major Brass forecasts for his "new table." By cross-referencing Major Brass' table and Table VI, we noticed the resemblance between the engagements, with the main differences being range to targets and ammunition used. However, this is not the case in all the engagements, since some are identical. It is apparent to us that the training result in firing either table will be the same.

Our basic resistance to the proposed table is that, in recent years, the cry throughout the Armor community has been the lack of standardization in tank gunnery programs and qualification standards. This has led to having to continuously retrain 19E personnel of all ranks upon permanent change of station since Baumholder gunnery standards did not in any way resemble Fort Bliss gunnery. RC units can suffer the same problem, especially if they have an active Army unit as a partnership unit, because they are directly influenced by the active unit. If the active unit has developed their own gunnery standards, it disrupts the RC gunnery program. From our own experiences, nonstandardization of gunnery programs by the partnership units confuses the RC and hinders what we, the RC Assistance Team, try to do in order to keep FM 17-12-2, C2, as the only acceptable standard. Our basic complaint with Major Brass' proposed tank table idea is that standardization is hard enough to integrate into RC tank unit programs without the advocates of change always trying to modify the proven, well known standards as outlined in FM 17-12-2. C2. Gunnery tables are established to provide a logical progression of training to meet the only goal—tank qualification, which, for the RC, is Table VII as established last year by FORSCOM Headquarters. Table VII also must be the point where an accumulation of training skills gathered on the other tables meets the toughest standard.

The logic of saving training ammunition by firing this new table escapes us since the requirement to fire Tavle VI still remains. It is true that by firing established zeros and meeting the tough ammunition conservation standards outlined on the tables, a unit might be able to save enough main gun rounds to fire the new table. However, this would be at the expense of multiple firings of tables by weak crews, since even the RC only get the ammunition allocated in FM 17-12-2, C2—no more and no less.

In response to Major Brass' statements concerning the validity of using subcaliber devices, we maintain that their use, coupled with innovative training practices, will result in main gun proficiency at a lower cost. Utilizing the *Telfare* device in concert with TC 17-15-11, *Tank Crew Drills*, gives the trainer an unbeatable combination for preparing crews for main gun firing.

We do applaud Major Brass for his keen interest in a subject that is given a lot of "lip service," but which few people really make the effort to improve. However, this time we feel that since, finally, the total armored force is talking off the same sheet of requirements, and standardization in tank gunnery is becoming a reality, let us, the Armor community, not take a step backwards under the guise of an improvement.

JEFFERY W. WOODALL
Captain, Armor, MTARNG

and

PHILLIP C. TOW
SFC, Master Gunner, MTARNG
Kalispell, MT

Faults Soviet Armor Article

Dear Sir:

After reading the article titled "Soviet Armor-Past and Present" in the July-August 1981 issue of *ARMOR*, I marvel at the amount of misinformation it presents.

First, the Red army did have a medium tank capable of defeating the common antitank round at the beginning of World War II. That tank was the *T-34* and the standard German 37-mm tank and antitank gun and the 75-mm gun on the *Mark IV* tank could not reliably kill the *T-34* from the front.

Burniece and Hoven unfortunately perpetuate the myth that the *T-62* throws its tracks easily. This is not true. A U.S. unit in Europe set out to prove or disprove the myth and found that it was very hard to throw a *T-62* track even in turns and evasive maneuvers. In fact, it was as hard to throw a *T-62* track as it was to throw a track on the *M-60*, if both tanks had proper track tension.

The external fuel storage on Soviet tanks is not such a bad idea. Internal fuel tank fires are catastrophic. External fuel tank fires are a nuisance. Perhaps the Soviets have self-sealing fuel tanks. In any event, moving fuel outside of the armor envelope reduces the size, weight, and overall vulnerability of the tank.

With regard to reloading the *T-62* main gun, it should be noted that the gun automatically elevates to an angle of 3 degrees for 30 seconds for loading, after firing.

Admittedly, the turret cannot be traversed while the gun is being reloaded, but that is probably not a major problem as the gunner has to sense the round or have the next target identified to him.

While the statements about the Soviet tank engine might be true, I have only seen it in one report of doubtful validity.

The authors have the chronology of Soviet tank fielding somewhat out of order. Figure 1 has some major discrepancies. First, the *T-64* is not listed in the right place, between the *T-62* and *T-72*. Second, the *T-72* is listed as having only a minor gun modification. In fact, the *T-64* and *T-72* guns are major developments. The gun may itself be a scaled up *T-62* gun, but it is 125-mm and not 115-mm. The ammunition is two-piece ammunition, with a combustible case for all rounds and the sabot of the APDS projectile is surrounded by a combustible case in addition to its primary propellant charge. The *T-64* is a major change from the *T-62* turret. The *T-62* turret is almost half-egg shaped while the *T-64* turret resembles a frying pan. It is circular, with a flattened front section. The *T-72* turret closely resembles the *T-64* turret, but the rear half is slightly oval, when viewed from the top.

The *T-64* cannot use an upscaled version of the BMP's autoloader because the BMP uses one-piece ammunition while the *T-64* uses two-piece ammunition. We know that the autoloader on the *T-72* resembles a Kodak Carousel slide tray. The projectile is loaded in the bottom half of a carrier while the powder charge is loaded in the upper half of the carrier. When the gun loads, it must pick up the carrier and ram the projectile and then the powder charge. This is not the cycle used by the BMP.

The assertion that the Soviets have never changed more than one system at a time in their design history is true, if you restrict yourself to the data in figure 1. The *T-64* alone was the first Soviet medium tank to have an auto-loader, new opposed-piston engine, and a suspension incorporating return rollers.

The DIA Warsaw Pact Ground Forces Equipment Handbook-Armored Fighting Vehicles, lists the *T-64* as having a 5-cylinder, opposed piston diesel engine, developing 700-750 horsepower. There is no indication that the *T-64* has a turbine engine. Certainly, the *T-64* would require very large air filters and a much bigger snorkel to supply a turbine engine with air.

While there is a great deal of similarity between the *T-72* and *T-62* suspension components, there are significant differences. The *T-34* through the *T-62* had five road wheels. The *T-72* (and *T-64*) have six road wheels. The placement of the *T-72's* return rollers scarcely appears to be an afterthought. The best way to improve a tank's ride is to increase the vertical distance a road wheel can travel. "Flat-track" return systems (such as on the *T-62* limit this distance, while return rollers allow the road wheels to move higher. *T-62* and *T-72* road wheels, idler, and drive sprockets are all interchangeable. That does not alter the fact that the way these components are used is different.

Soviet tanks have increased in weight over the years, as shown below.

T-55	36T
T-62	37.5T
T-64	38T
T-72	41T

The weight difference between the *T-62* and *T-72* is 3.5 tons and not one ton as mentioned on page 24 of the article.

The reasoning on the *T-64* is interesting, but ignores the initial dates of observation. The first *T-64s* were seen in 1970, but the first *T-72s* were seen in 1977. Consider that the *T-64* has an opposed-piston engine. Such engines are very compact and powerful for their size. However, once a tank is designed around such an engine, it is very difficult to replace with a conventional V-12 engine. The British tried an opposed piston engine in the Chieftain tank. It is just now being debugged to the user's satisfaction. It is possible that the Soviets had a great deal of problems with the *T-64's* engine. Perhaps the *T-72* was a "backstop" parallel development program. Examining the *T-64*, it must have required a much larger capital investment program to convert a tank plant to build *T-64* tanks than to convert a *T-55* or *T-62* plant to produce *T-72* tanks. This being the case, the Soviets may have elected to continue both *T-64* and *T-72* production after the *T-64* was (apparently) debugged. The Soviets did produce the *T-62* and the *T-55* at the same time for many years. In any case, just as the *T-55* was produced in the Warsaw Pact and the *T-62* was not, the *T-72* will probably be produced by the Czechoslovakia and Polish tank plants. The argument that the *T-64* may have been observed rather than the *T-72* is also interesting, but ignores the picture of a T-? in the January-February 1980 issue of *ARMOR* that indeed shows a *T-72* type tank with skirts.

I think then the hypothesis that the *T-64* is the *T-80* is in error. The *T-64* represents early 1970 technology. Surely the Soviets can do better than that in their next engagement tank. In any case the real *T-80* should appear by 1985.

GERALD A. HALBERT
Captain, Military Intelligence
Fort Knox, KY

Recognition Quiz Scrambled

Dear Sir:

Each month, I anxiously look forward to the "Recognition Quiz" as a challenge to my ability to identify vehicles belonging to both friend and foe (potential).

In July-August issue, the explanation/identification for the number 2 and number 4 pictures have been reversed; the British *Scorpion* is identified as the BTR *M-1978* and vice versa.

While I am reasonably sure that I will not be the only reader to point out this switch, I could not let it go without informing you.

Everyone's entitled to an honest mistake. . .and your publication is still the best all-around information source for what is happening with the Armor community throughout the world! Keep up the excellent work!

DAVID F. RICH
1st Lieutenant, Armor
Fort Hood, TX

Lieutenant Rich is correct on all points regarding the Recognition Quiz. There are slips that pass in the night, but the slips that pass in type are noted much more quickly. Ed.

Suggests Study of German Tank Gunnery

Dear Sir:

In the July-August issue of *ARMOR* you noted that the Canadian Army Trophy for tank gunnery was won by the Germans with a Belgium crew placing second. By the point spread that you published it appears that the top crew far outpaced all others.

Gentlemen, I recommend that *ARMOR* develop and publish an in-depth study of the German formula for gunnery, including crew training and any other activity that may impact on their success. I can think of no other article you could formulate that would be more helpful to the Armor community.

JERRY A. THOMAS
LTC, Armor
Fort Riley, KS

President Reagan's Cavalry Service

Dear Sir:

As a long time member of the Armor Association, I want to compliment you on the outstanding May-June 1981 issue. Excellent in every respect!

I was particularly interested in your synopsis of President Reagan's service in the United States Cavalry. For your information, the 1st and 2d Squadrons of the 322d Cavalry are organic to the 5th Cavalry Brigade (Tng), 89th US ARCOM. A Brigade, incidentally, I was privileged to command for three years. The entire 1st Squadron with headquarters in Great Bend, Kansas has units in Great Bend, Dodge City, Salina, Scott City, and Fort Riley.

Together with the 3d and 4th Squadrons, 302d Cavalry, the Brigade is the only pure Cavalry Training Brigade in the inventory, and upon mobilization, would open up a 19D Cavalry Scout Training Center. Thought you and your readers might be interested in knowing that the 322d Cavalry is still on the troop list and a viable military force.

PHILLIP J. ZELLER, JR.
Brigadier General, USAR
Deputy Commander
89th U.S. Army Reserve Command

Ronald Reagan
Lieutenant, United States Cavalry
Photo courtesy of USAF Museum

A Reply to Comments Regarding "Flyswatter"

Dear Sir:

In reply to Joseph E. Backofen's letter (July-August 1981 issue) commenting on Douglas' "Flyswatter" concept, I must take exception to the extreme sophistication that Backofen suggests.

Douglas has proposed a weapon based upon KISS technology (Keep It Simple Stupid), a form of technology that is unfortunately becoming too rare. Mr. Douglas' "Flyswatter" version could be produced in great quantities by moderately equipped tool and die shops, such as the popular *M3* "Grease Gun" manufactured by American Can Company. Backofen's version could only be developed and produced, in more limited quantities, by very sophisticated ordnance factories.

Backofen contends that the *Hind* helicopter is too well armored to be seriously affected by "mere" 20-mm rounds. The last I heard, a 20-mm round can penetrate one-half to three-quarter inch steel plate. I doubt if the *Hind* can afford that much weight to *totally* protect it in *all* areas.

The larger version Backofen wants developed would surely knock out a *Hind* at quite a respectable range. But the Douglas version would very likely keep the helicopter pilot out to that range. Any closer and the nine-round cluster is bound to do some damage.

Additionally, the Douglas version is designed to be carried and operated by one man, not counting a loader and as many ammunition carriers as can be volunteered. The Backofen version tends to be a vehicle-mounted type controlled strictly at company level rather than squad level.

Backofen may be, unfortunately, very correct in assuming that *our* Army would want to develop a brand new projectile. However the Douglas version allows countries of lesser financial R&D priviledges to use their depots of surplus ammunition.

I am not attempting to totally downgrade Backofen's concept. On the contrary. His version should be considered seriously as a much more sophisticated, more powerful and longer ranged version of the Douglas "Flyswatter." Yet credit must be given to the smaller version for its simplicity, low cost, and versatility.

Antihelicopter use would not be the sole restriction of the "Flyswatter." It would also be an excellent weapon to use against light ground vehicles and even some light armor—again at squad level command. The French truck-mounted *Javelot* cannot be hidden quite as easily as an infantryman with a "Flyswatter." I'd lay odds on the "doggie" if he was ordered to go out after the truck.

RICHARD A. LANDGRAFF
Long Beach, CA

Photos of AFVs Wanted

Dear Sir:

I am writing about armored fighting vehicles (AFV). The book will be illustrated extensively with approximately 250 photographs, and I shall be most obliged for the loan of any photographs showing U.S. and Army of the Republic of Vietnam AFVs in action; any such photographs would of course be returned as soon as possible.

SIMON T. DUNSTAN
4 Tate Road
Sutton
Surrey SM1 2SY
England

TRADOC Commander's View on the Use of Second Lieutenants

Dear Sir:

The article by a Captain on the use of Lieutenants has caused quite a stir (latest Armor).

This is the response from the new TRADOC Commander. I agree wholly with him.

In peacetime we often overlook that 2d Lieutenants will be Company Commanders as soon as mobilization starts—or even higher.

You may want to use General Otis' remarks with his O.K. O.K. to use mine.

BRUCE CLARKE
General, USA (Ret)

Dear General Clarke:

Thank you for your 7 July letter and inclosed article, "A Commander's Training Center Experience." I feel as you do that the author missed the mark on how to use lieutenants. The idea that new lieutenants are to be best used as orderly room managers is absurd! They need to be out in the field learning and doing their jobs. You are right about the apparent pervasive attitude on the part of some commanders to want to do everything themselves rather than risk looking bad when subordinates make mistakes. This kind of attitude runs counter to the leadership principles that for years have been our standard.

I can assure you that the Chief and the rest of the Army's senior leadership are dedicated to continue efforts to enhance cohesion and provide the kind of command climate that permits junior leaders to do their jobs, make mistakes and grow.

GLENN K. OTIS
General, USA
Commander
TRADOC

Agrees with Vee Technique

Dear Sir:

This is in reply to the letter from Captain Swan in the July-August 1981 issue, which disagrees with the article, "The V Maneuver Technique."

The Vee formation *does not* force the commander to make contact with the bulk of his unit, thereby severely restricting his tactical options. The Vee technique, if the article is read correctly, allows the punch force, or tanks, to overwatch the scouts who are fixing the enemy. This allows the platoon leader or troop commander the flexibility to maneuver the bulk of his units power to enhance his tactical options of hitting the enemy on his vulnerable flanks or rear.

The Vee technique, with overwatch as an integral part, is effective and a definite success. I have used it and seen it used in numerous ARTEP evaluations for the last 4 years as a platoon leader, executive officer and troop commander in an Armored Cavalry Regiment and am continuing to use it with success.

KEY H. DRYDEN
Captain, Armor
L Trp, 3/2 ACR

COMMANDER'S HATCH

MG Louis C. Wagner, Jr.
Commandant
U.S Army Armor School

Combat Arms Pre-Command Course: Phase II (Armor)

This is the sixth in a series of "Commander's Hatch" and "Forging the Thunderbolt" articles outlining various training and professional development courses conducted at the U.S. Army Armor Center. In this issue, the Combat Arms Precommand Course—Phase II (Armor), commonly referred to as the PCC, is highlighted.

The Armor Center has traditionally conducted refresher training for armor battalion and brigade commanders. In 1978, the TRADOC Commander directed that this type of training be formalized for all branches of the combat arms, and assigned proponency for the program to the Combined Arms Center, Fort Leavenworth, KS.

The PCC is conducted for those active duty officers selected to command armor battalions and brigades. It is also available to field grade officers of the Reserve Components who are in, or who have been designated to command, armor units.

The PCC is designed to assist individuals in preparing for battalion and brigade-level command by providing refresher training in selected functions and duties and to insure a common understanding of current U.S. Army training, personnel and logistical management, and tactical doctrine.

The PCC is a four-phase course. Phase I is a home study program and diagnostic test. Phase II consists of orientation and refresher training at the branch school. Phases III and IV, taught at the Combined Arms Center, Fort Leavenworth, present instruction in command development and how to fight. Additional training is programmed for selected individuals who require a language capability or who will have Special Courts-Martial jurisdiction.

Phase II for Armor, conducted at the Armor Center, is a 2-week course that includes instruction in training management, tactics, weapons, preventive maintenance, and logistics.

The course begins with an introduction to the Army Training System from the viewpoint of the Armor Center. Discussion is centered on individual and collective training and how the commander must tie the two together to attain and sustain a high level of combat readiness. Instruction in training includes discussion of the Skills Qualification Test (SQT) program and how the commander can use SQT feedback data in identifying training weaknesses at the company and battalion level. Methods and materials available to support individual training are also outlined. The Army Training Evaluation Program (ARTEP) and training literature are discussed as they relate to the development and implementation of unit training programs. Training devices and simulators and their use in enhancing individual and unit training are reviewed in light of constraints on training funds and training areas. The factors that detract from training and the actions that a commander must take to overcome these detractors in the development of a viable training program are highlighted. The Commandant of the Noncommissioned Officer (NCO) Academy/Drill Sergeant School provides a briefing on NCO education conducted at Fort Knox. During this presentation, the commander's role in the selection process is outlined.

The Command, Staff and Doctrine (CS&D) Department's 31 hours of instruction focuses on tactics and tactical training and is tailored to meet the specific needs and interests of the PCC students. The students are provided an update on current threat organizations, equipment, and tactical doctrine. The fundamentals of nuclear, biological, chemical, and electronic warfare, and combat support/service support are reviewed. The CS&D instruction concentrates on tactical operations at battalion, squadron, and task force levels and includes a series of small-group, round-robin seminars on offensive, defensive, and cavalry operations. Students are provided up-to-date information on doctrinal literature changes in each area. A tactical exercise without troops is scheduled dependent on the needs of the students. Finally, the CS&D Department presents a mini-workshop in training management that provides hands-on training in the techniques of developing and managing short- and long-range training programs.

The Weapons Department presents 25 hours of instruction to familiarize the students with turret-mounted weapons systems, fire commands, training devices, and the management of tank gunnery programs. Each command designee has an opportunity to fire a modified tank table using the major weapons system of his projected command.

The Maintenance Department provides 34.5 hours of instruction on the command aspects of logistics. This includes a review of the Army Supply System, the Army Maintenance System, property accountability and adjustment procedures, and unit/materiel status reporting systems. The students receive training in vehicle driving, maintenance-indicator inspection techniques, and hands-on, crew-level maintenance procedures for the track and wheeled vehicles organic to the command to which they are assigned. One day is spent with an armor battalion in the field for on-site practical exercises to apply the knowledge and skills learned in the classroom.

The Committee Group presents 8 hours of instruction in communication, small arms, and mortar training. The small arms training is conducted concurrently with the modified tank table firing. The communication instruction is presented jointly with the CS&D Department in order to tie in the communication system with tactical operations.

The Office of Armor Force Management and Standardization (OAFMS) presents an evaluation of the Armor Force based on internal and external observations, including the current status of personnel, training, and logistics in the Armor Force.

The 1st AIT/OSUT Training Brigade presents an orientation to acquaint the command designees with the soldierization process of Basic Armor and Basic Reconnaissance Training in order to provide an understanding of the capabilities and limitations of the Initial Entry Training graduate.

One of the most beneficial elements of the course is the Command Seminar. During the seminar, the command designees discuss contemporary command and leadership problems with a command sergeant major and a company, battalion and brigade commander, all of whom are in command or have recently been in command.

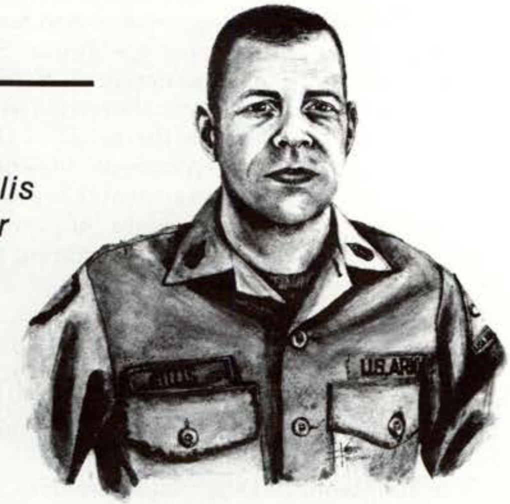
Attendance at the PCC is of prime importance because it is the only training an armor unit commander receives that encompasses the full range of subjects he must have knowledge of in order to be an effective commander. This is particularly important for the command designees who have not had recent troop experience. The course is time-intensive with a student-to-instructor ratio of approximately 4:1 to insure the best instruction possible. Each command designee is provided a veritable library of field manuals, technical manuals, student texts, and other training materials to use as ready reference on the subjects covered during the course. All training presentations are correlated to the type unit, including major weapons systems and mission, and the command designees' experience.

The PCC is a *gentlemen's course* in that no tests are administered at the Armor Center. However, graduates of the course do, in time, take a long and difficult, but rewarding, final examination—*they take command.*

PROGRAM OF INSTRUCTION

CLASS TITLE	**HOURS**
Commanding General	
The Army Training System	2
Commandant, NCO Academy	
NCOES	1
Command, Staff & Doctrine Department	
Combat Support	4
Battalion Training Management System Introduction	1
Battalion Training Management "Mini-Workshop"	5
Task Force Tactical Operations (Offense, Defense, Cavalry)	12
Tank Munitions Effectiveness—Threat Systems Update (**Secret**)	4
Threat Tactics	1
NBC Update (**Secret**)	3
Electronic Warfare/Surveillance Systems (**Secret**)	1
Weapons Department	
Management of Tank Gunnery Programs	2
Turret Refresher Training	4
Conduct of Fire	3
Tank Table VI (Modified)	11
Tank Gunnery Training Devices	3
TOW/Dragon Systems	2
Maintenance Department	
Welcome and Administrative Brief	0.5
Command Seminar	4
Exit Briefing	1
Army Supply System	2
Army Maintenance System	2
Unit Status Reporting System	2
Property Accountability and Adjustment Procedures	2
Unit Operations—On-Site	1
Dining Facility—On-Site	1.5
PAC—On-Site	0.5
Motor Pool—On-Site	2
Supply Facility—On-Site	2
Inspection of Troop Support and Aviation Materiel Readiness Command Equipment (Troop Support)	2
Maintenance Procedures	4
Turret Maintenance Supervisor's Checks and Services	4
Vehicle Driving	4
Committee Group	
Communications (**Secret**)	3
Armor Unit PM Checks and Inspections (Small Arms)	4
4.2-in Mortar	1
Office of Armor Force Management and Standardization	
Evaluation of the Armor Force	1.5
1st AIT/OSUT Training Brigade	
Command Briefing	1

DRIVER'S SEAT



CSM John W. Gillis
Command Sergeant Major
U.S. Army Armor Center and Fort Knox

NCO Leadership at the Company Level

Most of what I have to say about the noncommissioned officer (NCO) and his obligation for professional leadership is directed to those in the rank of corporal through first sergeant—those NCOs who lead soldiers in the company. I do not intend to say that those who do not lead soldiers in the company are any less important—rather I want to emphasize that, no matter how great the leadership above company level, success on the battlefield will not be attained unless professional leadership has been established in the company. History tells us that captains—company commanders—fight wars. They will do so in the future. Captains lead companies—first sergeants run companies—therefore, my reasoning is that without professional leadership at company level we will not succeed in combat.

If I am to talk about the NCO leadership at the level that will win the next war, I must start with the soldier of *today's* army, an army that includes Active, Reserve, and National Guard units. I must start with the soldier because, as the product of our leadership, he will be the deciding factor in the next war—just as he has been in previous conflicts. Too often we spend our time complaining about the quality of today's soldiers and comparing them with those of the past. We talk about how great the units were in which we served, compared to the unit in which we now serve. We talk about how we were a better soldier than today's soldier.

That's all right, if that's what you want to talk about, but remember that you will go to war *as a leader today, not as a soldier of the past!* You will go to war as a member of the unit you *are in*, not as a member of a unit you *were in*! Most of all, remember that you will *not* go to war with yesterday's soldier, or with tomorrow's soldier, you will go to war with today's soldier! Today's soldier will survive or die on the battlefield. Today's soldier will win or lose on that battlefield, and NCO leadership will determine the outcome.

What is leadership? Is it the "book definition" in FM 22-100 *Military Leadership*? Is it the definition found in some NCO development program, that reads "an NCO is a leader who knows himself, his job, and his soldiers, and sets the example?" Is it mission first, while looking out for the welfare of the soldier? Is it the NCO academy or the entire NCO education system? Is it success in training the soldier to survive and win on the battlefield? Or is it one of the many other definitions that you and I have heard or read over the years? The answer is yes,—it is all of these. But who judges leadership, who determines that you are an NCO leader? Some will say the Army does, because the Army promotes you. Some say your superiors do, because they judge your success or failure. I say, the soldier determines what leadership is, because he is the one who must follow you into combat. He is the one who *decides* whether or not the *best* chance for survival in combat is to follow *you*.

He decides whether you are capable enough for him to put his life in your hands. If you have trouble believing this, think about the NCO under whom you serve, whether he is a staff, platoon, or first sergeant, or command sergeant major. Ask yourself "If I went to war today, would I put my life in his hands, would I follow him without hesitation?" If the answer is no—you have judged that NCO to be a leadership failure. Your soldiers do the same—they judge your leadership by determining your success or failure.

Those who think there is more to the army than surviving and winning on the battlefield are wrong. Those who think we should concentrate on values other than the hard values of the battlefield—those simple values of living or dying, winning or losing—are wrong. Those who think their soldiers are not concerned with the battlefield are wrong. Battles can be lost in many ways, but they can be won by leadership—demanding, hard driving, yet sensitive leadership. Your soldiers know this, and look to you to provide that leadership. It is personal with them. You do or you don't—they will decide! No matter what the other reasons may be that *demand* the very best leadership from the NCO, the most important one is that our soldiers demand it, and we must provide it!

Let's look at what our soldiers see in us. Think of your soldiers—their names, race, positions, ranks—think of anything, and all things, that will bring and keep your own soldiers in your mind.

It is your behavior, not words, that will teach your soldiers what is worthwhile and what is not.

At first, he may take his cues from your words, but over the long run he will take his cues from your behavior. How does your behavior influence your soldiers?

Your soldiers are led by "laying a club on the outside of their head, or laying a club on the inside of their head." They will do what they should because you outrank them—the club on the outside of their head—or they will do what they should because you are an NCO whom they respect—that is the club wielded inside their head. Which club do your soldiers see?

Discipline is the ultimate product of effective leadership. General George S. Patton said, "There is only one kind of discipline—perfect discipline. If you do not enforce and maintain discipline, you are potential murderers." If you can't get your soldiers to salute when they should, to wear the uniform properly and proudly, to shine their footgear, to be where they are supposed to be at the time they are supposed to be there, how are you going to get your soldiers to fight—and die if need be—for their country? How do your soldiers see your discipline?

Your soldiers look to you to right what is wrong. They expect you to make good on your promises. They are not fooled when you promise what they know you can not reasonably accomplish. The outstanding NCO has a realistic concept of his power, he knows what he can and cannot do. How do your soldiers evaluate your promises?

The outstanding NCO does not hesitate to punish when the situation calls for it. Your soldiers expect you to know exactly what that situation is. They expect you to punish them when they fail because they do not try hard enough, or just do not care. They do not expect punishment when they fail because of a lack of ability, or circumstances beyond their control. Soldiers want *you* to take the proper action, to punish them when warranted, but not for you to report them to the company commander, and recommend an Article 15 for disciplinary actions that they know you are authorized to administer, and that you are responsible for doing so. What do *your* soldiers see when punishment is required?

Your soldiers have heard all the words on training. They know that you are responsible for their personal training. They expect you to know what it is that they should learn. They question you, when their training is given by anyone other than yourself—their own NCO. What do your soldiers see when it comes to your responsibility for their training?

I have no answers for the questions that I have asked. Only you know the answers. By answering each, you will determine for yourselves whether or not you are providing the leadership demanded of you by your soldiers. Whatever your answers, you and your soldiers are the only ones who will know if those answers are absolutely truthful—that is the only way it should be!

We must recognize why the NCO is the most important leader in the United States Army. It is not because we outnumber the officer leadership, *which we do*. It is not because we "conduct the daily business of the army" and our units, *which we do*. We NCOs are the most important leaders because of our relationship with our soldiers. As the enlisted leadership, we are always there, and because we are always there, soldiers expect more from us. They expect us to understand them, help them, suffer with them—and if necessary, to live or die in combat with them. We are theirs, and they are ours. They are a reflection of ourselves, and we are what they have made us. Those NCOs who consider themselves a success should never forget that they are a product of successful soldiers with whom they served and *led*.

In a peacetime army, we are often caught up in things that we believe more important than the soldier's demand for leadership from his NCO. We develop what I call a garrison mentality and do things because it is easier. It is easier to:

- Rely on the CQ to awaken our soldiers.
- Have soldiers report to the motor pool for duty, rather than marching them there.
- Tell the soldier with a problem to, "Go see the first sergeant," rather than taking the time to personally solve that problem.
- Leave on-the-spot corrections to "all those other NCOs."
- Consolidate skill qualification training 2 months before the test by putting nothing but that type of training on the schedule, rather than having a year-round training program.
- Not to have retreat or reveille formations.

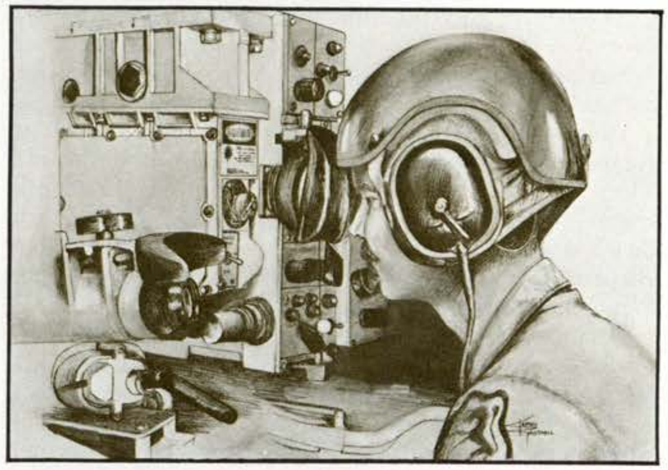
I could go on and on, and on. All of these "easier things" that you do are seen by your soldiers. Some will expect you to do things in combat the same way—the easy way—because that is how they have seen you operate in peacetime. Then, even though you tell them that war and peacetime differ greatly, they will not change their expectations of you—they will die early. Our highest casualties have been in the opening days of every conflict in which the Army has been involved because of leadership failures in peacetime. The same will not occur in the next war, however, if you provide the leadership necessary to avoid it.

To quote General Creighton W. Abrams, "There must be, within our army, a sense of purpose and a dedication to that purpose. There must be a willingness to march a little farther, to carry a heavier load, to step out into the dark and the unknown for the safety and well-being of others." I will take some liberties with that statement and close with this:

"You must, as an NCO, have a sense of purpose and a dedication to that purpose. You must be willing to march a little farther, to carry a heavier load, to step out into the dark and the unknown for the safety and well-being of your soldiers, and for the country that you have sworn to defend."

John W. Gillis

MASTER GUNNER'S CORNER



SFC James Barnes
Chief, Master Gunnery Branch
Weapons Department
U.S. Army Armor School
Fort Knox, KY

Only the Best Qualify To Be Masters of Gunnery

Lessons learned from the Middle East wars point out the tremendous importance of armor unit readiness, and tank gunnery proficiency. Resource limitations, however, preclude training all tank crewmen to desired standards during advanced individual training, or attendance at service schools.

An alternative solution is to train *carefully-selected* noncommissioned officers in a course of instruction that will provide the graduate with a true mastery of tank weapon systems, along with a thorough understanding of tank gunnery training techniques, and associated gunnery training programs. These individuals become master gunners, and are tasked with the responsibility of improving, and maintaining the gunnery standards and readiness posture of the tank crews within their respective units.

The concept of the master gunner is not new. For years British armor units have selected *highly-skilled* noncommissioned officers (NCOs) to attend a course of gunnery instruction at the Royal Armor Corps Center. After graduation, these master gunners return to their troops or regiments, in which their prime mission is to teach gunnery instruction, and place emphasis on gunnery training throughout the year.

As a result of the increased complexity of modern tank fire control systems, and the lack of advance gunnery knowledge within U.S. Army Armor units, commanders realized some time ago that there was a need for a resident, trained "gunnery expert" in armor units. It was further realized, that the commander and his staff, frequently could not afford the amount of time that was required to personally develop and implement a detailed year-round gunnery program.

In 1974, a staff of senior officers from the United States Army Armor School (USAARMS) visited CONUS commanders in the field, and proposed the master gunner concept as a method that the Armor Community could use to increase gunnery expertise in the field. This proposal was favorably received and the U.S. Army Training and Doctrine Command tasked the USAARMS to develop a program of instruction.

On 10 April 1974, the Chief of Staff, U.S. Army, approved the concept for the Master Gunner Program, and the Armor School was directed to conduct a Master Gunnery Course on a one-time basis that would teach advanced gunnery for the *M-60A1, M-60A2,* and the *M-551*. The Armor School was then tasked to evaluate each course based on training lessons learned and analysis by field commanders of the contributions the course graduates made to their units.

In order to properly evaluate the worth of the course, and to insure that the graduates had been taught the skills required by all active army units, graduates were distributed equally between U.S. Army, Europe and continental U.S. commands.

In February of 1976, based upon the success of these graduate master gunners, and numerous comments from the armor unit commanders, Department of the Army approved the Master Gunner Course for resident instruction at the USAARMS.

To date the Master Gunner Course has provided the Armor Community with over 500 master gunners, and is known to be one of the courses most sought-after by the armor noncommissioned officer.

Prerequisites for attendance at the Master Gunner Course are outlined in DA Pamphlet 351-4. Additionally, the Tank Crew Gunnery Skills Test is administered to each candidate upon his arrival at the USAARMS to determine if he is technically qualified. There is only one passing score—100 percent.

The Master Gunner Course is a highly technical course requiring above average intellect and motivation. The brisk pace of instruction does not allow for students who cannot keep up. The Director of the Weapons Department personally reviews the records of each student who fails to meet the course standards to ensure that each has been given ample and fair opportunities to achieve those standards. The course is demanding, but the standards must be maintained because it is imperative that the course provide the field with the highest quality product.

Selection of an individual to attend the Master Gunner Course at Fort Knox should be undertaken with great deliberation and thought.

Perhaps the most important question that must be answered after the individual has met the prerequisites is, "Is this individual the best man the unit has to offer?" The Master Gunner Branch strongly recommends that a battalion-level board, comprised of the unit's master gunners or senior NCOs, be convened to screen applicants. The commander should serve as president, with the understanding that the final selection of candidates rests solely with him. The candidate must:

- Be *highly-motivated* and want the job and all the responsibilities of a master gunner.
- Be a *highly-proficient* Armor NCO in the grade of E6 or E7.
- Possess the *ability to instruct* other NCOs and officers on how to teach their soldiers and crew.
- Be *able to interact and relate* with his fellow NCOs and officers.
- Be *dedicated* to improving training so as to benefit the individual as well as the unit.

The Master Gunner Program was implemented as a tool for getting the knowledge out of the school and into field units. The course is designed to take an NCO with a good basic knowledge of Armor and the vehicle he is to receive training on, and make him a "Master of Gunnery."

Keep in mind also that the individual sent to Fort Knox for the Master Gunner Course represents his battalion or division, and that the finished product represents the master gunners throughout the Army.

Furthermore, thousands of dollars are spent to train a master gunner; therefore, his assignment and utilization should insure that he has the opportunity to impart his specialized knowledge to the unit.

Neither the unit master gunner nor the Master Gunner Program is a cure-all for the gunnery training problems that exist within the Armor Community. However, the master gunner at all levels can certainly assist the commander in upgrading unit and gunnery training programs—he is the eyes and ears for the commander at local and major training areas during gunnery training periods.

The master gunner does not request nor demand special recognition, he only asks to be used in the capacity and in the role for which he was trained.

Program of Instruction (M-60A1/A3)

Subject	Hours
Weapons Department	
Welcome and Course Orientation/ Tank Commander's Skills Test	8
Use of Firing Tables	6
Armor Fighting Vehicle Identification and Capabilities	8
Ammunition	4
Surface Danger-Area Diagram	8
Training Program Development	28
Mechanical Training and Techniques of Fire, *M-85* Machinegun, *M-2* Machinegun	4
Mechanical Training and Techniques of Fire, *M-240* and *M-219* Machinegun	4
M-68 Gun Functioning	4
Tank Gun Capabilities	2
Fire Control/Conduct of Fire	12
Training Devices	12
Range Determination	8
Night Vision Equipment and Techniques	8
Target Acquisition and Identification	8
Examination IV	8
Conduct of Tank Ranges	8
Prepare to Fire	4
Conduct of Fire (Advanced)	24
Stabilization Gunnery	8
Examination V	8
Examination VI	8
Tank Table IX	12
Examination VII (Management)	8
Maintenance Department	
Technical Manuals, DA Pamphlets, and DA Maintenance Forms	8
Basic Electricity and Electrical Repairs	6
Troubleshooting, Disassembly and Assembly of the 105-mm Gun, *M-68* and Combination Gun Mount	8
Firing Circuits, 105-mm Gun, *M-68* and Coaxial Machinegun	14*
Examination I	8
Cupola Circuits and Grenade Launchers	6
Gun Elevating and Turret Traversing Systems	32
Stabilization System	20
Examination II	8
Fire Control System	40**
AN/VSS-3 Xenon Searchlight	2
Scheduled Maintenance Services	12
Examination III	8
Repair Parts Supply	5
Maintenance Records	4
Command and Staff Department	
Tactics	3

*Ten hours for *M-60A3* classes

**Thirty-four hours for *M-60A3* classes

Subjects are not listed in the sequence in which they are presented.

The first Master Gunner Course for the M-1 Abrams will begin 10 January 1982, using a provisional program of instruction that incorporates most of the subjects shown above, plus those that are systems-peculiar to the M-1 Abrams.

Breakthrough to Bastogne

by A. Harding Ganz

Into the Ardennes. Bigonville was rough. With intelligence of advancing German armor, Reserve Command (CCR) had been committed on the right flank, as the other two combat commands of the American 4th Armored Division continued to slug north toward Bastogne and the beleaguered paratroopers of the 101st Airborne Division. Colonel Wendell Blanchard, commander of CCR, had the 37th Tank (Tk), 53d Armored Infantry (AIB) and 94th Armored Field Artillery (AFA) Battalions, when the command jumped off on 23 December 1944. The Reconnaissance Platoon of the 37th Tk preceded the advanced guard—Team B (B/37 Tk and B/53 AIB)—as far as the 25th Cavalry's outpost, where Lieutenant Marion Harris pulled the platoon aside and waved the column on.

The approach march to contact, along the sheer, ice-covered secondary road was difficult, and tanks and half-tracks skidded out of control. Initially, Team B received no fire, nor observed any enemy, save an awesome pair of very large enemy tank tracks looming before it in the new-fallen snow.

But as the team approached Flatzbourhof—the Bigonville-Holts railroad station—it began to receive tank, antitank, and machinegun fire from the railroad building and adjacent woods. Captain Jimmie Leach, commander of B/37 Tk and of Team B, deployed his force along the railroad embankment, while the artillery pounded the nearby woods and German positions beyond the railroad station.

As expected, the Germans were quick to counterattack, with white-clad paratroopers, reinforced by two self-propelled guns and a captured *M-4 Sherman* tank. Just as quickly, B/37 tanks, firing from their positions behind the railroad embankment, dispatched all three German vehicles, halting the counterattack. During the fight, it was *Sherman* against *Sherman*, with Captain Leach's gunner coming out a winner.

As darkness fell Team B was ordered to hold its position, while Lieutenant Colonel Creighton W. Abrams, Jr., commanding the 37th Tank Battalion, attempted to maintain the momentum of his attack by sending the tanks of A Company through Team B, and those of C Company around its right flank. However, stubborn resistance by tank-reinforced troopers of the German 13th Parachute Regiment, mines, and casualties, brought the attack to a standstill a full mile away from Bigonville, the CCR objective. The A/37 Tk's passage of the B/37 Tk's lines was aborted due to numerous vehicles lost to snow-covered mines, including Lieutenant John Whitehill's command tank; and the C/37 Tk attack was likewise aborted because of the loss of nine tank commanders, including the CO, Captain Charlie Trover, who was killed.

During the cold, clear night with outposts alert, the CCR tankers, redlegs, (artillerymen) and doughs (infantrymen) received some badly needed replacements. They repaired their vehicles and reorganized their troops and crews for the next morning's attack.

On the 24th, Team B's tanks and doughs attacked again, fighting their way into the very center of Bigonville, where the tough troopers of the German 5th Parachute Division had to be blasted out house by house. Small arms and *Panzerfaust* fire continued to take its toll. Lieutenant Bob Cook, B/36 Tk's executive officer and 3d platoon leader, went down with a rifle bullet in his chest.

He was briefly captured by the Germans while he was attempting to find the accompanying medic jeep, but abandoned as the B Company doughs advanced.

As the Bigonville battle continued, Colonel Abrams ordered a blocking and screening position, without its infantry, to the north of town. No sooner had its tanks moved into position, than a flight of four American P-47 "Thunderbolt" fighter-bombers, thinking them enemy, made two bombing and strafing attacks on them. Captain Leach and his tank crews tossed out red smoke grenades, and frantically attempted to uncover the red recognition panels for identification, while the battalion S-3, Captain Bill Dwight, radioed Colonel Abrams to call off the "friendlies." There were no casualties—luckily the U.S. fliers had missed everyone and everything,

When the mopping-up was over, Bigonville and the surrounding area yielded some 400 prisoners of war (POW) and 100 enemy dead to the tenacious CCR attackers.

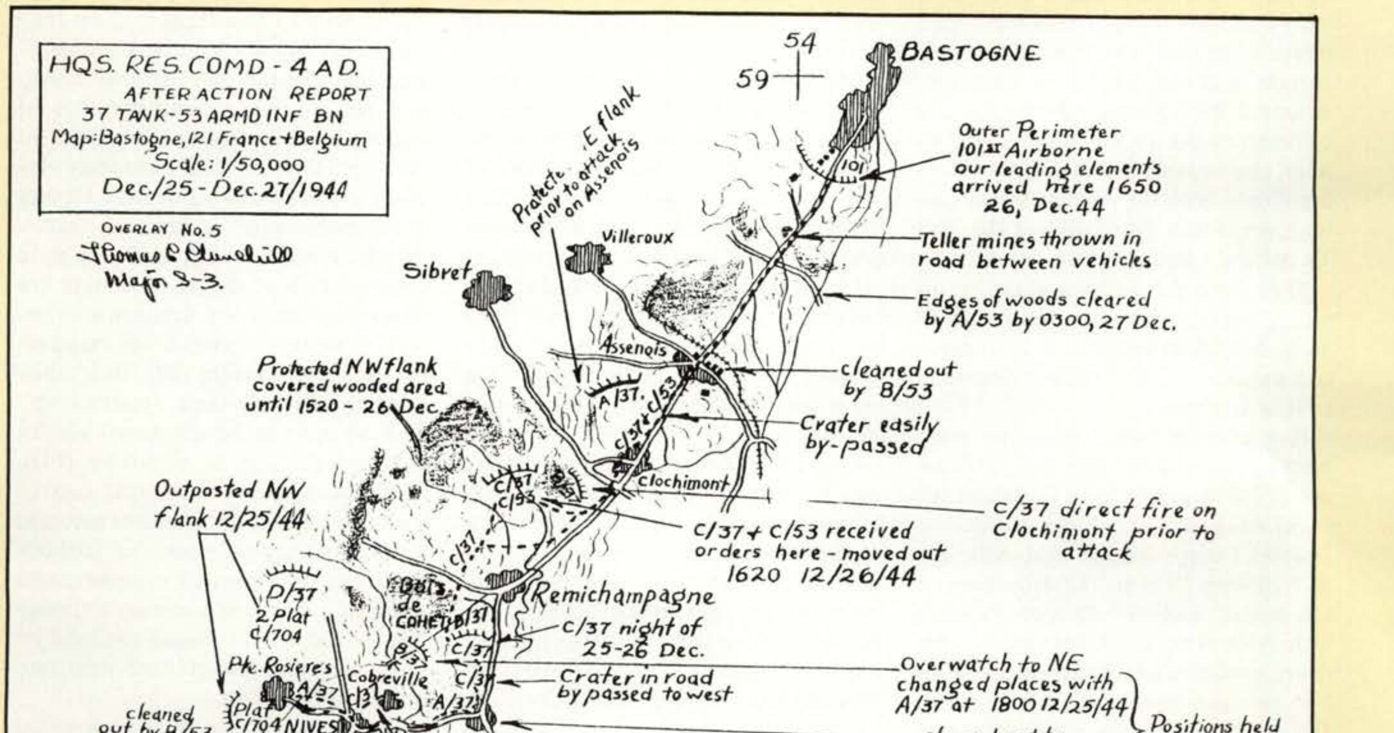
With Bigonville secured, CCR looked forward to spending a restful Christmas Day, feasting on a turkey dinner. The battalions were much understrength, and the 37th Tk in particular, had just completed a 160-mile road march up from Lorraine and the Saarland, where it had been supporting the newly-arrived 87th "Golden Acorn" Infantry Division in the Westwall fighting.

Bastogne "Fire Call." When alerted for the "fire call" run to the Ardennes, the 4th Armored Division had just been pulled out of line in Lorraine after a month of slugging from the Seille valley to the German border. Mud and mines had restricted the tanks, overcast had grounded the tactical air support, and the revitalized German defense had skillfully parried every thrust—all of which combined to deny Patton a breakthrough. Having achieved a brilliant reputation as it slashed across France after the Normandy breakout, the 4th Armored was bitter about the casualties it had suffered in the November offensive. Knocked-out tanks were strewn along the way in what was considered an atrocious misuse of armor; and after a shouting match with his corps commander, Major General John S. Wood, the 4th Armored's beloved commanding general, was relieved by Lieutenant General George S. Patton, Jr., 3d Army commander.

But Patton gave the 4th his own chief of staff, Major General Hugh Gaffey, who had commanded the 2d Armored in Sicily. "Gimlet-eyed Gaffey," the laconic Texan with immaculate riding breeches and "boots you could use as a mirror," had a style completely unlike the bluff, good natured "P" Wood. But he was cooly efficient, and the 4th was an experienced war machine.

On 22 December, 1944 the 4th Armored, under Milikin's new III Corps in Belgium, jumped off to drive on Bastogne where the 101st "Screaming Eagles" Airborne Division was surrounded by the German offensive of the "Battle of the Bulge."

The counterattack cut into the still expanding torrent of the German offensive, and resistance stiffened north of the Sure River. Patton, who had promised to reach Bastogne "by Christmas," found his advance stalling. On the 24th, Miliken decided to regroup his forces to concentrate more power for the relief of Bastogne. Two battalions of the 80th "Blue Ridge" Infantry Division were trucked over to reinforce the armor, and the boundary of the 26th



"Yankee" Division was extended to include the Bigonville area, thereby releasing CCR to the 4th Armored Division.

By doctrine and practice, CCR was not employed tactically. Its TO&E headquarters was much smaller than those of Combat Commands A and B, (CCA, CCB) and it was only intended to administratively control units not in the line. But Gaffey employed the reserve tactically, to meet the threat to the right flank at Bigonville, and now he intended to shift it around to the left, to seek a weak spot in the German front.

Night Road March. CCR had just turned in on Christmas eve, when it received orders for a 27-mile night road march from Bigonville around to Neufchateau highway leading to Bastogne. Attended by appropriate griping, the column crossed the initial point (IP) an hour after midnight under radio listening silence, with the reconnaissance platoon peeps and light tanks of the 37th Tk battalion leading as the point.

Then came the advance guard, comprising the light tank company (D/37 Tk–), B/53 AIB mounted in halftracks, and a squad of C/24 Armored Engineers to clear obstacles.

Five minutes back came the main body of the combat command, with the rest of Lieutenant Colonel Creighton W. (Abe) Abrams' 37th TK and Lieutenant Colonel George Jaques' 53d AIB; the *M-7* 105-mm "Priest" SP Howitzers of Lieutenant Colonel Robert Parker's 94th AFA with C Battery of 155-mm towed howitzers attached from the 177th FA; two gun companies, of the 704th TD, and other attachments. Service and supply elements came separately, under CCR Trains command.

The Christmas Eve night was clear and cold, lit by a nearly full moon, while flares and explosions illuminated the northern horizon at Bastogne. As the column twisted through the dark forest areas, bleary-eyed drivers tried to focus on the cat-eye blackout markers of the vehicle ahead. In the open halftracks, armored doughs dozed fitfully and stomped their frozen feet to regain circulation. There were some 400 vehicles in the column that stretched over 16 miles of road space. Standing operating procedures called for an 8-mph rate-of-march at a 50-yard closed interval at night (15 mph at a 100-yards open interval by day), with a 1 minute interval between company march units and 5 minutes between battalion march groups (serials), giving a time length of about 2 hours. Thus, the vanguard of the column had already pulled into its assembly area south of Vaux while the rest of the column was still closing on the release point (RP) at Molinfaing.

Tactical organization and commanders. As the troops topped off their vehicles and got a cat-nap their commanders attended a conference for planning the Christmas Day attack. If there were prayers, they were silent and individual. CCR's mission was flank protection, with the main drive still to be mounted by CCB, in the center. The three combat commands were deployed abreast, each comprising a tank battalion, an armored infantry battalion, a direct support armored field artillery battalion, and the normal attachments; a company each from the tank destroyer, engineer, medical, ordnance-maintenance, and antiaircraft artillery battalions, a troop from the cavalry/reconnaissance squadron and the MP platoon, as well as supporting III Corps Artillery.

In Lorraine, each combat command had operated with two battalion-sized task forces, the tank and armored infantry battalions cross-reinforcing each other. But because of the constricted terrain in the Ardennes, there was only one ridge-running road on the axis of advance of each combat command: the Arlon-Martelange highway for CCA; a secondary road through Chaumont for CCB, bounded by the Strainchamps and Burnon Creeks; and the Neufchateau highway for CCR—a zone of advance 8-miles wide. Thus, the tank and armored infantry companies were paired as teams to leap-frog from village to village, with the infantry and tank battalion commanders working closely together. Normal practice for the three company teams was to leap-frog from assault to reserve, to support, with a team's turn to lead coming up every third turn.

The 37th Tk had three medium tank companies and one light tank company, supported by the *M-4* 105-mm assault gun and 81-mm mortar platoons of Headquarters Company. Since each of the 37th's three medium companies were down to 9 or 10 tanks instead of 17, they often maneuvered as one unit (rather than in three platoons), deploying from column into line, wedge, echelon, or line of sections formation, depending on terrain. If serious resistance was expected, the armored doughs left their thin-skinned halftracks and "married up" with the tanks in the attack position just short of the line of departure (LD), mounting a squad on the rear deck of each tank. The platoon leaders mounted their counterparts' tanks to facilitate control by using the tank company radio frequency. The tank company CO commanded the team's assault until the infantrymen dropped off and went into action on their own.

Each team advance would be preceded by direct fire from the supporting team, a sharp artillery concentration on call by the forward observer in his tank, and tactical air support by P-47 fighter planes, if available. The few air controllers were normally at combat command headquarters.

The commander of the 37th Tank Battalion was chunky, 29-year-old Lieutenant Colonel Creighton W. (Abe) Abrams, who was already making a fighting name for himself. In 1944 campaigns, Abrams aggressive leadership of the 37th Tk, under the skillful direction of Colonel Bruce C. Clarke of CCA, did much to establish "P" Wood's 4th Armored as Patton's favorite division. (When the German Ardennes offensive began, Clarke had gone to CCB of the 7th Armored with a brigadier general's star and was blunting the German drive in the St. Vith sector as the 4th fought toward Bastogne.) Abe's combat philosophy was simple: "Our operations are all based on violence," and "Go East, it's the quickest way home."

Abrams had developed the 37th Tk as a finely-honed fighting unit. His staff not only functioned well as such, but he often used his staff officers to direct his attacks. They would monitor both battalion and company radio frequencies, leaving the company commanders free to handle their units, yet the battalion CO was kept in close touch with the situation.

"Abe led by courageous example, and the 37th's motto was "Courage Conquers."

As the 105-mm assault gun tank of each company was frequently grouped with the battalion assault gun platoon, so too did Abe take the seventeenth tank from each of the medium companies and give them to his S-2, S-3, and liaison officer (LNO). These HQ tanks, with those of the CO and XO, received names beginning with "T," just as the company tank name began with the company letter. Thus, Abe rode in "Thunderbolt VI" (he would wear out seven M-4s during the war), with its name painted on its flanks in letters 8 inches high on a background of billowing white clouds punctured by jagged red streaks of lightning. "We can always spot his tank," said A/37's CO Lieutenant John Whitehill, "because it doesn't roll ahead like others. It gallops." And in the hatch was Abe, his long, black unlighted cigar clenched in his teeth, aggressively jutting forward, looking like "just another gun." He led by courageous example, and the 37th's motto was "Courage Conquers."

The 53d AIB was still absorbing replacements from the Lorraine fighting. The armored infantry had long since discarded their 57-mm antitank (AT) guns as useless against German *panzers,* and the AT platoon of each of the three rifle companies was used as a fourth rifle platoon or as replacements. Though badly under their TO&E strength of 10 men (excluding the halftrack driver), the three rifle squads of each platoon augmented their firepower by mounting an additional machinegun on their halftrack, and by trading tanker jackets for Browning automatic rifles (BAR) and Thompson submachineguns (Tommy guns). The rifle platoon leaders each had a 60-mm mortar squad and a light machinegun (LMG) with two .30 caliber LGMs to provide fire support, backed up by the battalion assault gun, mortar, and machinegun platoons.

The commander of the 53d AIB was Lieutenant Colonel George L. Jaques, "Jigger Jakes," whom his fellow Bay Stater, Abrams, addressed over the radio as "Sadsack." In fast-moving armored combat, nicknames were preferred to the daily changing SOI call signs, and voice recognition as authentication. More orthodox than the tanker, "going by the book," Jaques was ably seconded by his battalion executive officer, Major Henry A. Crosby. The 53d AIB was an experienced outfit.

Both battalion commanders had more tactical experience and expertise than their CCR commander, and it was Abe who headed the final drive to Bastogne.

Armored Assault. At 1100 on Christmas Day, the drive began. The German combat outpost line was quickly scattered as CCR tanks roared down the highway, firing as they went. In fact, the only obstacles encountered were those implaced earlier by American engineers withdrawing from the onslaught of the German offensive. The 37th's S-3, Captain Bill Dwight, had hit a mine on the night road march in his tank "Tonto." It was an American mine, "fortunately," and only broke a track block, which was soon replaced. While returning to his CP the next day, Abe hit another mine that tossed him out of his peep—unscratched—but totalled the peep and crippled his driver. "Another lesson about marking minefields," wrily observed the 37th Tk XO, Major Ed Bautz.

As Baker Company of the 53d AIB cleaned out Vaux-les-Rosieres, the armored spearhead continued up the highway toward Bastogne, 10 miles ahead.

The German main line of resistance was probably astride the highway itself, covering the primary armor approach. But the available intelligence, such as it was, was not of much help. Red-penciled enemy symbols cluttered the situation maps, many with question marks. (It is now known that it was the 5th Parachute Division that had responsibility for protecting the German southern flank, while the 26th *Volksgrenadier* Division invested Bastogne, launching attacks in conjunction with the 15th *Panzergrenadier* and *Panzer Lehr* Divisions.)

"Radio contact with battalion was lost, but Lieutenant Boggess acted on his own initiative and continued the attack."

To avoid possible minefields astride the highway, the armored attack swung off the hardtop beyond Vaux into a secondary road that might be less-defended. The terrain was fairly open—snow-covered fields, patches of dark woods, and stone-built farm villages dotted the countryside. D Company's light tanks and *M-18 Hellcat* TDs outposted the flank beyond Petite Rosiers, while C/25 Cav Sqdn screened the open flank to the west. Now, the main attack began to pick up momentum. Team A tanks and infantry drove into Nives supported by Team C, and then Team C passed through the town before it was cleared, on its way to Cobreville. There radio contact with battalion was lost, but C/37 Tk's commander, Lieutenant Charles Boggess, who had taken over the tank company only 2 days before, acted on his own initiative and continued the attack. While his team cleared the town, Boggess dismounted from his tank around 1400 to reconnoiter an area where the road crossed a small creek, and found the bridge had just been blown. Colonel Abrams called up his tank-bulldozer, which crumbled a nearby stone wall and pushed it into the gap so the drive would continue—it was moving again by 1530.

"Gunner! Kraut Bozooka! Barn! HE! Traverse Right! Steady! . . . On! Eight Hundred! Fire!"

Since the Cobreville bridge had been prepared for demolition, it was likely

that Remoiville would be defended. Four artillery battalions pounded the town for 10 minutes, while the supporting Shermans blasted the stone buildings: "Gunner! Kraut Bazooka! Barn! HE! Traverse Right! Steady! . . . On! Eight Hundred! Fire!" Then Team A charged into the dust and rubble, with the tanks firing high explosive rounds and spraying machinegun fire everywhere. B/53 AIB came in to help in the house-to-house fighting—it was toss a grenade through a window, kick open the door, leap in and to the side, and spray the room with Tommy gun fire! High-velocity tank shells screamed through the upper floors, sending plaster dust flying. By 1800, 327 POWs had been rounded up from the 3d Battalion, 14th Parachute Regiment.

The advance had already rolled through Remoiville, but leading elements encountered a crater in the road as dusk fell. B/37 Tk worked around to the left and took up positions in and around Remoiville overlooking Remichampagne, while infantry screened the woods to the west. CCR was now abreast of CCB, which was in sight across the gorge of Burnon Creek, after having finally driven the German paratroopers out of Chaumont. CCA had likewise slugged ahead up the Arlon highway, but now the Germans were reinforcing their front to stop the 4th Armored.

Change in mission. On Christmas night, the infantry line companies dug in fronting on the *Bois de Cohet* and Remichampagne, 6 miles from Bastogne. The 94th AFA had displaced by battery up from Juseret to just south of Sure, from where its 105-mm SP howitzers could range to 12,000 yards, or almost to the outpost lines of the 101st Airborne Division.

During the evening, a German counterattack came down the highway from Sibret, but was warded off by tank destroyer and artillery barrages.

The 37th Tk and 53rd AIB CPs moved into Cobreville, and the CP of CCR relocated to Vaux. The CPs were set up in towns now, with the stone buildings providing both warmth and protection from shell fragments, and the radios from the headquarters tracks were remoted inside.

Colonel Blanchard came forward to meet with Abrams, Jaques, and Crosby. CCB was still slated to flank onto the Arlon highway and enter Bastogne. Accompanying CCB was a fretting Major General Maxwell Taylor, who had been on leave in the States when his 101st Airborne entrucked for the Ardennes. Now, he was impatient to rejoin his command.

CCR was to cover the left flank, advancing through Remichampagne and Clochimont, then turning left toward Sibret, which was held in strength. The battalion commanders were vehemently opposed to attacking Sibret. Instead they urged a drive directly to Bastogne. Blanchard was concerned about the left flank thus being exposed, but finally gave in at about 0300 stating, recalls Major Crosby, "that if we failed it was on our heads and not his as he was refusing to take any responsibility." The battalion commanders then issued oral attack orders to their company commanders—armored units didn't take time to draw up five paragraph field orders.

As dawn broke on December 26, CCR moved over frozen ground with Team B under Captain Jimmie Leach, in "Blockbuster III," in the lead. Teams A and C laid down a base of fire into the *Bois de Cohet* and Remichampagne. Lieutenant Don Guild, in his FO tank, prepared to lift fires as the attack went in. Suddenly P-47 fighters, probably from the 362d Fighter Group, appeared overhead. They had not been called in, and there was no forward air controller to coordinate their actions, but they flew in, bombing and strafing only a few hundred yards ahead of the tanks, and sent the Germans diving for cover. Nonetheless, house-to-house fighting gave Team B a 2-hour fight before the town was secured at 1055.

Meanwhile the armored column passed through Remichampagne and, finding the Burnon Creek bridge intact, continued on up the road to the crossraods to Clochimont. There, Lieutenant Gild dismounted from his FO's tank, and personally captured about a dozen Germans who were cowering in their slit trenches from the fierce assault.

Moments after joining Leach at the crossroads and reviewing the situation. Colonel Abrams ordered A/37 to sieze the high ground to the left of Clochimont. But as A/37 Tk arrived on position, its tanks received several rounds of AT fire from a position down the road to the right front of Abrams in "Thunderbolt." "Gunner! Steady . . . On! Twelve Hundred! Fire!" Once again Abrams proved he had the best tank crew in the 37th. "Target! Cease fire!"

By now, the 37th Tk was down to 20 of its 53 TO&E medium tanks, and the 53d AIB was short 230 riflemen. While Abrams and Jaques were coordinating their planning, hundreds of C-47 transport planes thundered low over them, heading for Bastogne like flocks of fat geese. Red, yellow, and blue parachutes with supplies began blossoming out over the town. But so did ugly bursts of German flak, and several planes arched down streaming flames. Since Leach's Team B had gotten this far rather easily, Abrams was ready to drive for Bastogne, and radioed the division commander directly. The other two combat commands had made less than a mile each on the 26th. At 1400, Gaffey telephoned Patton who quickly gave his approval for Abrams to move on Bastogne.

CCR artillery prepared to fire on Assenois. A and C Batteries, which had displaced forward to Nives, would fire on the woods north of the town, B Battery on the south edge of the town, and the 155s of C/177 on the center. Additionally, the three artillery battalions with a neighboring CCB were also tied in, to give a total of 13 batteries to annihilate any enemy force in Assenois. D and A/37 Tk were to overwatch the Sibret road on the left flank and give warning of any German tank movements.

Abrams then called his S-3, Captain Bill Dwight, to bring up Team C from reserve. Lieutenant Boggess mounted the battalion commander's tank for a briefing at the Clochimont crossroads. There had been no reconnaissance up the road, but the area was known to be strongly defended. Abe told him simply,

"You all know we've got to get to those men in the town. All you've got to do is keep 'em rollin' and follow me."

"Get to those men in Bastogne." The Charlie Company commander called his eight tank commanders together and told them he would lead and set the speed of the attack. "You all know we've got to get to those men in the town. All you've got to do is keep 'em rollin' and follow me. It won't be any picnic, but we'll make it."

Final breakthrough. At 1620, Abe gave the familiar hand signal, "Let 'er roll," and the tanks moved out. Boggess picked up speed, tracks squealing, and charged right through Clochimont toward Assenois, guns firing. Three miles to go. Boggess in C-8, "Cobra King," fired straight ahead, Lieutenant Walter Wrolson in the second tank fired to the right, the third tank to the left. The *Shermans* pumped fire in all directions, firing on the move, with their gyrostabilizers enabling them to maintain the momentum of the attack. "I used the 75 like a machinegun," said "Cobra King's" gunner, Corporal Milton Dickerman. Boggess had instructed him to choose his own targets. "Murphy was plenty busy throwing in the shells. We shot 21 rounds in a few minutes and I don't know how much machinegun stuff."

As soon as he had cleared Clochimont Boggess called Abe for artillery fire on Assenois. Abrams radioed, "Concentration Number Nine, play it soft and sweet." Almost immediately the town seemed to erupt in a chaos of explosions. At the edge of the town, Boggess called for the artillery to lift 200 yards, and barrelled on in without pausing. But there was German fire, even if erratic; Lieutanant Chamberlin's FO peep was hit and he went into a ditch, and it was Lieutenant Billy Wood in a Cub plane overhead who finally got the fire lifted.

Leaning into friendly artillery fire cut losses from enemy resistance, but Assenois was a murky haze of shell bursts and the dust of collapsing houses. Tank commanders in combat usually rode with head and shoulders out of the hatch because visibility through the periscope was too limited; but Boggess had to pull his hatch down to 3 or 4 inches above the turret roof because shell splinters were singing off the armor. Dirt from an earlier enemy shell burst had smeared the driver's periscope, and Hubert Smith "sorta guessed at the road." In addition the left brake locked and the "Cobra King" swerved up a side street. Two other tanks also took wrong turns.

Walt Green's C Company infantrymen had been following in their halftracks, but artillery fire was still coming in and they piled out of their open-topped, thin-skinned vehicles to seek any shelter they could find in the town. Simultaneously, the defenders emerged fighting from the cellars, and the armored doughs mixed it up with the German paratroopers and *Volksgrenadiers* well into the night.

Nineteen year-old Private Jimmy Hendrix went swinging into two 88-mm guns crews with his *M-1* rifle, forcing them to surrender. He then silenced two machineguns and dragged a dying GI from a burning halftrack, all of which earned him the Congressional Medal of Honor. Abrams followed into the confusion that was Assenois, and even dismounted his tank to help wrestle a fallen telephone pole off a tank to keep the attack moving.

Boggess cleared Assenois with three tanks as dusk fell. A gap in the column had opened that gave the Germans a chance to throw some *Teller* mines onto the roadway from a dark tree-line, and blow up a following halftrack. Dwight was right behind in his Sherman, "Tonto," and helped clear the wreckage and toss the mines aside. The column moved forward again, running a gauntlet of *Panzerfausts,* mines, and small arms fire. Four more halftracks were lost. Dwight was simultaneously trying to raise Brigadier General Anthony McAuliffe and the 101st Airborne—"Tony, this is one of Hugh's boys, over"—on channel 20 assigned the command, but to no avail.

"Suddenly the tanks debouched from the woods into an open field where multicolored supply parachutes dotted the snow."

Up ahead "Cobra King" led the spearhead. Dickerman slammed three main gun rounds into an old camouflaged concrete pillbox, and the bow gunner, Harold Hafner, traversed his machinegun through a chow line of appalled German soldiers standing under the snow-covered fir trees, knocking them over like bowling pins. Suddenly the tanks debouched from the woods into an open field where multicolored supply parachutes dotted the snow. Boggess slowed as he approached a line of foxholes, and called, "Come on out, this is the Fourth Armored." No answer from the wary GIs. Finally a khaki-clad figure emerged to shake his hand. "I'm Lieutenant Webster of the 326th Engineers, 101st Airborne Division. Glad to see you." At 1645, CCR logged in its journal: "Hole opened to surrounded forces at Bastogne . . ."

"One of the paratroopers asked the veteran tank battalion S-3 if all tanks were commanded by officers."

"Tonto" was the fourth tank to arrive, followed by more halftracks and the other tanks, as paratroopers gathered around, beginning to realize the seige was finally over. Noting the clean-shaven faces Dwight muttered, "Well, things don't look so Goddam rough around here to me." The airborne felt that discipline and morale were closely related. One of the paratroopers asked the veteran tank battalion S-3 if all tanks were commanded by officers, rather like the Air Corps, as there were three officers in the first four tanks. Dwight said no. But it was a significant observation; leadership in the 4th Armored was up front. Dwight then met McAuliffe who had come up to the

perimeter. To his salute, the general replied, "Gee, I am mighty glad to see you." Abrams joined them shortly thereafter.

Back at Assenois B/53 AIB under Lieutenant Robert "Potsi" Everson was committed to help clean out the town, some 500 POWs and heavy artillery pieces including four 88-mm guns and a battery of 105-mm howitzers finally were taken. A/53 AIB passed through to clear the dense woods northeast of the town. Lieutenant Frank Kutak, though wounded in both legs, nonetheless directed the company from his peep as the armored doughs worked through the fir trees. A and B company tankers of the 37th TK defended the left flank of the corridor. That same night the division G-4, Lieutenant Colonel Knestrick, led a column of supply trucks and ambulances through to Bastogne, escorted by D/37 Tk light tanks. Wrote Patton happily—if with hyperbole—to his wife, Beatrice, "The relief of Bastogne is the most brillant operation we have thus far performed and is in my opinion the outstanding achievement of this war."

CCB widened the corridor on 27 December, even as CCA of the 9th Armored came up on the left flank, and the 35th Infantry Division came up on the right. The Germans had already called off their Ardennes offensive. The high drama of the breakthrough to Bastogne had passed into a bitter struggle of attrition in the winter snows.

Critique of operations. The breakthrough to Bastogne vividly demonstrated what an elite armored unit in action can do.

• Though understrength and fighting under less than favorable conditions of terrain and weather, the 4th Armored Division brought overwhelming force to bear at the decisive point.

• The battalion task force organization was modified to one of joint infantry-tank company teams that leapfrogged one another in a column of companies to maintain the momentum of the attack.

• The reserve company passed through to attack the next objective even before the first objective had been secured, keeping the enemy off guard.

• The tanks' gyro-stabilizers enabled them to smother the defense with fire while moving across the battle area, and leaning into friendly artillery fire gave the defenders no chance to recover.

• Preplanned and hip-shoot artillery concentrations, air strikes, and organic supporting bases of fire further overwhelmed the defenders.

True, such cavalier tactics would be less successful against a well-prepared defense; but in this instance, the Germans were not given time to prepare. Nonetheless, the principle of bringing the full force of infantry, armor, artillery, and air power to bear at the point of the main effort remains valid today, and is exemplified by the Combined Arms Team.

Of particular note is the quality of personal leadership, both in direction and by example. The company and even battalion commanders were well forward or leading in their combat vehicles, providing leadership up front at the decisive point. Orders were oral, simple, and of the general "mission-type." This encouraged initiative on the part of junior officers who knew where to go and were confident their commanders were with or right behind them.

Lastly, at a time when many were bewailing the inferiority of the American *Sherman* tank, the 4th Armored maintained unbounded confidence in themselves and their equipment. *For "armor" was a concept, of a combined arms team, and when all elements were brought to bear, they were bound to prevail.*

Source Materials

4th Armored Division operations are based on unit diaries, journals, and after action reports, U.S. Army Armor School special studies, Military History Institute oral history projects, and published sources. Research in these materials was supported, in part, by an Ohio State University, Newark Campus, research grant. Drs. John Slonaker and Richard Sommers and Ms. Phyllis Cassler of the U.S. Army Military History Institute, Carlisle Barracks, Pennsylvania, were very helpful, as was Mr. William Hansen, Librarian of the U.S. Army Armor School, Fort Knox, Kentucky. Interviews with veterans were facilitated by Samuel Schenker and the late Frank Paskvan of the 4th Armored Division Association. Correspondents include Major Generals Edward Bautz, Jr. (37 Tk) and DeWitt C. Smith, Jr. (B/53 AIB): Colonels (ret) Robert Connolly (4th Div Adj and G-1), William Dwight (37 Tk), and H. Ashton Crosby (53 AIB); Charles Boggess (C/37 Tk.) and especially Colonel (ret) James H. Leach (B/37 Tk) who helped revise the manuscript.

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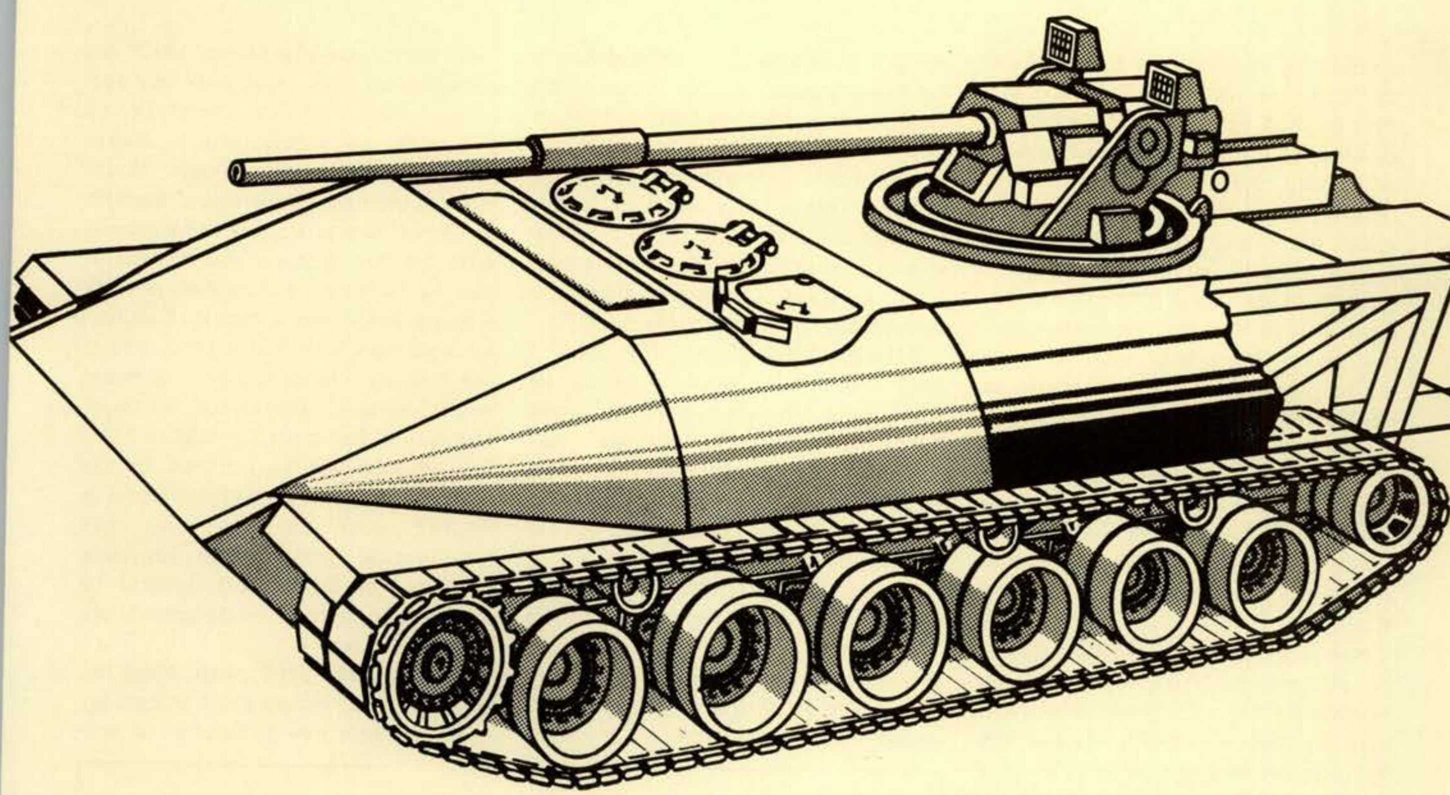


Closing the Survivability Gap

by Brigadier Richard Simpkin

In his article, "Future Close Combat Vehicles,"[1] Cliff Bradley highlighted the need for new thinking on survivability. I want to weigh the question marks in his "future" cake (figure 1) and consider how any resulting survivability gap might be closed.

The survivability cake. *System survivability* is defined as the chance that the total system, crew *plus* vehicle, will remain fit to fight after a fair hit from a given type of attack. Informed opinion seems almost unanimous in predicting a dramatic fall in the contribution of *direct protection,* passive and dynamic armor, to survivability. Briefly, the gun and frontal armor of the tank or its future counterpart(s) may remain roughly in balance. But the advent of attack helicopters with substantial payloads, the introduction of indirect antiarmor systems like *Copperhead*, and the development of downward-looking attack based on self-forging fragments (SFF) have two effects—delivery of a chemical energy (CE) attack of outmatching weight and collapse of the frontal arc concept (figure 2) on which direct protection against dedicated attack rests. [2,3] In any event the level and rate of energy transfer in modern kinetic energy (KE) and CE attack has increased 60 to 100-fold over a period in which tank weights have risen only by a factor of 4 or 5.

Despite some differences in expert interpretation, I, for one, have never accepted that a modern tank and its crew could take a fair hit from the opposition's primary antiarmor system and remain fit to fight. Even if the armor "defeats" the attack, that tank is going to be helpless long enough for the tide of modern battle to roll on over it, or for it to receive a *coup de grace.*

Let me qualify this statement, though, and at the same time mark out the first two slices of my future survivability cake (figure 3a). Many Western and Soviet studies in numerous military fields, notably chemical warfare, keep coming up with a minimum casualty figure of 10-15 percent due to human error, equipment failure, compounding of effects, environmental conditions, and the like. The law of diminishing returns would lead one to expect a figure like this; and it seems sensible to regard it as the combat equivalent of much lower figures for residual proneness to failure or accident of complex systems. Applied to tank survivability, it means that say 15 percent of tanks, which offer themselves as targets, are going to become casualties regardless of their theoretical survivability (dark slice CAS in figure 3). Likewise a similar proportion of hits on a vehicle with serious direct protection will be "freak" failures (slice DP in figure 3).

Countermeasures (CM) need defining. There is a laudable tendency to think of countermeasures in terms of the whole spectrum of antiantiarmor activity by fixed and rotary wing aircraft, armored vehicles, artillery, and infantry. In the survivability context, though, I guess we should consider countermeasures generated by the target. The present 5 percent (figure 1a) is attributable to neutralizing or deterrent fire or local smoke. In the future we may have antimissile SFF grenades, "metallized" local smoke (cf. rope), or spoiling electromagnetic radiations. This approach is probably inevitable, and possibly worthwhile. But experience has shown such devices to be of limited practical value because, in spoiling a proportion of attacks, they disclose the user's whole tactical layout. More important, any protective system of this kind provides an ideal arena for the well-known luxury sport of "sensor *v.* countermeasure" and "countermeasure to the Nth." All in all, one must expect a marginally improved contribution to survivability, but I would not put much personal money even on the 10 percent CM slice of figure 3.

Now, I want to stick my neck right out by addressing the question of *hit avoidance* (HA) with guestimates that I have no space to justify. My ballpark figure for *mean target acquisition time* in the eighties and nineties is 30 seconds.[4] For a vehicle with the mobility of the high mobility, agility (HIMAG) test vehicle and a reduced silhouette facing *Leopard 2* or *Abrams*, I pulled out a bracket of 25-43 percent for the contribution of hit avoidance to survivability, and so went along with Cliff Bradley's 33 percent (slice HA in figure 3a). On this basis, we are left with a *27 percent survivability gap* (SG slice in figure 3a).

BUT,—and I mean it to be a big one—I am not alone in predicting that the next advance in fire control systems will be a hard-target acquisition device, effective around the clock, for stationary as well as moving targets; and that other advances foreseeable for the nineties will simplify the integration of such a device into the tank commander's art. With an aid like this, an effective mean acquisition time of 5 seconds looks reasonable, if not excessive. That puts the contribution of hit avoidance just about back where it started (figures 1a and 3b) at 5 percent, leaving a rather uncomfortable *survivability gap of 55 percent* (slice SG, figure 3b).

Adding back the 15 percent "freak casualties," this means that, at best, over 40 percent and maybe 70 percent of armored vehicle weapon platforms that offer themselves as targets are likely to become casualties. My figuring may be wrong, but it is not that wrong. It bears out the picture of intensity and violence one gets from a common sense glance at the airmechanized combat system of the nineties. And it means that we have to take a very skeptical look indeed at two fundamental aspects of armored fighting. One is the concept of system survivability. The other is the ship-like approach[5] that equated direct protection with a single armored envelope surrounding all vital subsystems.

"Restorability." At this point I need a new buzz word. It would be wrong to redefine "survivability," since this must remain the ultimate goal. Recoverability, repairability, and reclaimability all have specific meanings in United States, British, or NATO logistic jargon. So, after due delving, I decided to borrow "restorability" from the art world. *An armored vehicle is "restorable" if, after a hit, it can be driven by its crew to a place where it can be restored to fitness by the rapid exchange of damaged modules*—an extension of the idea of unit replacement.

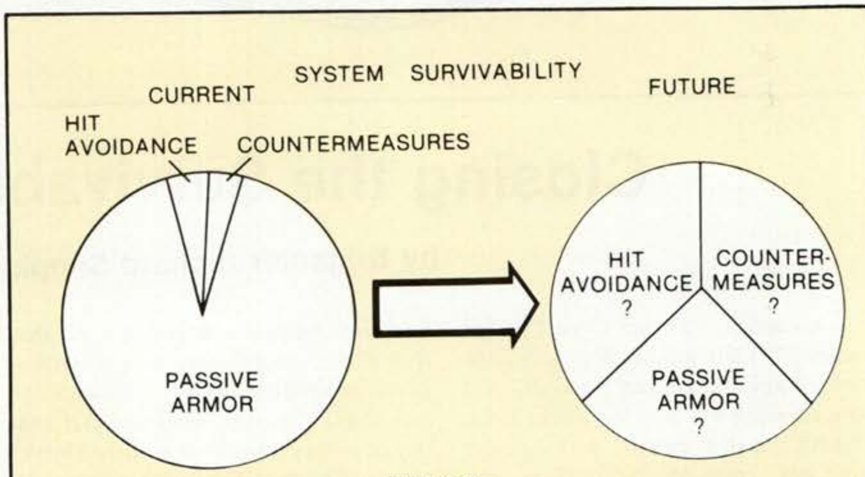


Figure 1

Ship-like protection. Initially the protection of tanks had to come from a mixture of naval architecture and boiler design because no other relevant technology existed. It stayed that way for over 60 years, for a number of good technological reasons. Outstanding among these were the need to have somebody up top to see, to provide space in which the guns could be manually served, and to have the sight integral with, or mechanically linked to, the gun(s). Even so, a design needs a second wind to stay in the running for over half our century, and the tank gained this when the evaluation of dedicated antiarmor weapon systems was countered by the frontal arc concept (figure 2a).

Of these four planks, on which the conventional tank rests, only one survives. The eighties spectrum of dedicated antiarmor attack makes nonsense of the frontal arc. Autoloaders, even for external guns, are with us. Digital data processing and transmissions between sight and gun are with us too. Replacement of the optical primary sighting and vision system by multisensor optronics with image processing is *not* here yet. Optics still provide better resolution, and this is critical for target acquisition. But experts predict that this key advance will be achieved by the nineties. Since this is an improvement in degree with spinoff over the technological gamut from consumer durables through quality control to defense and aerospace—the experts are likely to be right.

Aircraft-like protection. More importantly still, aeronautical technology offers a whole new philosophy of protection. Evidently an airplane protected by a single external armored envelope would never get off the ground. So aircraft designers deliberately set about *protecting vital areas against specific threats*. Elsewhere they went for minimization of secondary effects (in other words allowing a projectile to go straight in one side and out the other) or even openwork sections (as in some helicopter fuselages) that present a minimal real target size.

Applying this approach to an armored vehicle turns up five quite different types of risk.

- *The human organism*—vulnerable to a very low level of attack and highly susceptible to secondary and tertiary effects.
- *Electronic, electromechanical and*

mechnical elements—these can be easily and fairly cheaply replaced, or their housing can be hardened against the residual energy of attacks they are likely to face.

• *Massive mechanical subsystems* (like the gun and running gear)— the metal needed for structural strength, the containment of pressure, or whatever, provides considerable resistance to attack.

• *Fuel* (DERV or AVTUR/ JP3)—a hazard of rapidly developing, even subexplosive fire, if it is heated beyond its flashpoint, or initiated by ignition of an air-vapor mixture. Otherwise, thanks to its high thermal capacity and neutron capture cross section, fuel is a valuable element in any protective system. [6]

• *Munitions* (notably large propellant charges)—easily initiated and susceptible to immediate or chain-reaction fratricide fires totally lethal in their effect.

The cost aspect. There is an abundance of commercial and military figures for the cost of an aircrew; but I, at least, serving or since, never saw a similar estimate for a tank crew. Once again, space prevents me from exposing my figuring; but I came up with a guestimate that the real cost of a fully trained crew of three might be around 50 percent of the cost of the vehicle.

On the hardware side, General von Senger und Etterlin wrote in 1975[7] that electronics (including optronics) accounted for 60 percent of the cost of a modern main battle tank (MBT). Most informed opinion puts the, then, figure at 40 percent plus, but agrees that it may approach 60 percent plus for vehicles developed in the eighties (falling later as electronic *design* also gets automated.) An advanced power train *plus* the generation and storage side of the power electronics probably account for 20-25 percent of unit cost. *So the second risk category above accounts for, say, 70 percent-plus of the hardware cost, and the first two categories together for 85-90 percent of the cost of the total crew-vehicle system at risk.*

Fuel and ammunition fires. Before pursuing this argument to its conclusion, I want to digress briefly on means of dealing with fuel and ammunition fires. Traditionally these have represented the greatest, if not the only chance of achieving a K-kill on a tank.[8] Freak cases apart, these hazards can now be virtually eliminated within the concept of "restorability."

One approach to the fuel fire problem would be to carry all fuel, bar a small emergency reserve, in jettisonable tanks within externally vented compartments. By contrast, self-sealing tanks pressurized with nitrogen to keep oxygen out of the vapor space, backed up by leak detection, clean bilges and an "atmosphere-inhibiting" firefighting system would just about end the fuel fire hazard—allowing fuel to be incorporated into the protective system.[2,5,6]

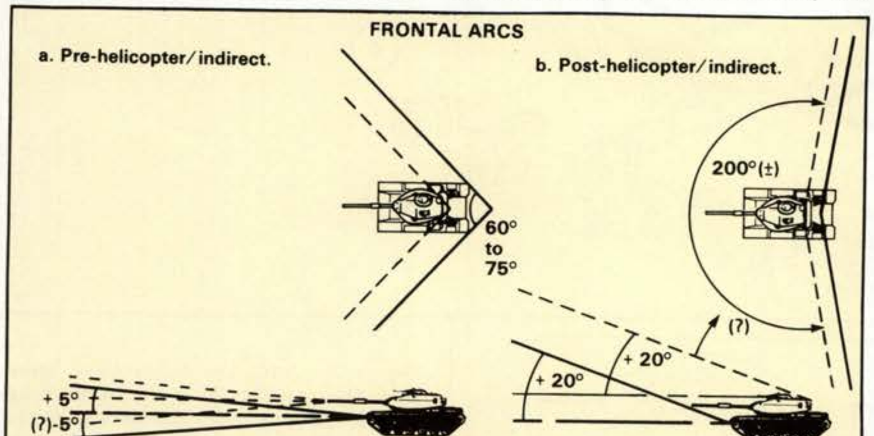


Figure 2

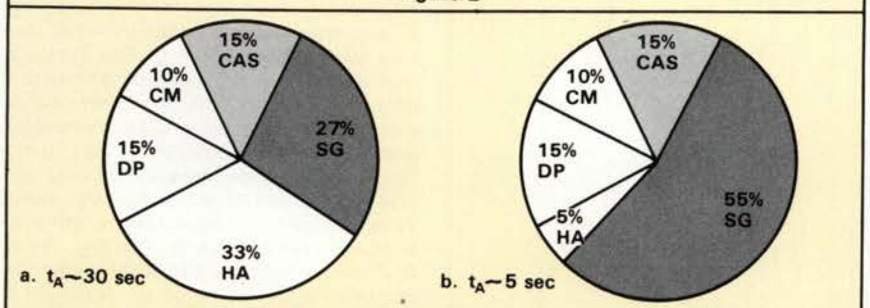


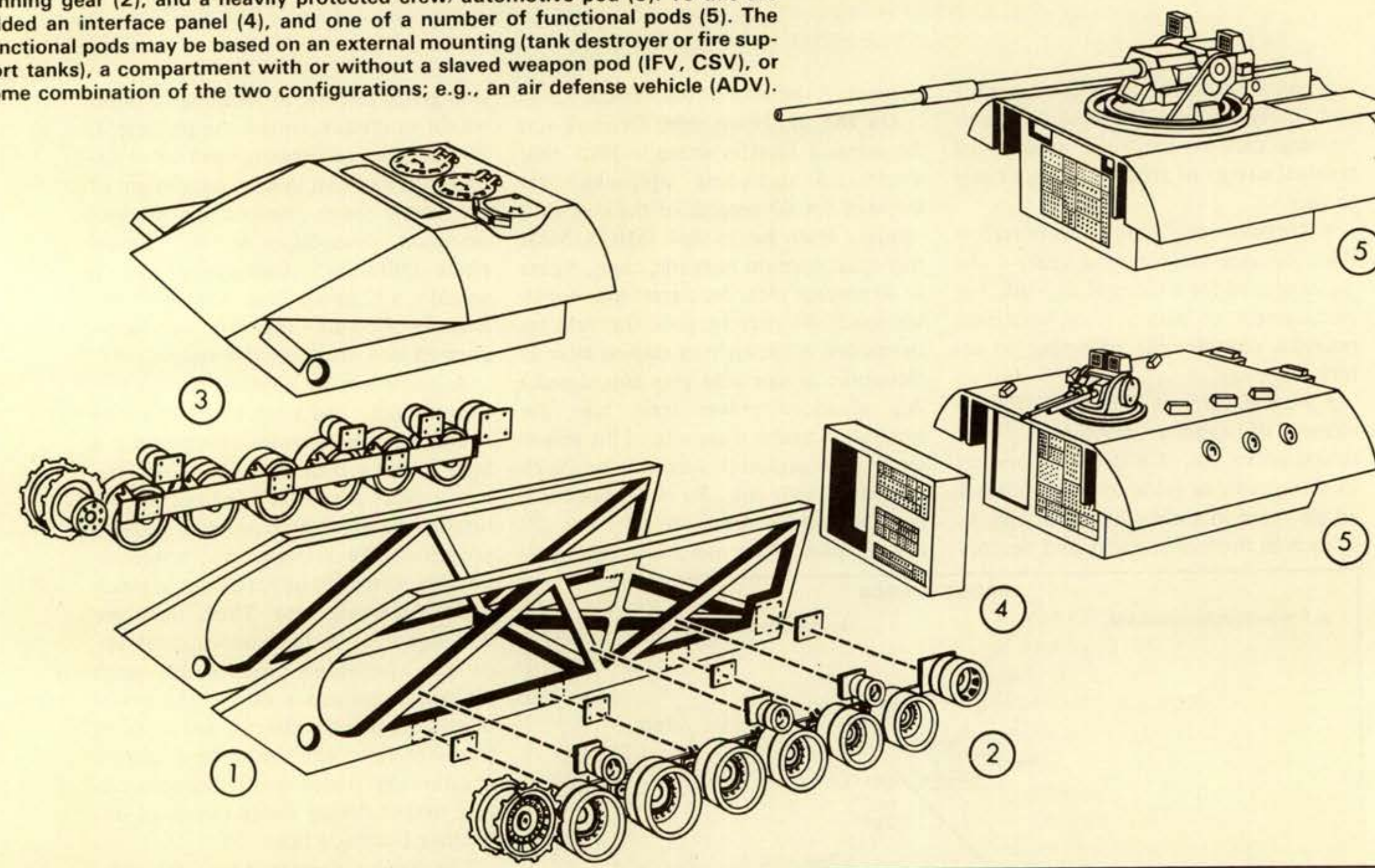
Figure 3. These survivability "cakes" are based on mean acquisition times of 30 seconds (a), and 5 seconds (b). The abbreviations have the following meanings: CAS, freak casualties; DP, direct protection (freak failures of attack); CM, countermeasures; HA, hit avoidance; and SG, survivability gap.

A propellent by contrast contains its own oxygen, and even a slow-burning fire in a metal cartridge case presents a high risk of a fratricide fire. Move one, is to replace the metal in all but the obturating base of the case, with molded propellant-like material (the semicombustible cartridge) or plastic (as in much artillery ammunition). Then, there are two options. In the conventional approach, individual rounds or small groups are isolated in extinguishing containers to minimize the risk and scope of fratricide fires; and the entire magazine is externally vented and jettisonable, in case overwhelming attack causes an immediate fratricide fire.

The far-out alternative is to leave the ammunition exposed, reasonably well spaced in skeleton racks, and partially shielded at a distance by other elements like gun or running gear. This needs to be tested, but I strongly suspect that the risk of a round being struck would be slight, and the chance of a chain reaction slighter still. Nonetheless such an arrangement would evidently have to be backed up by an autojettison facility. Let me head back on course by emphasizing that jettisoning ammunition lies outside the concept of survivability, but within that of restorability.

The pod concept. In the tactical nuclear heyday of the late fifties and early sixties, the United States sponsored a major program using early *M-60* subsystems to examine unconventional configurations.[9] One of the goals was a crew pod offering a high level of nuclear all-around protection. Since the power train and armament were also to be lightly and separately podded and the pods carried in a frame, this was the first point of contact between the tank and aircraft protection philosophy. The project was scotched, though, by two of the planks I mentioned above. Lack of any adequate means of slaving the armament or remoting the primary vision and sighting system made the basic geometry of the design unworkable. Later the emphasis swung back to ballistic protection,

Figure 4. The pod concept. The constant elements consist of a "chassis" frame (1), running gear (2), and a heavily protected crew/automotive pod (3). To this are added an interface panel (4), and one of a number of functional pods (5). The functional pods may be based on an external mounting (tank destroyer or fire support tanks), a compartment with or without a slaved weapon pod (IFV, CSV), or some combination of the two configurations; e.g., an air defense vehicle (ADV).



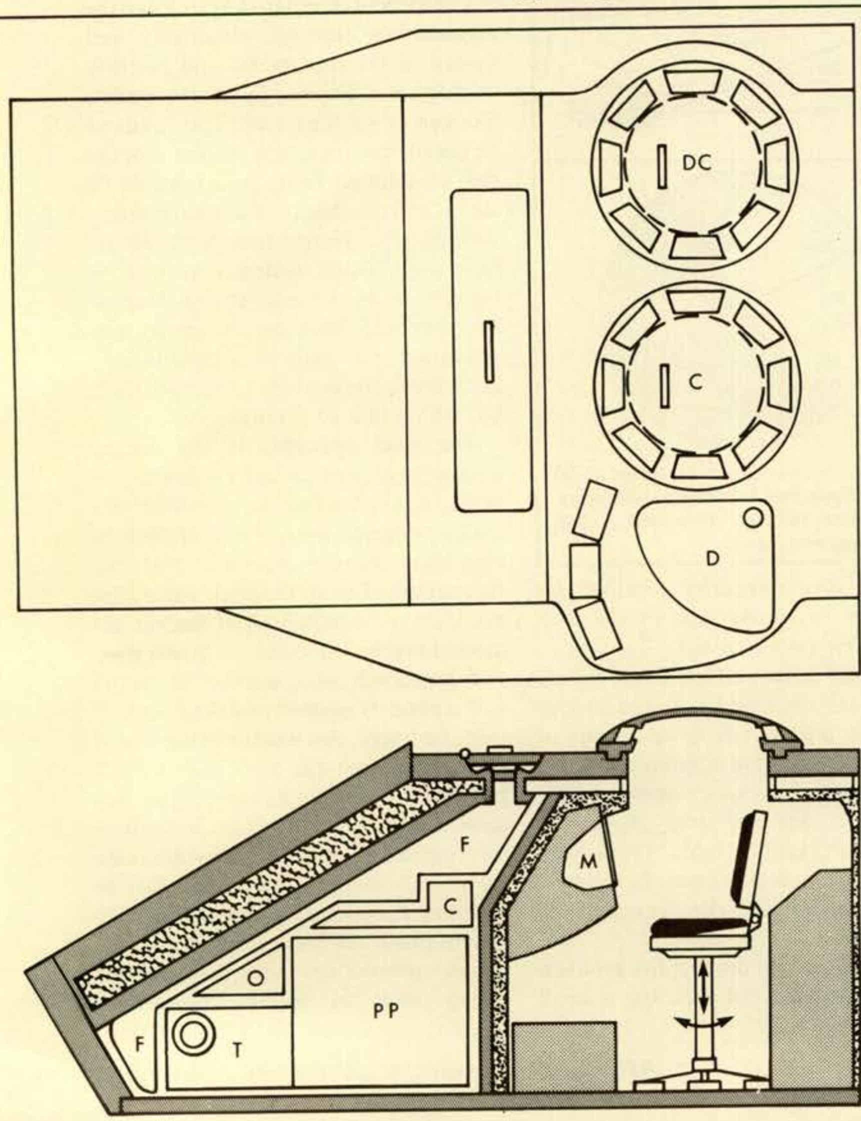


Figure 5. (left) The automotive/crew pod. The power train at the front forms part of an integrated compound armor system. The hatched sections are armor steel plates or castings, the heavy outline in a compound array that includes the area with zigzag shading. The stippled rear element is a lining of boronated polyethylene (or such). The crew of 3 is seated in line—D, driver; C, commander; and DC, deputy commander (see text). The optical arrangements indicated for stations C and DC are secondary vision systems, the main input for the optronic sighting/vision system coming from multisensor heads at the highest point of the vehicle via an image processor to a monitor (M). The open areas are: F, fuel; O, oil; C, coolant; T, transmission; and PP, powerplant. The shaded areas in the crew compartment are housings of electronic/electrical packs, controls, etc.

where the frontal arc concept still quite properly held sway.

Now, the end of this decade looks to be a point at which the antiarmor threat, the state of the art, and the restorability concept would be combined to produce a design revolution. I believe I can best justify this assertion by asking the reader to bear in mind the general points I made above and outlining "one possible solution."

Suppose, then, one has a family of vehicles, similar to the MLC40, with HIMAG's mobility, made up on *three constant elements and two sets of role-oriented modules* (figure 4 (1) (2)). The basic structural element is a *U-shaped frame* that provides mounting points for the other elements and stiffness over the rear half of the vehicle. The second constant element is the *running gear*, mounted on either side of the frame, which is likely to be hydropneumatic, have a frontal sprocket, and provide very large vertical roadwheel deflections. The material and design of these two elements are chosen to make them as open as possible. They are unarmored apart from the suspension unit housings being hardened against the level of nondedicated attack likely to reach them.

The third and major constant element is the *crew/automotive pod* (figure 4 (3)and 5). The front part is similar to that of the *S-Tank* or *Merkava*, in which the power train forms the inner part of an integrated compound armor system and its housing are hardened against the residual energy of attack. The crew of three is positioned in line, the commander and deputy commander (or commander/maneuver squad commander, or tactical commander/vehicle commander) having identical stations with control of surveillance and firepower subsystems, mutual line-up and driver override. The primary vision and sight inputs to those stations come from independent multisensor heads at the top of the various functional modules via image processors, and from the on-board computer in its fire control mode. The secondary optical system (with a "direct," passive night vision aid) provides excellent unity power buttoned-up vision but no sighting facility. As much as possible of the vehicle's electrical power system and electronics are located in this pod, the only role-oriented element being the computer software (presumably in the form of audio cassettes). The crew compartment has its own collective nuclear, biological, and chemical protection system—a separate system being provided when required for functional modules. I hope I have said enough to give the reader a feel for this pod, and I must ask him to accept that it is based soundly on available or firmly predictable technology.[11,12]

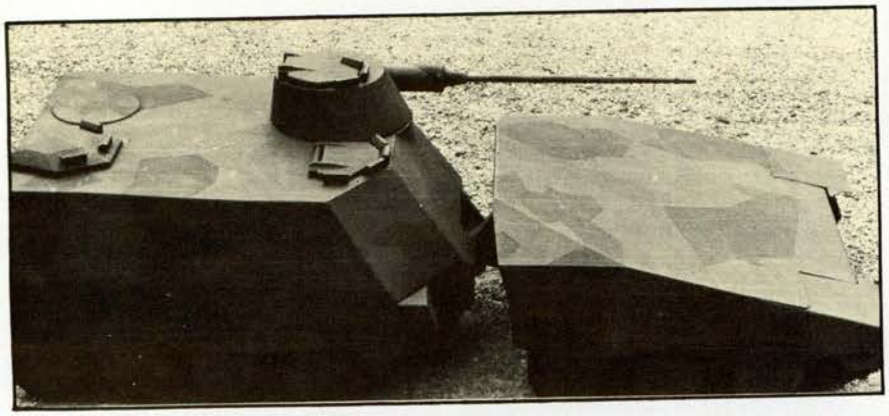
The first set of role-oriented modules consists simply of *interface panels* (figure 4) fitted to the rear of the main pod to match it physically and electronically to the *functional modules* (figure 4, 5). The principal weapon platform would produce an external gun tank, complemented if necessary by a tank destroyer (TD) mounting a longer and/or larger gun, maybe with limited usable traverse and a lower rate of fire.[13] The multisensor heads would be on the trunnion supports above the gun level, giving "turret defilade." This module would be partially or completely unarmored, relying on minimal real presented area to reduce hit chance and on the curvature and inherent strength of the major components to ward off or withstand minor attack.

The infantry fighting vehicle/command and support vehicle (IFV/CSV)[11] variants would have modular rear compartments mounting an appropriate slaved weapons pod. The maneuver squad commander would (and the tactical commander or forward observer could) occupy one of the forward crew stations.

The air defense vehicle (ADV), and minor variants, could be based on either the platform or the box concept. I have presented a family like this in ***ARMOR's*** columns and elsewhere and will not take more space with it here.

The main functional modules would weigh 10-12.5 tons; they could form swapable bodies for logistic vehicles, and the exchange would be carried out by horizontal longitudinal body-

A model of the proposed Swedish tank destroyer with double articulated steering, now going into hardware (see text). Here shown crossing an obstacle, the vehicle weighs around 24 tons and mounts the German 120-mm smoothbore tank gun. The initial design of the autoloader and recoil forces limit usable traverse. Latest Swedish work on autoloaders for external guns opens the way to a similarly configured MBT at around 45 tonnes. (Forsvarets Materielverk, Stockholm.)



The Swedish concept study for an articulated IFV comes closer to the pod concept discussed in this article. Here the front unit is automotive; crew, armament (and maneuver squad) are located in the rear unit. (Forsvarets Materielverk, Stockholm.)

swapping techniques.[12] In the long haul, this could become the normal method of ammunition replenishment for the major weapon platforms.

Briefly, the advantages of the pod concept in terms of restorability and survivability are these:

- Armored volume to be fully protected is small, and the space within the integrated frontal protective system is fully utilized.
- Side protection is enhanced by the frame and running gear and a skirt plate could be used.
- The rear is covered by the interface panel and the functional module.
- The external gun configuration provides a degree of supplementary overhead protection to the crew compartment. (The Swedes are considering extending this by a disc-shaped umbrella, but that could prove a hostage to fortune.)
- The crew compartment need not be exposed in a fire position, and will be exposed to fire on well under 50 percent of movement exposures of the vehicle.[11]

If, for these reasons, we allow the pod and running gear a 30-percent chance of survival by passive protection and the same of hit avoidance, we close the survivability gap for the *mobile subsystem crew* plus *pod, frame, and running gear* (comprising 80 percent or more of system cost), and gain an imponderable asset in the shape of improved morale. The greatest threat becomes in fact a track-cutting mine—even then, the vehicle would be recoverable (in the normal sense). The price of this "restorability" concept is evidently short-term loss of availability and the provision and carriage of replacement functional modules.

The Swedish articulated option which has just gone to the first hardware stage (for the antitank gun, page 23), does not exploit these advantages to the full because it is at the moment an eighties program based on an optical primary sighting/vision system. But a moment's thought and glance at the possible IFV concept (page 24) suggest that, quite apart from its potential for mobility, the concept with "double articulated steering" (positive control of the vertical angle between two halves) is at least as well suited to a "restorability" concept as a one-piece modular vehicle.

Task configuration. I owe the terminology of this last heading to *ARMOR's* editor, who pitched it into preliminary correspondence on this article. It is one of the reasons for including an interface panel in the conceptual drawings (page 22). Technically a rigid or articulated modular concept would allow the weapon system mix and "tank-infantry" balance of a force to be changed in the field to suit the needs of a particular mission, or type of terrain or combat. The subsystems, which account for around two thirds of battle weight and three quarters of hardware unit cost, would be in constant use and have high survivability. "Regrouping" would be achieved by logistic means within a constant organization and command structure.

The implications of this in terms of force structure, logistics, and training are as formidable as the prospects for strategic mobility of a flexible intervention force of this kind and are exciting.

RICHARD SIMPKIN joined the Royal Tank Regiment (British) in 1940, and saw service in the Middle East. He graduated from Staff College in 1951, and the Royal Military College of Science in 1953, specializing in vehicles. He was responsible for user trials of the *Chieftain*, and worked with the *Scorpion* and *Swingfire* development. He was promoted Brigadier in 1968 and placed in charge of equipment policy for the direct-fire battle and all aspects of mobility. He headed the British team on the project definition and operational requirements of the Anglo-German MBT program, where he was closely concerned with the exploitation of Chobham armor. After retiring he set up a language consultancy in 1971, and divides his time between that and writing books.

Footnotes

[1] *ARMOR*, Jan/Feb 81, 36-41.
[2] Simpkin, Richard E; "Multi-layer Armour—A Quantum Jump?," *NATO's Fifteen Nations*, Special Issue, 1/81 (Whither Armoured Warfare?), 29-35.
[3] Simpkin, Richard E; "Concentration of Firepower in Time and Space," in *Proceeding of Swedish Royal Academy of War Sciences*, late 81 (Lecture published in Swedish translation).
[4] This is extrapolated from a figure (I think obtained from a student project I supervised) which I used for 12 years in discussion in the FRG, Sweden, UK and USA, and since in my books, without anyone challenging it or coming up with a better one.
[5] Backofen, Joseph E, Jr; Series of articles in *ARMOR*, 1980 (interalin).
[6] Berge, Sven; "Pansarmaterial," *Militar Teknish Tidskrift*, 2/81, 9-11.
[7] Senger und Etterlin, General Dr. F M von; *Taschenbuch de Panzer* 1976, Munich, JF Lehmanns Verlag, 1976, 7.
[8] *K-kill*—the target is rendered incapable of firing *and* of moving for a specified time, and is likely to be damaged beyond economical repair.
[9] Based on recall. See also my book *Tank Warfare* (London and New York, Brassey's and Crane Russak, 1979).
[10] Simpkin, Richard E; "The Airmechanized Maneuver Force of the Nineties," *ARMOR*, July/Aug 1981, page 54, table and note to figure 2.
[11] Simpkin, Richard E; *Antitank—an Airmechanized Response to the Nineties Armored Threat*. Oxford, Brassey's (Pergamon Press), 1981.
[12] Simpkin, Richard E; *Human Factors in Mechanized Warfare*, Oxford, Brassey's (Pergamon Press) (due out 1982).
[13] Simpkin, Richard E; "A New Proposal for Fighting Vehicles," *ARMOR*, Nov/Dec 80, 13-17.

Reconnaissance Revisited

by Captain Rodney B. Mitchell

Past issues of this journal have seen a great deal of discussion concerning the suitability (or unsuitability) of the *M-3* cavalry fighting vehicle (CFV) as a mount for the Armored Reconnaissance Specialist (19D). To better understand the pros and cons in this situation it would seem necessary to examine the reconnaissance capabilities of the U.S. and its potential adversaries. For the purposes of this discussion, we will be limited to reconnaissance performed by Army units at division level and below. Whether NATO or the Warsaw Pact has a superior strategic intelligence capability will not be addressed, but it is assumed that a valid need exists for manned reconnaissance at division level and below.

A recognition of the importance of reconnaissance is made in both the U.S. and Threat doctrinal literature:

• "See the battlefield" is listed as a fundamental of both offensive and defensive operations in FMs 100-5, *Operations*; 17-95, *Cavalry;* 71-1, *The Tank and Mechanized Infantry Company Team;* and 71-2, *The Tank and Mechanized Infantry Battalion.*

• "The first duty and main task of each commander is to organize his reconnaissance effort." This sentence from a Soviet field manual shows the emphasis reconnaissance is given at all levels.

The doctrinal guidelines for performing reconnaissance are essentially the same on both sides as shown below.

U.S. *Fundamentals of Reconnaissance*	SOVIET *Principles of Reconnaissance*
Orient on the location or movement of reconnaissance objective.	Purposefulness
Report all information rapidly and accurately.	Timeliness Accuracy
Retain freedom of maneuver.	Reliability
Gain and maintain enemy contact.	Continuity
Develop the situation rapidly.	Aggressiveness

Given the equivalent theoretical concern both forces have for reconnaissance and close correlation between the principles or fundamentals of reconnaissance the two forces are to operate under, it is interesting to consider the differences the two forces exhibit in performing reconnaissance. Figure 1 displays the dedicated organic reconnaissance units normally available to commanders at various levels. Figure 2 displays deployment of the reconnaissance elements of a U.S. and Soviet division.

LEVEL OF COMMAND	U.S.	THREAT
Division	Armored Cavalry Squadron	Reconnaissance Battalion
Brigade or Regiment	*Note 1	Reconnaissance Company
Battalion	Scout Platoon	*Note 2

1. *A U.S. brigade* has no dedicated, organic reconnaissance element. Brigade commander obtains reconnaissance information via division intelligence summaries and intelligence and operations reports from subordinate or attached units.

2. *A Threat battalion* has no dedicated reconnaissance element. Lead battalion commanders form an advanced party based upon a reinforced motorized rifle company to precede the remainder of the battalion by 5-10 km. This advanced guard *dispatches a combat patrol forward.* The combat patrol is a fighting patrol, consisting of a motorized rifle platoon augmented with chemical, radiation, and engineer reconnaissance personnel. *The mission* of the patrol is to provide prompt information on the enemy's strength, composition, and direction of movement. The patrol will attempt to penetrate to and report on the enemy main body. The patrol also reports information on roads, the radiological and chemical situation, and the nature of the terrain.

Figure 1. Organic reconnaissance units—division and below

The Soviets have further divided tactical reconnaissance into two categories.

• Combat patrolling or reconnaissance—as performed by the BMP, scout car, and long-range reconnaissance and motorized rifle units of the division reconnaissance battalion, regimental reconnaissance company, and advanced party.

• Special or technical reconnaissance—conducted by radio, radar, chemical, and engineer reconnaissance elements.

Threat reconnaissance units at all levels are equipped with combat and technical reconnaissance elements. These elements have personnel specifically trained in a particular phase of reconnaissance and are furnished with specific vehicles and equipment tailored to the type of reconnaissance to be performed.

However, the U.S. armored reconnaissance specialist (military occupation specialty (MOS) 19D) is expected to be a master of all types of reconnaissance—combat, nuclear,

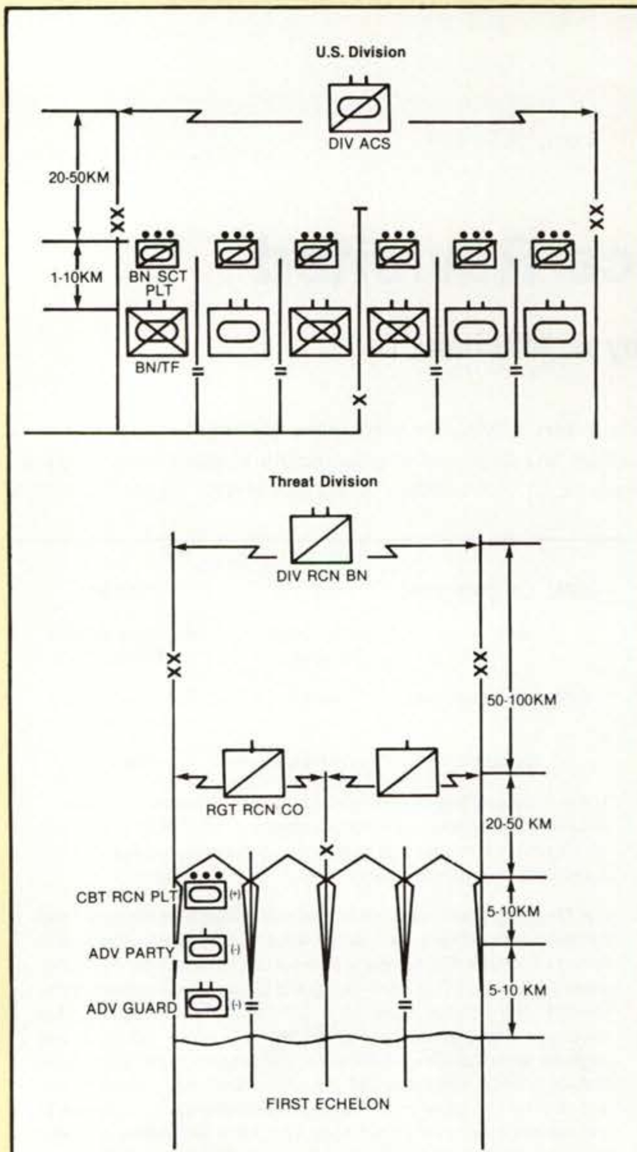


Figure 2. Reconnaissance element deployments in a movement to contact on 2 axes of advance

biological, and chemical (NBC), engineer, etc., as opposed to his specialized Soviet counterpart. Additionally, the U.S. reconnaissance specialist is to perform all of these various types of reconnaissance while operating from a general purpose vehicle (modified infantry fighting vehicle or ¼-ton truck).

The current U.S. reconnaissance organizations by mission statement and equipment are more oriented to actual fighting than their Soviet counterparts.

A part of this difference in reconnaissance unit orientation can possibly be attributed to the difference in general military philosophy. U.S. materiel, organizations, and tactical developments seem to keyed to the active *defense.* The assumption that U.S. forces will conduct defensive operations over known terrain (covering force actions) seems to have caused U.S. reconnaissance elements to become increasingly antitank heavy. In contrast, the Soviets envision the *meeting engagement* to be the most likely form of encounter, at all echelons, in either nuclear or nonnuclear war. With this emphasis on the meeting engagement, it is no surprise that the Soviets feel that "...in the final analysis, *the commander who wants to guarantee success in a meeting engagement must rely on his own reconnaissance unit to provide him with timely information of an approching enemy. . . .*"

All Soviet units are expected to be trained to perform combat reconnaissance. As an example, the mission statement for the motorized rifle platoon includes the requirement to perform as:

- Reconnaissance and combat patrols.
- Advance party, point, mobile, or stationary flank security, or rear guard in a march security mission.
- Security element during halts.
- Battalion reserve.

In contrast, FM 7-7, *Mechanized Infantry Platoon and Squad,* does not address reconnaissance operations by mechanized infantry platoons and squads until the sixth chapter, after a plethora of attack and defend techniques have been examined.

Some observations on the differences. The Soviet forces have created a system of continuous, complementary reconnaissance groups that are responsible to commanders at all levels and responsive to their reconnaissance needs. Each of these elements is fully capable of performing combat and special technical reconnaissance for its commander, and the personnel in these units are specifically trained and equipped to gather and report the type of information for which they are responsible. These reconnaissance elements are not expected to fight or kill the enemy units they find, but are expected to penetrate, report, and live to report on the "second day of the first battle of the next war." The necessity for reconnaissance is embedded in the training and planning of leaders at all levels from division to motorized rifle platoon. The U.S. system, on the other hand, seems to have some significant shortcomings:

- One level of command—the brigade—has no reconnaissance element that is directly responsible and responsive to the commander's reconnaissance needs.
- The armored reconnaissance specialist is a "jack of all reconnaissance trades and master of none," and his equipment has a similar problem.
- With the emphasis placed on fighting, the *information gathering* capability of U.S. reconnaissance units may be less than that of their counterparts, and the commander may have little or no reconnaissance force left on the "second day of the war."

To address these shortcomings, two actions are recommended. *First,* the reconnaissance specialty and related equipment should be revised. The current MOS for armored reconnaissance specialist should be divided into three sub-MOSs or skill designations as follows:

19D(C)—Combat reconnaissance specialist.
19D(N)—NBC reconnaissance specialist.
19D(T)—Terrain reconnaissance specialist.

The principal duties of each MOS would be:

- 19D(C)—Perform traditional "scout and report mission" of locating and identifying enemy forces, combat patrolling, etc. Would also include those personnel trained as gunners on the CFV.
- 19D(N)—Perform NBC reconnaissance, surveying, and monitoring, including the identification of NBC contaminants by type and strength and marking of contaminated areas.
- 19D(T)—Perform route, bridge, soil trafficability reconnaissance. Trained to identify sites for and aid in fording and river crossing operations. Perform limited demolitions to deny enemy use of designated routes, etc.

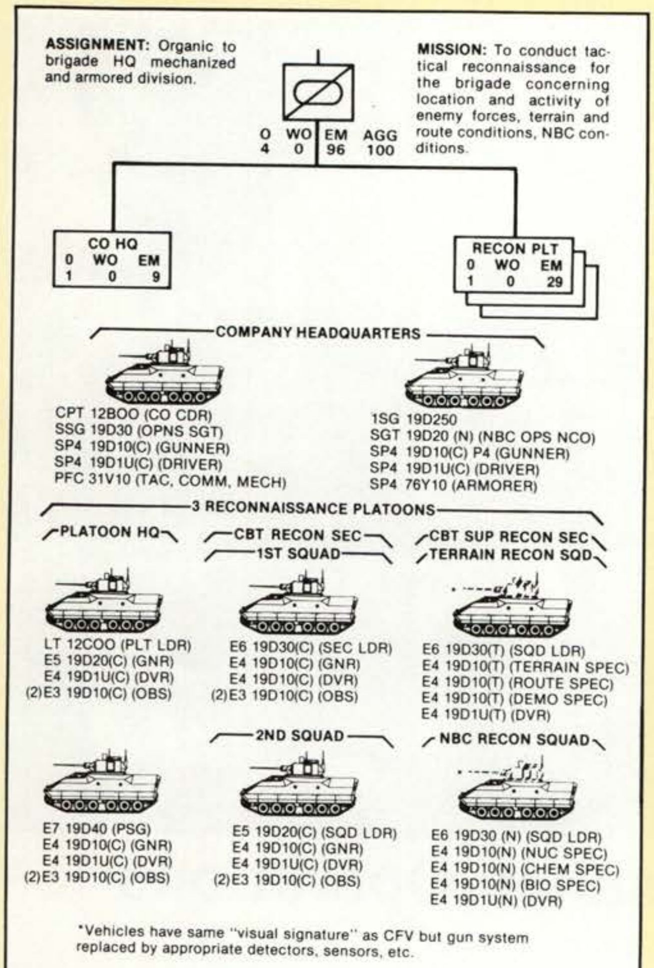


Figure 3. Brigade reconnaissance company

Each of these MOSs would initially receive a "core" curriculum of reconnaissance training in map reading, vehicle operation, weapons familiarization, radio telephone procedures, etc. They would then receive specialized training in their designated specialty in the last part of AIT or as an add-on course.

Along with this division of labor, it would seem feasible to field a family of reconnaissance vehicles that would be equipped or modified to enhance the crew's capability to perform a specific type of reconnaissance. For example, the 19D(C) crew would be equipped with a "stock" CFV, while the 19D(N) crew's vehicle would be fitted with a full array of NBC sensors, alarms, marking, and decontamination equipment. It is envisioned the cavalry and scout platoons would be composed of personnel having all three MOSs and vehicles.

Second, a brigade reconnaissance company should be created. As noted above, the current brigade commander has no organic reconnaissance assets he can "call his own." A suggested organization for a brigade reconnaissance company is shown in figure 3. Note that this organization has no combat service support assets. It would "satellite" on the brigade headquarters and headquarters company (HHC) for supply, administration,, etc. This would require the addition of one tracked vehicle mechanic and two cooks to the brigade HHC. It would be possible to form three of these brigade reconnaissance companies per current (H-series) division by combining the assets of the battalion scout platoons projected for Division 86. This would require some minor shifts in personnel rank structures (3 captains for 3 lieutenants, and 3 E-8s for 3 E-7s). By combining the assets of the scout platoons, 20 CFVs and 100 men would be available for each reconnaissance company.

The mission of the company would be to conduct tactical reconnaissance for the brigade, concerning the location and activities of enemy forces, terrain and route conditions, and NBC conditions.

Employment of the Brigade Recon Company

- The company headquarters (HQ) can maintain control and provide contact between the platoons and the brigade HQ over extended distances and frontages by deploying the two vehicles and crews independently. The company HQ can also provide a "backup" for the brigade tactical operations center (TOC) on the operations and intelligence net when needed.
- A 19D E-8 is indicated as the first sergeant in the company HQ. This assignment offers the capability to capitalize upon the experience of a "savvy-old scout" as a scout trainer and assisting the commander in field operations.
- When required (as an example, to support river crossing), the combat support reconnaissance elements can be consolidated under one platoon HQ to provide an increased capability in a smaller area.
- Platoons, when not actually deployed on reconnaissance missions, would locate in the vicinity of brigade trains to reprovision with fuel, rations, and ammunition, and perform required maintenance. They would be able to draw upon the assets of the brigade HHC and other trains elements to accomplish these actions. While in this area, they would be able to provide a limited reaction capability to threat operations in the rear, if necessary. The removal of the battalion scout platoons does not prevent the battalion or task force commander from fielding a reconnaissance element. By reinforcing a designated mechanized infantry platoon with the normally attached engineer squad, he can field an element that can collect combat information, prevent surprise of his main body, perform bridge and route reconnaissance and classification, and do limited pioneer work. This force would be of approximately the same size in terms of personnel and vehicles (40 infantrymen, 10 engineers/5 infantry fighting vehicles, 1 engineer track) as the CFV-equipped battalion scout platoon. This course of action would require that the mechanized infantry reemphasize the "lost art" of patrolling and reconnaissance and that the engineer squad get up "where the action is" rather than ride trail behind a maneuver company or in the battalion trains.

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Soviet Reconnaissance Operations

by Colonel William W. Crouch

Much has been written of the Soviet doctrine of offensive warfare, particularly as one might expect to witness its application in western Europe. Most of these accounts focus upon Soviet offensive operations and the functioning of the first and second echelons as they attack. Unfortunately, far less has been published characterizing Soviet reconnaissance operations which will be a part of the attack and may provide valuable *indicators* if understood and correctly interpreted.

Fundamental to this understanding for American observers is the requirement to avoid casting Soviet reconnaissance operations in the mold of its U.S. counterpart. On the surface, there are striking similarities, which can lead to misinterpretation if one is not careful. For instance, both the American and Soviet mechanized and armored divisions have reconnaissance battalions. Additionally, Soviet regiments have reconnaissance companies, while the American maneuver battalion has an organic reconnaissance platoon. All of these organizations are capable of obtaining information about the enemy and furnishing security to their parent organizations. Given these similarities, however, it would be unwise to carry the projection further. Regardless of the apparent likeness of the Soviet and U.S. tactical reconnaissance units in a division, the latter is really a combined arms economy-of-force unit capable of information gathering, while the former is focused wholly upon intelligence. The American unit is comprised of both scout and attack helicopters, tanks, armored personnel carriers with infantry, scout helicopters, mortar, and TOW carriers. It is capable of covering a larger force, replacing a larger force, fighting for information and terrain, or participating in almost any type of combat operation.

The Soviet reconnaissance battalion, in contrast, is a unit designed simply to gain information for the division. It is organized with a headquarters company, a *BMP* company, a scout car company, a long range recon company, and a radio and radar recon company.[1] From this unit will be tailored reconnaissance groups of *BMPs, BRDMs,* and motorcycles for recon work, as well as for long range and electronic surveillance.[2]

Soviet tactical recon operations focus upon four requirements: the detection of enemy nuclear systems, major groupings of forces, the determination of the nature of enemy actions, and the capture of enemy prisoners and documents.[3] In order to accomplish these tasks, the effort is organized at division level. Once the division commander has announced his offensive tactical concept, the chief of staff is responsible for planning and implementing the operation. The chief of the second section of the coordinating staff (intelligence) is also chief of the reconnaissance section of the special staff. Supervised by the chief of staff, he formulates and controls the recon plan.[4] The chief of operations must remain fully informed of the recon effort, but the responsibility is that of the intelligence section.

With a mission to determine all available information concerning the enemy and, to a lesser degree, the terrain, the intelligence/reconnaissance chief will task all of his organic assets to provide information. He will rely upon the battalion to provide direct observation reports from small recon groups, who will, in turn, establish observation and listening posts in the area of impending commitment. These recon groups will also attempt to penetrate enemy forward positions, concentrating upon the location of command posts, nuclear units, obstacles, and reserves. These units will probably be no more than one to three *BRDMs*, a similar number of *BMPs*, and possibly a few motorcycles. Their task will be information, not combat; hence, they will do all in their power to remain unobserved while they accomplish their mission. These division assets will, in like manner, be supplemented by elements from the forward regiment's recon companies, which have a similar organization.

Simultaneously, the division will task the long-range recon troops from the battalion to provide information, based upon the established priorities, at greater depth: as far as 100 kilometers in some cases.[5] These long-range troops will penetrate enemy positions via helicopter or other aircraft, or use any subterfuge available to move the required distance. The radar and radio reconnaissance company will also respond to division demands for enemy information, probably to supplement observer reports, as well as serving as a tracking source for emitters.

An important focus for the division's reconnaissance is the enemy weakness. If the division intelligence/recon chief can recommend an apparent route of least resistance or easier penetration, the initial recon will have been successful. As the division's forward movement begins, the recon groups will assist their parent organization advance. Depending upon the precise circumstances, division recon groups will lead and continue to provide forward observation. Regimental recon companies will follow, providing flank security (warning only). As initial enemy contact is made, recon elements will assemble behind the lead assault battalion and, as soon as a penetration in the enemy's position occurs, will attempt to quickly move beyond the fight. The task, at this point, is to provide information rapidly to the division commander, in order to exploit the penetration and lead the division main combat elements to the enemy's vulnerable positions (combat support and service support installations).

A key issue at this point is still that the recon groups are not fighting forces. They will move, avoiding enemy contact, but seeking to locate important enemy positions and routes to those positions. If correctly organized, they will be attempting to supplement and connect with the information provided by longer range groups and the radar and radio recon units. As they concentrate upon obtaining information forward of the division's combat elements, they will also be providing some degree of security and early warning of counterattack.

An interesting sidelight is worthy of note and leads to a rather revealing philosophy pertaining to Soviet recon operations. Although small recon groups are apparently a fundamental organization for accomplishing the mission, the use of single vehicles, such as a *BRDM-2*, is conceivable. To American cavalry units, this employment is unthinkable for the security and protection of the scouts themselves: movement by bounds with another vehicle covering is iron-clad doctrine. Conversely, the Soviet scout may be completely alone and vulnerable. In essence, this translates into the expendability of the scout, provided the division obtains the required information. Additionally, it places an even greater burden upon the scout to remain unobserved while seeking to obtain vital information.

Given the preceding doctrinal discussion of tactical reconnaissance, should NATO forces expect recon activities as described, before the initial Soviet attack? There is a strong and persuasive argument against this expectation. The logic follows that the most important principle for initial Soviet attack is surprise, and secondly, that time is absolutely essential to success (no delays once the attack begins). Since the East-West border has been closed only to the West, neither the Soviets nor other Warsaw Pact Forces, have probably been hindered in recent years in charting NATO installations and defenses: initial recon is probably unnecessary. The conclusion is drawn that, given the information already available, the Soviets will not risk loss of surprise or loss of time, once the decision to attack is made, by further initial reconnaissance.[6]

Counter to this argument is the position that, for surprise, the forward divisions would be required to attack blindly, relying upon old information. Secondly, the argument absolutely presupposes that surprise can be achieved. The effort will be focused in the forward division to penetrate the defenses at a point of weakness. With the NATO commander's flexibility in organizing his defenses, forward Soviet reconnaissance must continue to ensure that a reported gap does not close at the last minute.

It would appear more valid that NATO troops should look for forward Soviet recon elements prior to overt hostilities; they may violate the international boundry, particularly using reduced visibility, and will try to locate lightly covered positions, nuclear capable units and command posts. Low-level overflights for long-range troops should also be expected, and logistic units must be particularly alert to deep recon penetrations. Remembering that Soviet recon troops are trained not to fight, but to survive and report, and key to this objective is their own security, then the possibility of loss of surprise in the last few hours before attack may not be of supreme concern to the Soviet commander. To expect the Soviet division to attack without recon forward defies the principles of success in combat upon which the division relies.

Footnotes

[1]Department of the Army, USA Intelligence and Threat Analysis Center, *Soviet Army Operations*, April 1978, Washington D.C., pp. 2-37.
[2]Donnelly, Chris. Research Centre for the Study of Soviet Affairs, Journal of the Royal United Services Institute for Defense Studies, *Soviet Reconnaissance: Part II*, March 1976, p. 69.
[3]Babusko, A. LTC, Soviet Army. *Military Herald No. 1.* Kasnaya Zvezda Publishers, Moscow, 1977. Translated and republished by the Foreign Science and Technology Center, USA Materiel Development Command, Alexandria, VA.
[4]Lisovskiy, V. LTC, Soviet Army. *Military Herald No. 3*, 1977.
[5]*Soviet Army Operations*, Op. Cit. pp. 5-65.
[6]Vigor, P.H., Research Centre for the Study of Soviet Affairs, Journal of the Royal United Services Institute for Defense Studies, *Soviet Reconnissance: Part I*, December 1975, p. 41.

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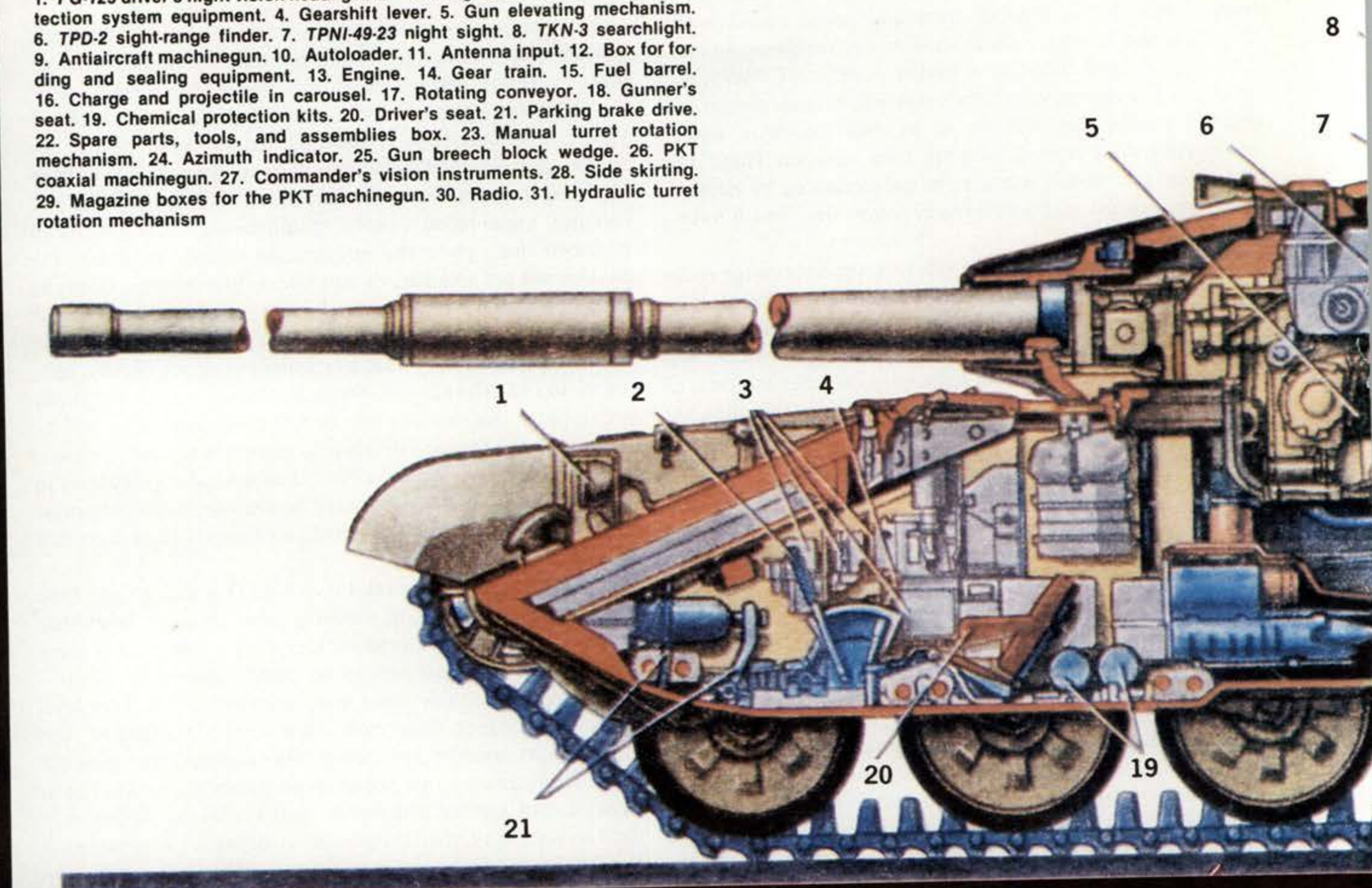
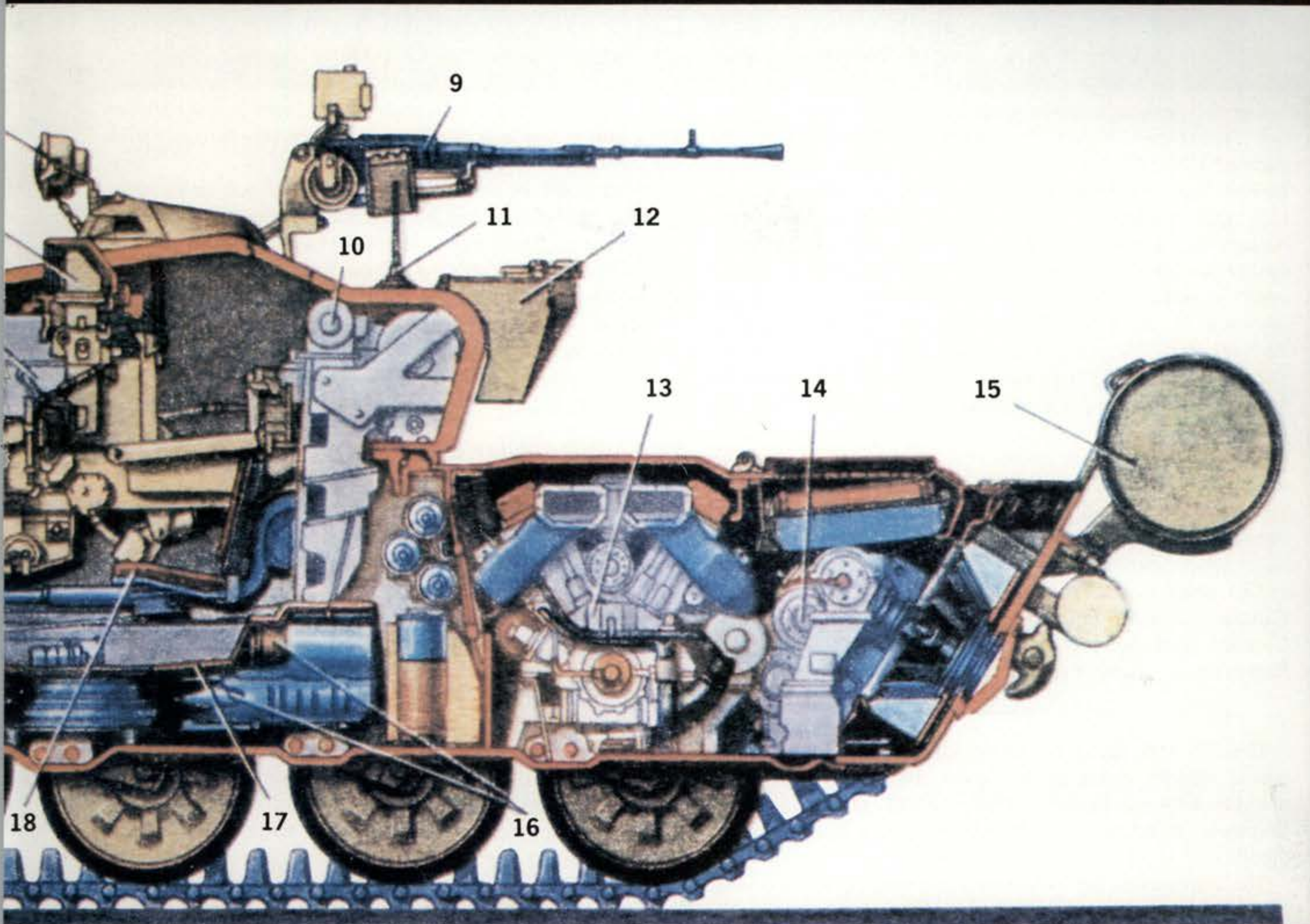
Legend

1. *FG-125* driver's night vision headlight. 2. Steering level. 3. NBC weapon protection system equipment. 4. Gearshift lever. 5. Gun elevating mechanism. 6. *TPD-2* sight-range finder. 7. *TPNI-49-23* night sight. 8. *TKN-3* searchlight. 9. Antiaircraft machinegun. 10. Autoloader. 11. Antenna input. 12. Box for fording and sealing equipment. 13. Engine. 14. Gear train. 15. Fuel barrel. 16. Charge and projectile in carousel. 17. Rotating conveyor. 18. Gunner's seat. 19. Chemical protection kits. 20. Driver's seat. 21. Parking brake drive. 22. Spare parts, tools, and assemblies box. 23. Manual turret rotation mechanism. 24. Azimuth indicator. 25. Gun breech block wedge. 26. PKT coaxial machinegun. 27. Commander's vision instruments. 28. Side skirting. 29. Magazine boxes for the PKT machinegun. 30. Radio. 31. Hydraulic turret rotation mechanism



T-72

Translated From An Article Appearing in ZNAMENOSETS



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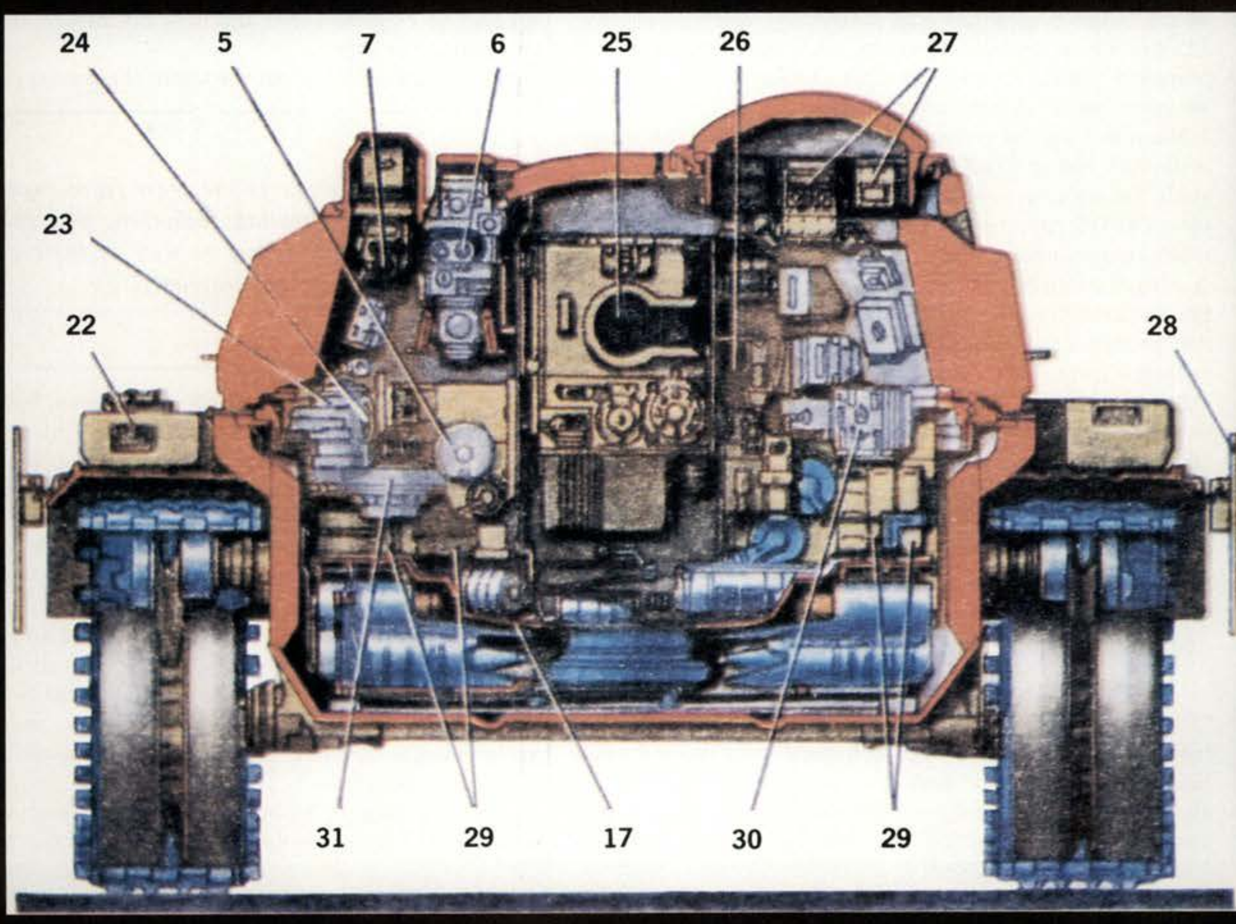

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The following article was submitted by the Foreign Science and Technology Center, Charlottesville, Virginia, at the request of Major General Stan. R. Sheridan. General Sheridan is Director of Development and Engineering, Headquarters, U.S. Army Material Development and Readiness Command, Alexandria, Virginia. General Sheridan has an extensive background in Armor and believes the article should receive wide dissemination within the Armor community. The article appeared in the May 1981 issue of the Soviet magazine, ZNAMENOSETS, which translated as "Banner Bearer" or "Standard Bearer." It is published monthly by the Soviet Ministry of Defense for a principal audience of NCO's and warrant officers.

The translation was made by the technical Russian translator, Foreign Science and Technology Center. A few adjustments were made from the literal translation to accomodate the Russian style, but no changes were made in the technical content.

This article was also brought to ARMOR's attention by Captain David M. Phipps, Studies Division, Directorate of Combat Developments, USAARMS; and Joseph E. Backofen, Jr., Battelle Laboratories, Columbus, OH. Ed.

The *T-72* tank occupies a prominent position among the armored vehicles produced by Soviet designers. It is a formidable armored fighting vehicle (AFV), combining great firepower, effective armor protection, and a high degree of mobility.

The designers of the *T-72* were concerned about increasing the principal fighting characteristics of the tank, its ability to hit a target, and therefore devoted a great deal of attention to armament. The tank mounts a 125-mm gun, a 7.62-mm coaxial machinegun, and 12.7-mm antiaircraft machinegun. The 125-mm gun is intended to knock out enemy tanks and self-propelled artillery, to neutralize artillery and assorted weapons, and to destroy enemy personnel.

Maximum sighted range of the 125-mm gun is 4,000 meters in daylight and up to 800 meters using a night vision sight. The gun's flat trajectory range for the armor-piercing, discarding sabot (APDS) round is 2,100 m. High explosive (HE) fragmentation rounds are used from indirect or covered fire positions at ranges up to 9,400 meters. The rate of sighted-fire is 8 rounds per minute. The main gun features an automatic loader that permits a reduction in the tank crew from four members to three—commander, gunner, and driver mechanic.

In theory, a tank gun does not differ from an artillery gun; in reality however, there are obvious differences that require additional design effort. Because of the space contraints in the tank fighting compartment, each part must be compact, lightweight, strong, and wear-resistant. Electric motor drives allow the gunner to rapidly traverse the turret 360 degrees, and simultaneously aim the gun smoothly on target with a high degree of accuracy. The large diameter sleeve on the barrel of the gun is a bore evacuator that scavenges powder gases from the barrel.

"The gunner can hit the target on the move with practically the same degree of accuracy as when stationary, even if the tank is traveling over bumps or being thrown from side to side."

Another special feature of the tank is its gun stabilization system. The gunner has only to sight the weapon, and the stabilizer unit fixes the position of the barrel, memorizes it and then automatically holds the gun on target. The gunner can hit the target on the move with practically the same degree of accuracy as when stationary, even if the tank is traveling over bumps or being thrown from side to side.

"Invulnerability is achieved by the tank's speed and mobility, its overall dimensions, the shape of the hull and turret, the armament, and the state of training of the crew."

Ammunition for the main gun is stored in special recesses (Translator's note: a carousel) located inside the tank hull. The basic rounds carried by the tank include APDS projectiles, HE fragmentation shells, as well as high-explosive, antitank (HEAT) projectiles.

In describing the tank, it is important to mention the vision devices and sights. With their aid, the buttoned up crew can conduct ground reconnaissance, detect targets, and destroy them with machinegun or main gun fire. The *T-72* also has provisions for conducting observation and fire at any time of day or night. This is an extremely important characteristic of the AFV. It is well known from experience in WW II that the combat operations of tank crews were much more difficult at night. The *T-72* can travel and fight just as well at night as it can during the day.

"The armor protects the crew from exposure to thermal and penetrating radiation, and the shock wave of a nuclear blast, as well as toxic chemical agents and radioactive materials."

Now, a few words about the armor that makes the tank invulnerable in battle. Invulnerability is achieved by many factors: the speed and mobility characteristics of the tank, its overall dimensions, the shape of the hull and turret, the armament, and finally, the state of training of the crew. And, yet, the effectiveness of the armor protection is most important of these factors.

Antiprojectile armor is employed on the *T-72* tank. This means that it is able to withstand an artillery shell, and to deflect or absorb the enormous energy created on impact. For example, the power developed when a 76-mm shell strikes the armor is 800,000 hp. The armor also protects the crew from exposures to thermal and penetrating radiation, and the shock wave of a nuclear blast, as well as toxic chemical agents, and radioactive materials.

The *T-72* has good mobility in spite of its 41-ton weight, but what is good or bad mobility? The term "mobility" includes

mobility, maneuverabiity, and cross-country performance.

Mobility by itself means the ability of the AFV to cover considerable distances in terrain within a short period of time. The basic indicators of tank mobility are the average speed and range. The *T-72* can travel on a dirt road at an average speed of 35 (21.1) mph to 45 km/hr (27.9 mph) and at up to 50 km/hr (31 mph) on a surface road. The maximum highway speed is 60 km/hr (37.2 mph). As for the range, it is diffucult to exaggerate the importance of this index. It is, so to speak, the tank's radius of operation. For the *T-72* it is a considerable distance of up to 480 km (298 miles).

The second component of mobility, maneuveribility, provides the AFV with the ability to be nimble and quickly change direction. This is a very important capability on the modern battlefield, which is packed with all sorts of weapons, and particularly during operations in the mountains or in built-up areas.

In this sense, a tank has a significant advantage over a wheeled vehicle. It can literally turn on a 5 *kopek* piece (Translator's note: about the size of a nickle).

As for last component cross-country performance, it goes without saying how important this is if a tank is required to travel over deep snow, plowed fields, quicksand or marshy swamps, and negotiate other obstacles. In these situations engine power, ground pressure of the tracks, and ground clearance are all important.

T-72 is powered by a 780-hp engine, which is considerable for a medium tank. In spite of the tank's 41-ton weight, the ground pressure of the tracks is comparatively low—0.83 kgf/cm^2 (11.8 lb/in^2) which is comparable with the ground pressure of an individual soldier. The secret is that the tracks of the *T-72* are 580mm (22.8 in) wide; consequently, their area is rather large. The ground clearance is also good at 470 mm (18.5 in). This is important when you consider that the tank must often operate where there aren't any roads.

With such qualities, the *T-72* tank can negotiate the most difficult natural and man made obstacles. If, however, a river is encountered that cannot be skirted, the *T-72* has several options available for making the crossing. The ideal means is to install a bridge that is strong enough to support the tank. A second option is to use a raft or ferry to accomplish the objective. If one of these options is not practical or would consume too much time the tank can also ford the river.

Modern Soviet tanks can safely travel under water. They have equipment for underwater operation (OPVT) which ensures the airtightness of the tank and provides a normal supply of air to both the crew and the engine. The OPVT set helps to maintain a set course underwater, and makes it possible to take the necessary steps to guarantee the safety of crew members. The width of a water obstacle that can be forded is several hundred meters, but the depth must not exceed 5 m (5.4 yd)

The *T-72* has special equipment for digging trenches and shelters. A mine-clearing attachment is also available for clearing passages through minefields. Tank formations and units equipped with modern armored vehicles can conduct active offensive operations by day or night, operate at a considerable distance from their own forces; destroy enemy forces in a meeting engagement, negotiate wide zones of radioactive contamination and rapidly cross major water obstacles on the move. They can also establish a solid defense and successfully repel an enemy attack.

Antitank Mines—Part III

by Joseph Backofen, Jr. and Larry W. Williams

Mines and booby traps are indiscriminate weapons requiring precise, careful detection and removal. The impact of mine usage is very great, not only on the immediate strategic and tactical situation but even on future generations. The former was indicated by the 16 percent armored-vehicle-loss rate during World War II, and the high 70 percent losses in the Vietnam Conflict. The effect on postwar activities was evident during the spring rains and thaw in Korea, where mines indiscriminately laid in enemy and friendly fields were still being uncovered and unfortunately detonated by the population 20 years after hostilities ended.

The policy of major powers (in past and future wars) has postulated specific, detailed plans for all fields laid. However, these plans may not be accurate, may become lost, and could be destroyed to prevent enemy capture. [1,2] In addition, the terrain in which the mines were planted can change as has happened in Korea and Vietnam. Moreover, the future armored threat implies that mine barriers must be rapidly constructed, or utilized to supplement the existing natural barriers, to delay the enemy.[2] As such, rapidly emplaceable mines have been developed and are being further refined. Both the mechanically emplaced and the man-emplaced, mechanically-delivered mines can be located and relocated by the pattern and accurate definition of the location of the field. However, high-speed, air-emplaced, or artillery-delivered mines will be relatively indiscriminate in their location due to delivery-system inaccuracy. Therefore, these mines will require some extremely reliable means of self-sterilization.[2]

The methods of employment will dictate the lengths to which one must go for detection and removal. Quite obviously, scatterable mines employed hastily without cover might be seen by the enemy who can then take fast countermine action. The same mines scattered in vegetation, though screened from optical view, might be readily identified by electronic methods. The response to the minefield, be it composed of metallic or nonmetallic mines, with or without antidisturbance features, is entirely up to the encroaching party. Accepted practices, such as firing at the stationary targets, explosive line detonation, plow removal, or hand removal can be used depending upon the situation. However, the tactical characteristics of scatterable air- or artillery-deliverable mines are of particular interest. They may be utilized to supplement a mine field as the enemy is penetrating it, or to restrict the dispersion of a column while it is engaged by artillery or direct fire, or to block avenues of escape or reinforcement while assaulting the enemy's position.[2]

Still, deliberately buried/emplaced mines pose the greatest threat to the potential application of proper cover and concealment. It is in this method that most mines have historically been employed and will probably be employed for deliberate minefields, as well as ambushes along lines of communication and supply (figure 1). In this regard, the design of mines has progressed to avoid detection by visual, probe, and electronic means. And, in addition, the mine fuzes have been hardened against the major methods of quick removal. Furthermore, the well placed horizontal effect Misznay-Schardin mine can be

A counterobstacle vehicle equipped with mine-clearing equipment has demonstrated the feasibility of breaching an anti-tank minefield with an unmanned, remotely controlled system. The system consists of a mine clearing roller and a rocket-propelled line charge mounted on a modified *M-60A2* tank chassis. Safe lanes breached by the system are marked by a device mounted at the rear of the tank.

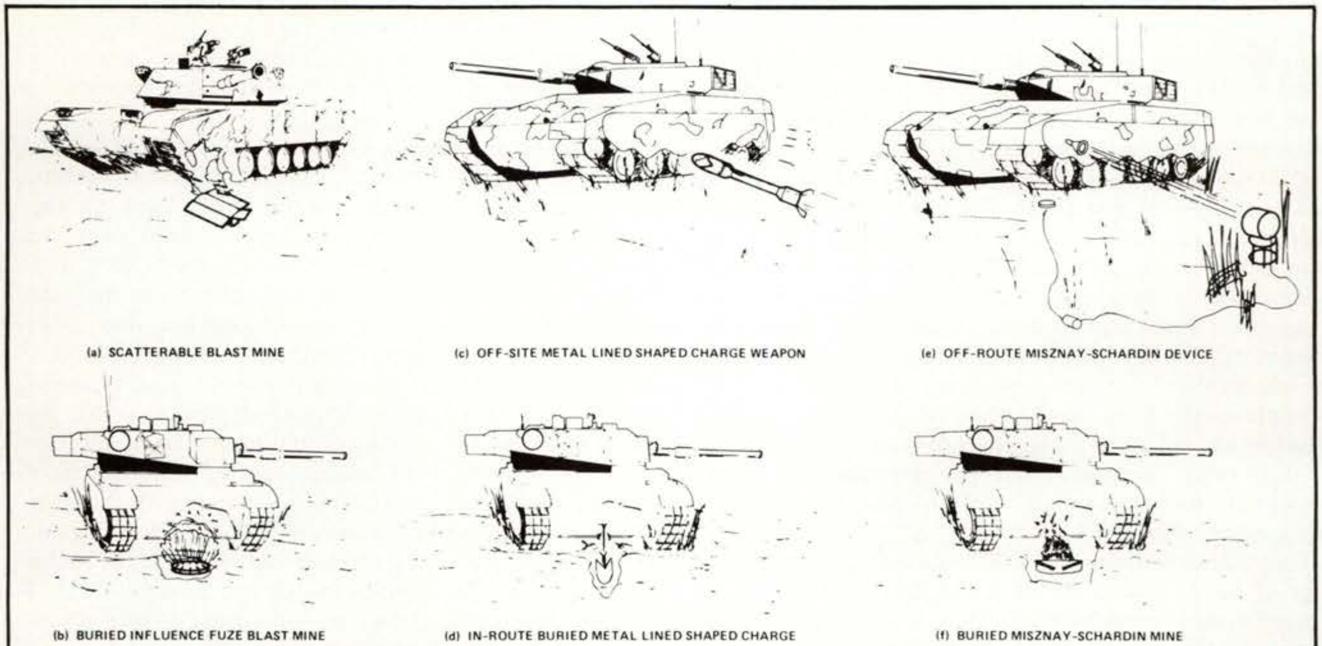


FIGURE 1. KILL MECHANISMS OF BLAST, SHAPED CHARGE AND MISZNAY-SCHARDIN MINES

hidden from view while covering its offset fuze so that it can attack anything activating (or attempting to disarm) the fuze.

The blast mine has progressed from that with a metallic case and other metallic components such as fuze, carrying handles, etc., to a totally nonmetallic type, such as the U.S. *M-19*. Early metallic mines were located by means of the visual change in the shallow vegetation over them, the disturbed ground, the metallic content, the density change, and the resistance to a probe.[3-4] An early solution to the detection problem was to make the mine with a wood or cardboard casing. By careful and deeper emplacement, the visual signs were removed; and by reduction of the metal content to that contained in the spring and striker in the fuze, the metallic signal was decreased to less than that of a buried small arm round. A further improvement was made by the use of chemical fuzes (CS-42/3, Italy) that totally eliminated the need for metallic components. In this configuration, the well-emplaced blast mine is only detectable at present by density change or hand probe.

Two problems with early pressure-fuzed nonmetallic mines were the deterioration of the case and the response to sharp blast overpressures. To eliminate the former problem, chemical treatment was applied to the wooden casing, and cases were fabricated from various plastics *(Model 52/53,* Denmark). However, more recently the case has been entirely dispensed with by the technique of molding glass-fiber-reinforced TNT as the basic body and charge *(Model 1951*, France; *DM-11,* West Germany; and *Mi-101*, Sweden). Solutions to the overpressure problem have involved the usage of pneumatic delay *(SH-55,* Italy), hydraulic delay (CETME mine, Spain), pulsed pressure *(PT-MI-K,* Czechoslovakia), long pulse pressure *(M-15,* US), and tilting cover plate *(PZ-Mi-2,* West Germany).

In addition to the reduction of the signature of the blast mine, field practices have developed toward better concealment and foreign object decoys. For example, in the ambush role in Vietnam, conventional mines and field-fabricated mortar or artillery shell mines were found concealed under the puddles found on roads, under dung, surrounded by empty shell casings, or under run-over soda cans. One particular decoy consisted of a tilt-rod "fuzed" bamboo basket that contained a snake and a 7.62-mm casing. In the future, the requirements for nondetection by electronic means will lead to deeper burial, better prepared positions, and the emplacement under unlikely objects, such as small rocks, bushes, and wet areas.

The lined shaped-charge mine contains a ductile lining that makes it susceptible to location by metal and density detectors, as well as hand probes. Due also to the jet characteristics, this mine is adversely affected by overburden and distance from the target (standoff). Therefore, it is usually found with an offset firing device and is employed either shallowly camouflaged in the main avenue of approach or in a remotely located off-route launcher aimed through a clear path.

Even though the lined shaped-charge mine is easy to detect, the offset actuating devices are as difficult to detect and clear as those used on the blast mine. In the case of a remote vibration infrared fuze, such as that with the *M-66,*[4-5] it will be difficult to anticipate the path of the infrared beam although it might be possible to pick it up with future sensors.

It must also be noted that the activation of any offset fuze exposes the individual or vehicle clearing the area to the effect of the primary charge.[6] This was found in Vietnam where vehicles using rollers were targets of offset blast mines that would explode under the vehicle when the roller closed the pressure switch. However, this anti-countermine technique is only practical when the target is forced to travel in a particular direction. Still, it can be expected that shaped-charge mines with offset fuzes will be used to harden a conventional minefield as well as in mechanical ambush positions.

Due to the Misznay-Schardin mine's characteristic of accelerating a metal plate, it is easily detected. However, as with the lined shaped-charge mine, offset actuating devices will be difficult to detect and will present a significant hazard to even armored vehicles attempting to clear a minefield containing these mines using flails, rollers, or plows. Mines containing a secondary charge that clears the surface of the mine before the metal plate is forged into a hypervelocity projectile can even be anticipated to be buried in an off-route application since the mine could punch its way out of a buried camouflaged position. This factor could make the Misznay-Schardin mine extremely useful in military operations in built-up areas (placement within a wall), in mechanical antivehicle ambushes, and in hardening hand-emplaced minefields.

Field-fabricated mines or booby traps can be quite annoying and devastating in their effect. The reasons for this are that they are, by definition, nonstandard and may contain any number of fuzes and charges of various shapes and effects. They may be totally nonmetallic, or they may have the various components widely separated. An example of a low-metallic-content mine was the Viet Cong application of two thin wires on split bamboo for a pressure-activated device, a number of dry cell batteries in another location, an electric cap in a third location, and the use of a detonating cord train to the bulk explosive charge. This type of mine was particularly difficult to detect and has the nasty characteristic of being set off by normal probing methods.

Future field-fabricated items will undoubtedly take advantage of new, standard, sophisticated fuzes and the lessons learned in local brushfire wars. They will most probably be discovered primarily in the rear area, disrupting the lines of supply and communication in the form of mechanical ambushes. But in a truly mobile armored conflict, they will be used throughout the battlefield to control a greater area and to provide security on obvious avenues of approach. It is in this application that foreign material (warheads, projectiles, weapons) will undoubtedly be used to advantage to augment the standard mines.

The detection of standard and nonstandard mines is a game played to the obvious advantage of the mine user. The detection is very highly influenced by several factors. In addition to the design variables of the mines themselves, because of the influences of both terrain and weather, a truly universal mine detector that rapidly locates all forms of mines may never be built. The reason for this is that it is difficult to eliminate the background noise created by variations in soil composition, rocks, roots, fragments, miscellaneous foreign objects, and water. Also, weather adversely affects the detection capability of both electronic and human or animal means by eliminating their means of detection (e.g., by comparison between the disturbed and undisturbed soil).

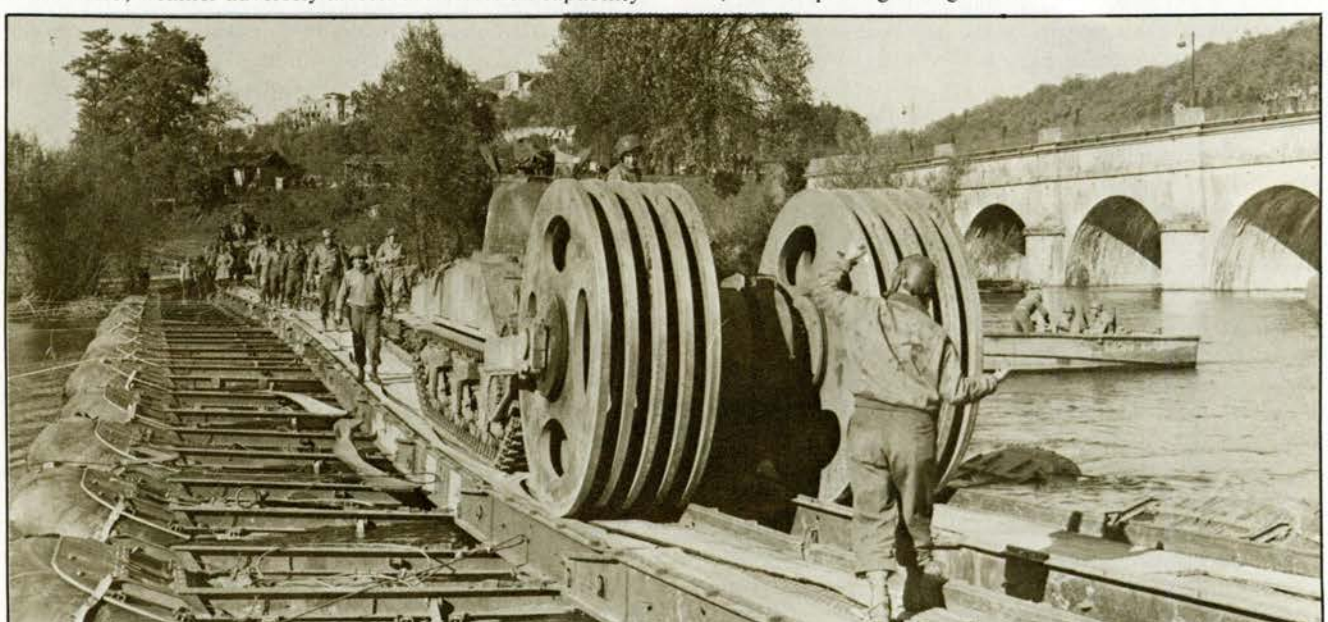
Research into mine detection has covered electromagnetics, magnetics, biological, chemical, molecular-atomic resonances, nuclear techniques, seismic-acoustic, radar, aerial photography, soil and environment and remote sensing (including dowsing and extra-sensory perception),[7-18] All of these techniques have been shown to be adversely affected by the variations of terrain, weather, mine emplacement and time.

The only method which is sufficiently reliable to detect a buried mine is probing.[7] This is a slow and hazardous operation at best. It is totally unacceptable for highly mobile armored forces. However, some systems such as hand-held thermal viewers and forward looking infrared units may have potential for detecting scatterable, recently buried, shallowly buried, and metallic mines as they would have a distinctly different thermal signature from their background in the course of temperature changes during the day and/or night.[8,19-22]

Future detector developments will attempt to take advantage of technological advances in order to provide faster means to accurately locate and verify the presence of mines. This could take the form of special vehicles.[8,23-25] It could also take the form of special electromagnetic equipment on the lower glacis plate just to warn of the presence of the vertical effect metal-lined shaped charge and Misznay-Schardin mines that could kill the vehicle by piercing its belly.[25] However, due to the natural advantages afforded the mine user, the speed of a tactical element moving through an area suspected of being mined will probably still be reduced to that of a man on foot, unless losses are accepted or antimine equipment is fitted to each vehicle.

As previously alluded to, mine removal is quite dependent upon the tactical situation and material at hand. It can involve a variety of means such as the:

• Signature duplication by means of using a remotely controlled vehicle,[8] nuclear or fuel-air/explosion overpressure,[8,26-28] or pulsing a magnetic field.[31]



These massive mine detonators of World War II placed a terrific strain on the power trains of the *M-4 Sherman* tanks on which they were mounted. They also posed a problem in mobility. Here 6th Armored Division engineers are conducting a dress rehearsal for the crossing of the Rhine.

This British bar mine layer of the late 1960's was towed by an FV 432. Although the layer left a distinct signature in open terrain, it offered the advantage of armor protection for the mines while being transported and for the crew while the mines were being laid.

• Signature suppression by covering the "cleared" lane with rapidly hardening foam.[32]

• Excavation or removal by means of plows,[6,25,29,30,33-36] ditch diggers,[30,34] and hand shovel.

• Direct attack by aimed gunfire, artillery concentrations,[10] ricocheting artillery rounds, explosive line charges,[1,4,8,10,30,36-38] hand emplacement of a counter charge or chain flails.[1,8,25]

• Rendering inert by means of disrupting or freezing the fuze or the explosive booster, or by manually disarming.

The reasons for dependence upon the tactical situation are that the minefield may be a scattered field, either not covered by fire or covered only by artillery; or it can be a thoroughly hardened, emplaced field covered by all means of firepower available. In a scattered minefield, that is not covered by fire or a mechanical-ambush position, personnel can move about unhindered and take the time required to properly inspect the ordnance and devise a means to clear the area. In a scattered, covered-by-fire mine field, direct attack of the mines by gun fire or explosive snakes and ropes can be made from within armored carriers (CEV, CET, MTK, *M-1, M-2, T-72,* etc.) or the mines can be pushed aside by plows in order to form safe lanes.[38]

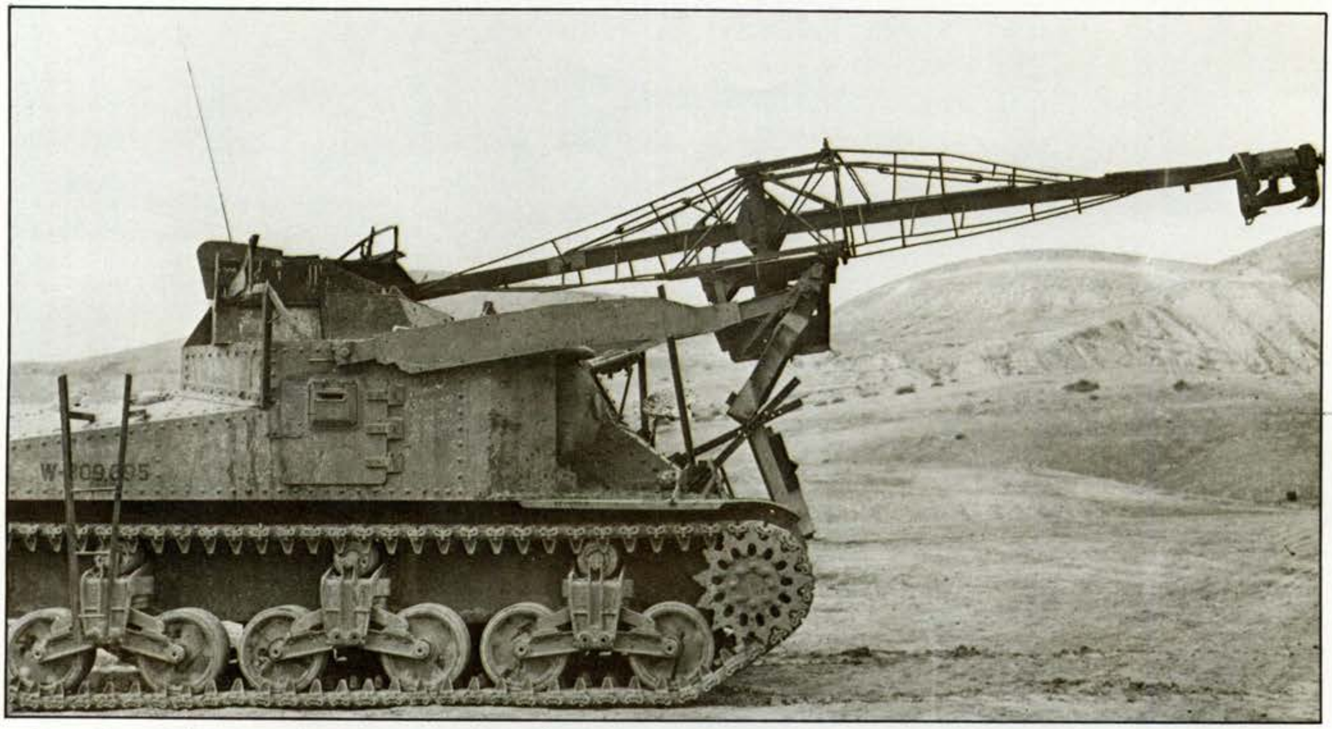
In the case of a buried field covered by fire, any means may be utilized, but losses are to be expected due to the lack of opportunity to inspect the composition of the field. In this regard, the field may contain various forms of fuze and offset that would nullify the use of any single method of clearing. For example, an offset fuze or set of fuzes of long-pulse pressure with an antilift device connected to an in-route or off-route Misznay-Schardin mine could defeat an armored vehicle clearing with a roller, a flail, a mine plow, a snake explosive (*Bangalore* torpedo), a direct-attack projectile, or a fuel-air explosive. The following examples show what can be used to harden a field against removal:

• Long-pulse pressure: resists being activated by snake explosives, nuclear overpressures, fuel-air explosions, rollers, flails, and other short-duration pressures.

• Antidisturbance: resists mine plow and hand removal by detonating the mine and causing damage.

• Vibration or magnetic rate: resists being activated by all but the particular signature that influences them, and may still operate under many of the bridging systems.

The most definite method of mine removal is by sympathetic detonation of the main charge. However, the primary charge of most mines is relatively insensitive. This means that the detonating charge must be brought into close proximity with the mine, or a strong shock must be transmitted through the surrounding soil. Methods of doing this include hand placement, explosive snakes, and fuel-air explosives. But the effectiveness of these methods is adversely affected by mine burial depth, soil condition or layering, and mine detection or location. The more sensitive explosive booster can also be attacked by the same means; but it can be designed and located so as to lessen the shock to which it would be subjected.



Down through the years, the search for a "safe" method for removing mines has produced some unusual vehicles and devices. This modified *M-3* medium tank of 1943 vintage mounts a boom equipped with mechanical claws for emplacing and removing mines. The vehicle was used in North Africa to train engineer troops in minewarfare.

Further complication can be induced by using additional fuzes to preclude mine removal. These can be in the form of simple spring-trap antilift devices, pull fuzes, mercury switches, antisafing fuzes, and small secondary, antipersonnel mines located in the immediate vicinity. The extra fuzes do not generally affect the brute force methods of removal, such as roller, flail, or plow, but they are significant when it is expected that the mine should be nonexplosively removed. An example of this case might be when the mine is located in an urban area and its detonation would only cause additional damage that would itself become an obstacle.

The fuze is the heart and mind of the mine. In this respect, the fuze designer really dictates the location, detection, and countermeasures for mines. The fuze can be varied through all possible mechanical, vibrational, electrical, chemical, or combination configurations. With modern technology, such as used in terrorist bombings in Northern Ireland, it can have clocks for on-off switching, radio communication, light detectors, X-ray radiation detectors, and counters.[39-41] In short it can be turned into a "smart" weapon. Still, the simplest fuze, one that relies on pressure, is the most common and the easiest to work with and harden so as to resist the most common methods of mine removal.

During World War II, the Soviets came up with electrified obstacles as an effective way of reinforcing obstacles and minefields.[42] During that war, the obstacle was supposedly very effective against troops. It may be similarly effective in the future and might also be a hazard to modern weapons systems and their components, such as wire guided antitank missiles and electronic fire control systems.

Generally, it has been possible to find naval technology that precedes similar technology used for land combat. In mine warfare, this is also possible. The problems of naval mines with their various fuzing techniques led to the need for a special purpose vessel, the minesweeper. This vessel is essentially a small specialized ship that can go through minefields without setting off mines by its signature (hopefully) and yet either destroy or disturb the mines by devices that it tows or controls by wire.[43,46]

Recent developments in naval minewarfare have resulted in sweepers being radio controlled from a larger vessel.[46,47] This could be done in land warfare and the vehicles could even be controlled by means of hard wire for communications security.[17,48,49] However, it could easily cost a number of these vehicles in order to breach a minefield. However, naval minesweepers have also taken to the air in the form of hovercraft and helicopters.[43,50,51] The observation that ". . . the chief advantage of the helicopter lies in its flexibility of movement and its relative invulnerability to the explosion of a mine underwater . . ."[43] can also be applied to land combat. Such an adaptation might use electronic viewing devices to look for scattered mines and signs of buried mine fields and either explosive devices or grappling devices/nets to remove scattered mines. The helicopter could temporarily mark buried mine fields with a colored powder or other means in order to indicate that it should be cleared by another vehicle. However, the helicopter over land could also tow a mine removal device in a manner similar to the naval minesweeping helicopter.[50] Still, as with any measure/countermeasure, the usage of helicopters in mine detection and removal may only last until antihelicopter mines are employed.

In summary, it must be said again that mines place all the advantages with the user. The newer mines can be lethal to armor. In addition, they are an inexpensive means to effectively control large areas and to inflict armor casualties through denial and through psychological means by prohibiting or delaying movement through well-prepared barriers and mechanical ambushes.

Of special note, scatterable mine systems enjoy tremendous flexibility for such varied use as supplementing an existing minefield while the enemy is in it, ambushing armored columns by indirect fire, and sealing off escape/reinforcement routes while defeating the enemy piecemeal. On the other hand, use against an armored force can deprive its vehicles of mobility/agility and frustrate its commander. The only countermeasure practical for armor is to have an anti-scatterable-mine system on each vehicle.

Finally, due to their potentially enormous impact and ease of delivery (strategic and operational mobility), mines will probably always be aggressively used in future wars—even with the problems of long-term environmental effects and control of these indiscriminate weapons.

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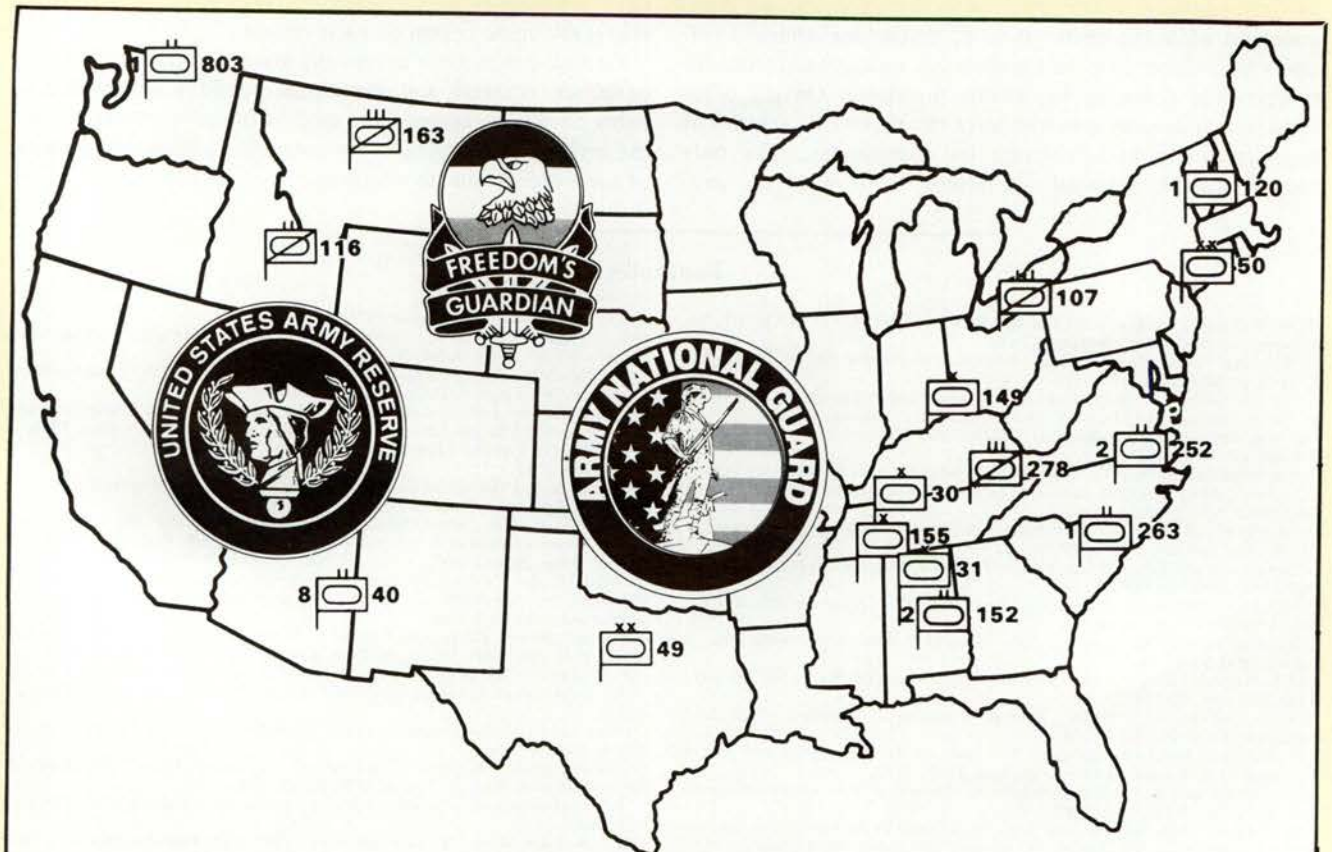

Figure 1

The Reserve Component Armor Force

by Majors Donald B. Skipper and James T. Kerr

As national policies place more and more reliance on the capabilities of Reserve Component (RC) units, there is increased emphasis, through several interrelated programs, on enhancing the combat readiness of the entire RC force structure. This article provides a brief overview of the Reserve Component of the Total Armor Force, and highlights and differentiates the various programs that have been initiated to improve RC training readiness.

Reserve Component Armor. A large percentage of the total Armor Force is in the RC of the U.S Army, which consists of U.S. Army National Guard (ARNG) and U.S. Army Reserve (USAR) units located throughout the United States (figure 1). Furthermore, the majority of Armor and cavalry units in the RC are Army National Guard units. The USAR has only one separate Armor Battalion while the ARNG has two Armored Divisions, four Armored Brigades (Separate), four Armored Cavalry Regiments, and five separate Armor Battalions. Figure 2 compares this armor combat force with that of the Active Component (AC).

The increased reliance placed upon the RC to execute mobilization and early deployment in the event of armed conflict carries with it the requirement to provide these forces with meaningful training commensurate with their mission. It has always been a challenge for the citizen soldier to achieve his goals, and today's intensified role for the RC Armor Force has compounded the difficulty. The obvious challenge is in making optimum use of a resource of which the RC is critically short—*time*. The typical RC Armor crewman is limited to a maximum of 38 training days a year in which to master both tank gunnery and critical Soldiers Manual and Army Training Evaluation Program (ARTEP) tasks.

Recognizing both the increased reliance on the RC Armor Force and the critical training time limitations on this force, the latest revision of Appendix B, U.S. Army Forces Command (FORSCOM) Regulation 350-2, "Reserve Component Weapons Qualification and Familiarization," provides specific guidelines to assist RC Armor units in achieving a high state of training readiness. RC tank crews are qualified under the same criteria in FM-17-12, "Tank Gunnery," as the AC force—with one exception. RC Armor units no longer fire Table VIII in either pre or postmobilization gunnery training.

The premobilization objective for RC Armor units is to have tank crews qualified on Table VII and to have the unit as highly proficient in gunnery and tactics as personnel strength, time, and facilities permit. This gunnery objective is only a minimum, and should not prevent a unit from completing Table IX and gaining proficiency in company-level ARTEP tasks whenever possible.

The critical time constraint under which RC Armor units must train requires that they conduct the majority of gunnery training during inactive duty training (usually referred to as weekend drills or IDT). Tables I through V, and in some cases table VI, are fired before the 2-week Annual Training (AT) period. The RC Armor unit often looks to its counterpart for support and assistance in completing all of this training in the equivalent of 24 days.

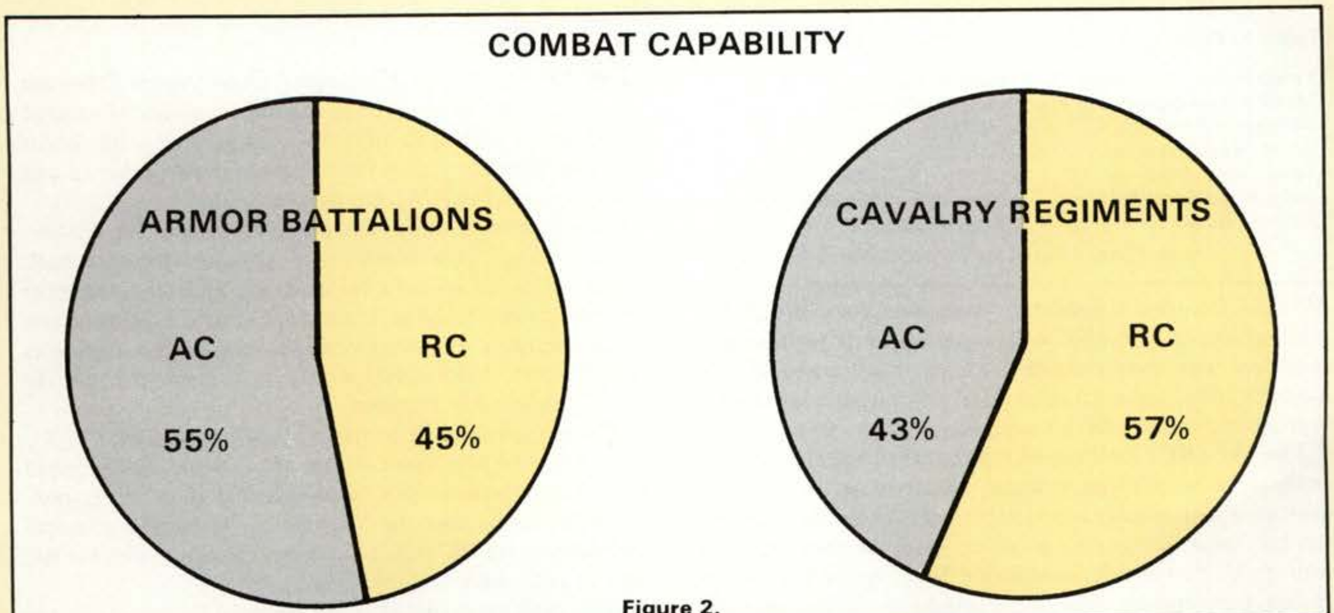

Figure 2.

AC/RC Relationships, both professional and personal, are being established between RC elements and their AC partners to make the ultimate goals of personnel, equipment, training readiness, and the ability to deploy on schedule a reality. These programs are aimed at both organizational and individual readiness and have a positive effect on training readiness. Today, through an evolutionary process, these programs have become interrelated and supportive of each other and have culminated in CAPSTONE. As the name implies, CAPSTONE represents a culmination of RC readiness and mobilization programs.

The Army CAPSTONE Program was initiated in 1979 in an effort to optimally align the total Army Force within a comprehensive series of command and control organizations designated to fight and support a war fought by NATO. The relationships developed among FORSCOM units of all components permit the identification of wartime missions and the initiation of peacetime planning and training to accomplish those missions. Although CAPSTONE alignments were developed primarily in response to planning requirements, a distinct advantage is gained when training associations match planning associations. A *training association* is a direct interaction among geographically close AC and RC units for the purpose of improved training and overall readiness. This association is technical in nature and does not circumvent nor violate established command channels on matters of policy, command, control, plans, or funding. A *planning association* provides a direct interaction of units to conduct mission planning based on a wartime assignment to a gaining wartime command. Exchange of standing operating procedures (SOPs) and direct command and staff communications are encouraged.

The primary objective of the CAPSTONE Program is to optimally align RC units based on USAREUR's wartime requirements and to develop an associated methodology permitting AC and RC units to train and plan in peacetime with the command with which they will deploy and fight in wartime.

The second objective of the CAPSTONE Program is to provide definitive guidance that can be used to plan and structure the RC force. CAPSTONE permits the alignment of the numerous programs developed by various elements of the U.S. Army with the RC management system and will ultimately define a basis for mobilization, stationing, and development of an RC force that has been tailored in peacetime in accordance with how it will be used in wartime. CAPSTONE will result in a single source document, known as the Intensive Management Force List (IMFL), which will be used to build and maintain programs affecting the RC.

The IMFL will list units in priority sequence and highlight those units that, due to their mission essentiality, deserve special resourcing. The many U.S. Army programs and actions with which CAPSTONE will interface or impinge upon in some manner are shown in table 1. CAPSTONE is an approved, functional program that is being implemented Army-wide.

A number of programs that were intended to improve RC training readiness were already in existence before CAPSTONE was implemented and several programs have been developed as a result of CAPSTONE. Relationships that might affect an Armor unit, either AC or RC, include the Affiliation, AC/RC Partnership, Mutual Support, and ARNG Attack Helicopter Counterpart Programs.

The Affiliation Program is funded and directed by the AC and is designed to improve the operational readiness of RC units that are required to support mobilization contingencies. RC units are affiliated for roundout, augmentation, or mobilization and deployment capability improvement (MDCI) (table 2).

Roundout. Active Army Divisions, due to manpower constraints, may be organized with fewer maneuver units than the number required in a "standard" configuration. RC units may be designated as a roundout unit to raise the understructured division to the desired configuration. RC roundout units have the same priority for resources as their active affiliates and are scheduled to deploy with their AC division sponsor at mobilization.

Augmentation. Augmentation increases the combat power of an AC unit by the addition of RC units. RC augmentation units have a priority for resources consistent with their position on the deployment schedule. They deploy with or immediately follow their AC affiliates.

Mobilization and Deployment Capability Improvement. MDCI units are RC units that neither roundout nor augment

Table 1. Programs and Actions Affected by CAPSTONE	
Troop Action Programs	Mutual Support Program
Mobilization Stationing Plan	Full-time Support
Affiliation Program	LOGEX
Force Modernization	Reforger
Total Army Analysis	OCONUS Training Programs
Joint Readiness Program	Annual Training Programs
Active Force FTX	Active Force CPX
Time-Phased Force Deployment Data	

AC units, but require dedicated AC assistance to meet deployment schedules. These RC units have a priority for resources consistent with their position on deployment schedule. The majority of RC units affiliated under this category are combat support and combat service support.

The AC/RC Partnership Program was designed to establish a continuing partner relationship for training assistance and mutual support between major AC and RC combat units (divisions, brigades, and Armored Cavalry regiments). Partnership units (table 3) are encouraged to exchange personnel or units to participate in training exercises and conferences throughout the training year. As a minimum the AC partner should provide a training support package for the RC partner during the AT period, IDT support whenever possible, and an evaluation of the RC unit during its AT. The affiliation program, previously discussed, is not affected adversely by the Partnership Program for either the AC sponsor or the RC affiliate.

Table 2. Affiliated Separate Armor and Cavalry Units

Sponsor	RC Unit	Component	Affiliation Category
3d Armd Cav Regt	1-108th Cav Sqd	MS ARNG	MDCI
1st Cav Div	1-263d Armd Bn	SC ARNG	RO
2d Armd Div	149th Armd Bde	KY ARNG	AUG
	2-252 Armd Bde	NC ARNG	RO
7th Inf Div	8-40 Armd Bn	AZ USAR	RO
5th Inf Div (M)	2-152 Armd Bn	AL ARNG	RO

RO—Round out AUG—Augmentation MDCI—Mobilization, deployment, and capability improvement

Table 3. AC/RC Partnership Units

AC Unit	RC Unit	Component
101st Abn Div (AASLT)	42d Inf Div	NY ARNG
	39th Inf Bde	AR ARNG
	73d Inf Bde	OH ARNG
	187th Inf Bde	MA USAR
3d Armd Cav Regt	163d Armd Cav Regt	MT, TX, ARNG
	116th Armd Cav Regt	ID, OR ARNG
172d Inf Bde (Sep)	205th Inf Bn	MN USAR
	207th Inf Gp	AK ARNG
193d Inf Bde (Sep)	92d Inf Bde	PR ARNG
	53d Inf Bde	FL ARNG
194th Armd Bde (Sep)	30th Armd Bde	TN ARNG
	107th Armd Cav Regt	OH ARNG
197th Inf Bde (Sep)	33d Inf Bde	IL ARNG
25th Inf Div	29th Inf Bde	HI ARNG

The Mutual Support Program is an informal program of identifiable, concerted working relationships between AC and RC units that is beneficial to one or more of the elements, in any combination of involvement. This program is supervised and administered on an informal basis with the ultimate aim of AC and RC units participating jointly in training and assistance projects as often as possible. Soldiers of both components assume roles of instructors and students and provide mutual support to each other to improve both AC and RC training readiness.

The ARNG Attack Helicopter Counterpart Program was established to improve the combat capability of selected ARNG attack helicopter units by aligning them with similar AC units, thus increasing their knowledge of operation and employment of the *AH-1* family of aircraft.

Training support under this program includes all unit personnel: aviators, crew members, and maintenance personnel. Opportunities are available for including RC unit members in New Equipment Training Team (NETT) programs with their AC counterparts. Wherever possible, counterpart alignments support either CAPSTONE or existing alignments under the AC/RC Partnership Program.

AC units involved in providing training assistance to RC units under the provisions of any of the programs described above must remember that, although they share the responsibility for seeing that the RC unit is trained, the principal responsibility for RC unit training rests squarely with the RC chain of command.

All of these programs have the potential for improving the training assistance and support that is provided to RC units. With new equipment being distributed to both the AC and RC Armor force as a result of force modernization efforts, Partnership, Mutual Support, and Counterpart Programs will play an even greater role in providing advice, training, assistance, and support to the RC Armor/Cavalry partner during both IDT and AT periods.

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MAJOR DONALD B. SKIPPER was commissioned Infantry upon graduation from OCS in 1969 and has commanded both Infantry and Armor units. A former staff officer in the 3d Armored Division and the Office of Armor Force Management, he received a branch transfer to Armor in 1972. He is a graduate of the Command and General Staff College and the University of Southern California with a masters degree in systems management. Major Skipper is currently serving with DCSOPS, FORSCOM and is an adjunct professor with St. Leo College.

Electronic Warfare and CP Survivability

by Captain William L. Mundie, Jr.

The capability of the U.S. Army to be a flexible and responsive force on the modern battlefield is dependent on the command and control of large forces through networks of complex communication systems. However, these systems can be seriously affected by the enemy. Therefore we must improve the methods we use to protect them from electronic warfare (EW) exploitation such as that described in the following scenario.

A battalion tactical operations center (TOC) has established operations near the crest of a hill or ridge to facilitate communications to forward units of the battalion and the brigade TOC. The high-frequency (HF) radio teletype (RATT) and five or so very-high-frequency (VHF) frequency-modulated (FM) antennas are erected, and normal tactical radio traffic is sent and received.

The enemy, while conducting normal radio signal intelligence (SIGINT) surveillance, scans the frequency spectrum and picks up a radio emitter. Within 10-15 minutes, a signal analyst is sure of the station's function in the net. If the station is determined to be a net control station, or report-receiving and order-giving station, or uses secured communication devices, it is considered important and radio direction-finding (RDF) specialists obtain a fix on the emitter's location. Then, an electronic signature of that area is established and a determination is made as to the type of SIGINT target involved. In this case, the electronic signature shows an HF RATT station and numerous VHF, FM emitters (4-7 FM nets). After this information is collected and analyzed a decision must be made. Are the emissions more important to intelligence as SIGINT sources, or is the destruction of this obvious command and control mode more important in obtaining tactical advantage? The enemy commander decides that the destruction of the TOC is more advantageous and orders a 122-mm multiple rocket battery to fire, using the RDF data.

Survival

The foregoing scenario is not unrealistic and the personnel in that TOC did nothing any differently than is done in most TOCs in command posts (CP) throughout the Army. They did what was expedient. They intended to move often and they wanted to constantly maintain excellent communications with forward units and higher headquarters located to the rear. Those were all excellent objectives, but present-day technology teamed up against their command and control objectives and the equipment they used as radio emitters.

During the 1973 Yom Kippur War, Egyptian and Syrian forces, using Soviet EW equipment and doctrine, located and destroyed Israeli command and control centers within 10-15 minutes. This loss of command and control, in the early stages of that conflict, added significantly to the confusion on the battlefields and was, in no small way, responsible for early Egyptian and Syrian gains.

In an "outnumbered" scenario we can ill afford loss of contol or flexibility. If our battalion and brigade CPs are destroyed, we lose one of our equalizers—our ability to exercise superior command and control in fluid battlefield conditions. A series of electronic counter-countermeasure (ECCM) techniques can be used to make exploitation by enemy EW specialists more difficult and increase a TOC's chances of survivability.

First, mask emitters that operate in nets to rearward units (next higher HQ, etc.) by placing hills, forests, or buildings between the antennas and the forward edge of the battle area (FEBA) (figure 1). (RDF and intercept equipment will gravitate toward the high terrain on the enemy side of the FEBA.) This will reflect and scatter much of the radio wave and reduce the signal power received by the enemy. If only one or two RDF stations can receive a signal strong enough to get a fix on the emitter, the reliability of the fix is reduced to near worthlessness. To insure reduced signal reception by enemy SIGINT, construct field-expedient unidirectional antennas for radios operating in rearward nets. The reduced wave pattern generated in the direction of the FEBA, when coupled with rear-slope masking will nearly guarantee unusable DF fixes and greatly reduce the electronic signature seen by enemy ground SIGINT stations. (Simple field expedient construction of unidirectional antennas will be discussed later.)

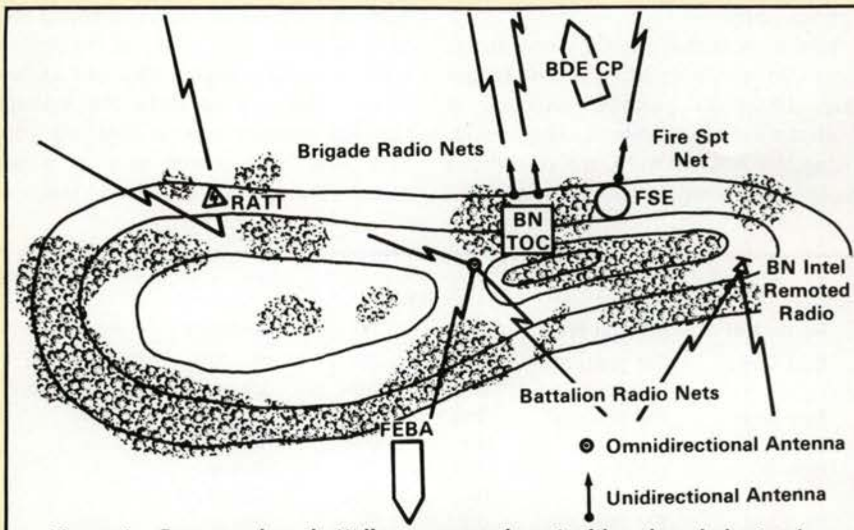


Figure 1. Reverse-slope battalion command post with reduced electronic signature due to unidirectional antenna and reverse-slope sighting.

The second ECCM measure is to position radio emitters as far apart as possible. Placing all your emitters and radios in one remoted location, removed from the CP, will invite the remote's destruction and the loss of communication due to the electronic signature of the remote site. The user should keep his own antenna and radio, with one or two exceptions, and the CP should be spread out more. Operations and intelligence sections can still collocate for effective coordination, but the rest of the CP's communication assets can be spread around one or two grid squares. Runners can carry messages from one area to another until wire lines are layed. Security of the CP will become more difficult, but each section or vehicle crew can provide security to their own area. Perimeter security could be limited to major access routes and reaction force duty. When the techniques just discussed are applied, the HF RATT is separated from the main TOC complex and the FM emitters are spread throughout the area; therefore, an RDF fix in conjunction with an electronic signature of the area may not give adequate data for pinpointing the heart of the TOC, and destroying it with indirect fire weapons.

In the event that the CP's operations net radio transmits often or for longer than 10-second periods, remoting it from the CP area should be considered. Using the AN/GRA-39, the operations radio can be remoted by wire up to 3 km away. However, the distance should be more a factor of setup than obtaining a maximum spread between the operations and intelligence radios.

The third ECCM technique calls for frequent movement of the TOC. The longer a TOC stays in one place, the more methods the enemy is able to employ to pinpoint its location, and the longer he has to react to that knowledge. Rate of movement will depend on the tactical situation and intelligence reports on enemy EW activities in the sector. If an enemy offensive is expected, and you must communicate from the TOC (i.e., radio silence is impractical), move as often as possible, because the enemy will want to target command and control nodes in order to disrupt organized resistance.

The fourth ECCM technique requires the reinforcement of strict radiotelephone procedures. Keep transmissions as short as absolutely possible and use low power to transmit. If the desired station doesn't answer the call in low power, then try to relay the message through another station that has contact. Use high power only as a last resort. The idea is to limit, as much as possible, the distance the wave travels across the FEBA and the duration of transmission. This increases the enemy RDF operator's degree of error and length of time required to locate the emitter. Scattering and absorption of our electromagnetic energy, before it is received by enemy EW stations, is more easily accomplished at low power than at high power.

The ECCM techniques just discussed are not new, but their collective use by TOC or CP sections are often disregarded in favor of simplicity or expediency. When applied, these ECCM techniques take no longer than the incorrect practices, and when they are coupled with good TOC and CP cover and concealment, they will greatly improve the survivability of command and control in each battalion and brigade in a conflict where the EW threat is real and sophisticated.

Field Expedient Antennas

The field-expedient, unidirectional antenna is one of the most important ECCMs and will do more to conceal emitters from ground-oriented electronic signature analysis than anything else, short of turning the radio off. The use of the terminated long-wire and the half-rhombic, or inverted-vee, in lieu of the whip antenna or *RC-292,* within the confines of the TOC, will be of great benefit in countering the Soviet EW threat. Radios used to communicate toward the rear (to higher HQ) will have little or no trouble using low power and reverse slope locations due to the increased antenna gain unidirectional antennas provide. They will also have virtually no exploitable radio emissions crossing the FEBA.

Consider the following situations (figure 2):

If all three battalions CP's use unidirectional antennas in the brigade nets and 1st and 3rd battalion orient their antennas halfway between themselves and the brigade TOC, it is possible for all stations to communicate using low power. The brigade will have to use an omnidirectional antenna in the net, especially if the battalion CP's are somewhat spread out. However, the low-power signal will not carry as far across the FEBA as it would have at high power. Table 1 shows recommended antenna and power usage for various nets found at brigade and battalion level. The table is not all inclusive and does not hold for all terrain conditions and tactical situations.

Table 1

Radio Net	Emitter Net	From	To	Antenna	Power
Bde Opns	FM (secure)	Bde	Bn	*RC-292*	Low
		Bn	Bde	Uni-	Low
Bde Intel	FM (secure)	Bde	Bn	*RC-292*	Low
		Bn	Bde	Uni-	Low
Bde Opns	RATT	Bde	Bn	Omni-	
		Bn	Bde	Doublet*	
Bn Cmd	FM (secure)	Bn	Co	Omni-	Low
Bn Intel	FM (secure)	Bn	Co	Omni-	Low
FSE	FM	Bn	DS Bn	Uni-	Low

*Position doublet on reverse slope and as low to ground as good communications will allow.

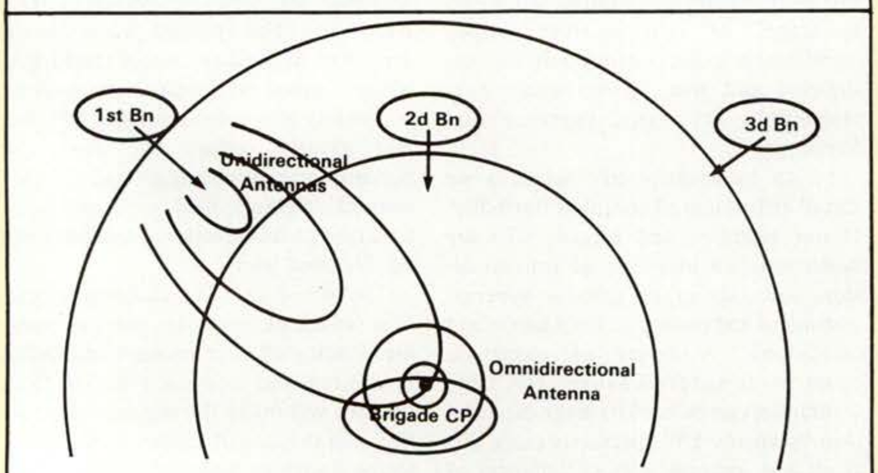


Figure 2

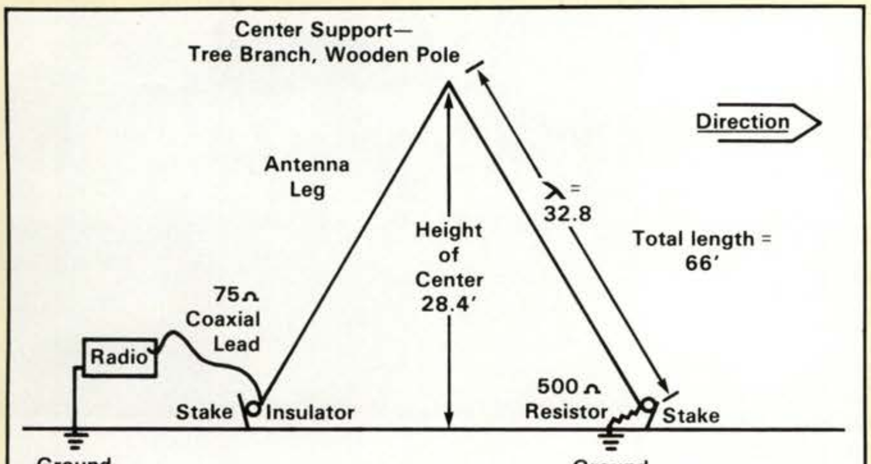


Figure 3

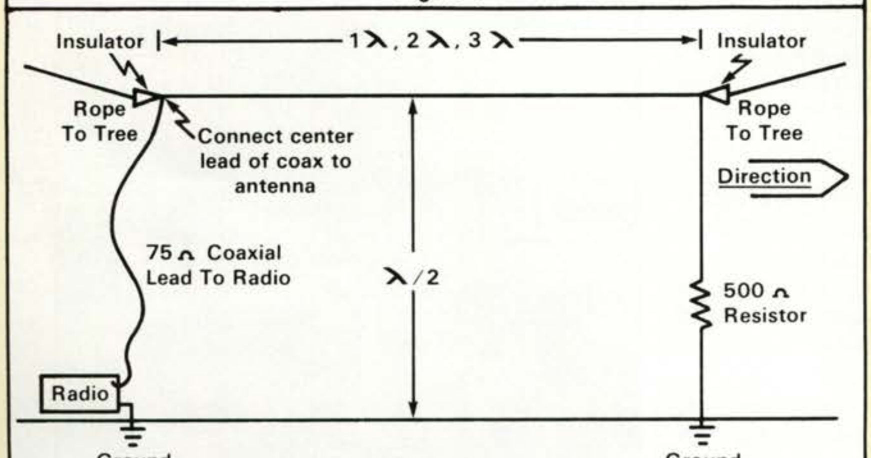


Figure 4

The following examples of field expedient unidirectional antennas can be made of *WD-1* communication wire. The insulation does not need to be stripped off except at connection points.

Transmission lines can be made from the 75-ohm coaxial cable used by the *AN/VCR-12* family of radios to connect the radio to the antenna matching unit. *RC-292* cable is also usable.

Insulators can be made of wood, plastic, glass, or even nylon rope.

Terminating resistors should be noninductive, 500 to 600-ohm resistors capable of dissipating about 1 watt in the *AN/PRC-77* type and *AN/VCR-12* family of radios operating at low power. Ten to twenty-watt dissipating resistors are necessary for the *AN/VCR-12* family of radios at high power. These resistors are inexpensive, and any electronics parts store would have them. In a pinch, a field-expedient resistor can be made from a plastic earplug container, with chain removed, and filled with water and a C-ration packet of salt.

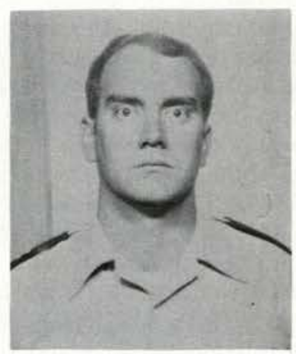
Poles used to erect these antennas should be nonmetalic, so as not to change the desired wave pattern characteristics. Wooden poles are best and readily available in most areas. Using trees for antenna suspension is the best alternative to carrying poles everywhere you go.

Unidirectional Half-Rhombic Antenna

This antenna (figure 3) has a complex method of generating its waveform, and should be constructed, as close as possible to this design. A change in leg length, center height, or launch angle could change its desirable features. The antenna feed line from the radio to the beginning of the antenna should be 75-ohm coaxial cable. The terminated end should have a 500-ohm resistor of appropriate wattage. The radio and the terminated end of the antenna (after the resistor) should be grounded. A pole or suspended and insulated rope will support the center. The resistor-terminated end should be pointing in the direction in which you want to communicate. There is very little back lobe and negligible sidelobes. For maximum flexibility, cut the antenna for 30 MHz and it will work for the entire FM bandwidth. Total length should be 66 feet (this allows for connections), with each leg 32.8 feet long. When erected, the antenna should form an equilateral triangle (each angle 60 degrees). See figure 3 for the procedure

Unidirectional Terminated Long-Wire Antenna

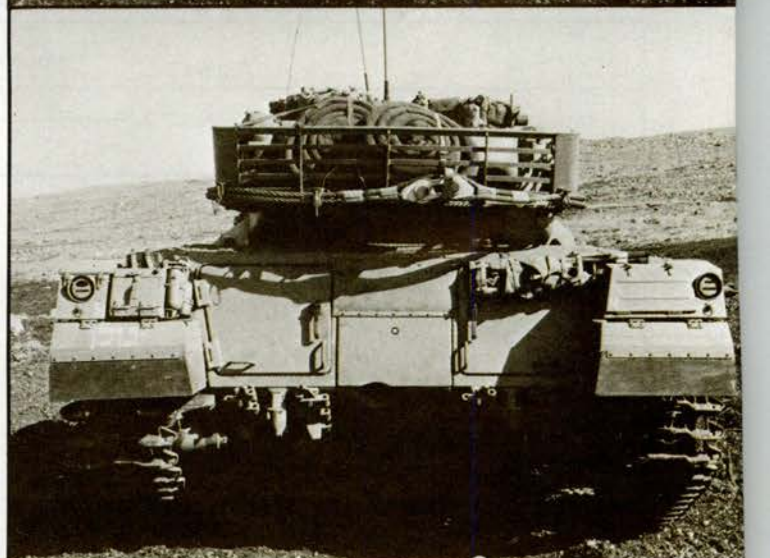
This antenna (figure 4) is to be one or more wavelengths in length. For maximum efficiency, it should be cut to the transmit frequencies in multiples of the wavelength. For maximum flexibility, it can be cut for 30 MHz and used for all higher frequencies. Termination is through a noninductive 500-ohm resistor of appropriate wattage. The radio and resistor-terminated end need to be grounded to provide a return path from the termination to the radio. Antenna feed should be through a 75-ohm coaxial cable with the shield grounded to the radio. Antenna height above ground will be one-half the wavelength of the transmit frequency, no matter how long the antenna. Maximum antenna gain will be from the terminated end, so be sure to point it in the direction desired.



CAPTAIN (P) WILLIAM L. MUNDIE, JR., is a student at the Naval Postgraduate School, Monterey, CA and is due to graduate in December with a master of science degree in electrical engineering. Prior to assignment there in, November 1979, Captain Mundie served as commander, Co C, 9th Sig Bn, Fort Lewis, WA. Other assignments included duty as regimental communication platoon leader and squadron communication officer in the 11th Armed Cav Regt, and battalion and brigade communication officer in the 9th Infantry Division. He also attended the Signal Officer Advanced Course, Ft Gordon, GA.

Merkava

by Second Lieutenant Mark Urban
British Territorial Army



Israel's program to produce her own tank appears to have begun in earnest in 1970, although theoretical work had been going on for some time previously. That year had marked the end of Israel's attempt to buy the British *Chieftain* tank following an embargo on its sale to Middle Eastern countries by the British Foreign Office. Evidently, this placed Israel in a situation of dependence on the United States, something that was, in the long-term, politically and militarily undesireable. The lessons of the 1973 War, probably well known to readers, must have had a considerable effect on the vehicle's final design parameters.

The *Merkava* has been modified constantly in the last few years as a result of developmental experience and infighting among Israeli generals. This infighting has concerned tactics, the vehicle fit, and production arrangements. One group of influential Israelis attempted to transfer production of the vehicle away from the Ordnance Corps (under the auspices of General Tal) to a semi-civilian concern modeled on Israeli Aircraft Industries (IAI) with an element of civilian management.

Eventually, the details were finalized, and in October 1979, operational units began receiving production vehicles. Today, production is in full swing, with *Merkava's* 30,000 parts being produced at over 230 plants in Israel, and approximately 12 percent of them being imported from abroad.

The production of *Merkava* has been an extremely expensive business—development costs alone are thought to have exceeded $43 million.

So on to a description of the vehicle itself, which we will call *Mk-I* main battle tank (MBT). Protection has been given a very high degree of importance in *Merkava*. The vehicle has been designed with firing from hull-down positions in mind, a result of experience in the Yom Kippur War, particularly on the Golan Heights. The turret is extremely well angled, and is cast in five parts (an inner shell, two side castings, roof, and turret rear overhang). The final assembled casting weighs 7 tons. A space of about 3 inches is kept between the two turret side walls (each of which are about 3 inches thick themselves). 7.62-mm GPMG ammunition is stored in this space. Throughout the vehicle, protection is enhanced by the clever use of stowed material in spaced armour. Naturally, the boldest step from the point of view of armoured design has been the mounting of the engine and transmission at the front with an obvious improvement in crew survivability.

Particular emphasis has been placed on defeating HEAT warheads used by enemy tanks and antitank guided missiles. One of the principal hazards caused by these rounds is one of internal explosions. Spectronnix, an Israeli firm, has developed an explosion suppression system that uses an inert agent, Freon 1301, to stop the explosion within 60 milliseconds before burns are caused (burns occur at 100 m/secs and beyond, and the crew is killed at 240 milliseconds). The absence of smoke dischargers seems to suggest a system of injecting fuel into the exhaust to generate protective smoke.

The vehicle's main armament remains the trusted 105-mm gun. This provides reliable firepower and standardization with the rest of the fleet. In the Yom Kippur War, engagements were generally at close range (1,000 meters being typical in the Sinai and 300 m in the Golan Heights), and the 105-mm gun is adequate at these ranges. The operational life of these guns has been extended by the adoption of IMI's Mill armor-piercing, fin-stabilized, discarding-sabot round. The projectile has a tungsten penetrator and a slipping driving band, and has also been accepted by the West German *Bundeswehr*. Fifty-two rounds are carried in the hull and 8 ready rounds in the turret. A further 16 rounds can be carried, but this makes evacuation through the rear door impossible. Thus, *Merkava's* maximum ammunition load of 76 rounds gives it the ability to engage enemy forces for longer than any other tank available to the Israelis. It also gives a significant edge over enemy armour, for example, being almost twice the ammunition load of a *T-62*. When *Merkava* does leave the battlefield for more rounds, reloading through the rear doors can be accomplished in 15-20 minutes, as opposed to 45 in other tanks. The gun has a maximum elevation of +20 degrees and depression of -10 degrees. The fire control system incorporates a laser made by Elpo Ltd., and a computer by Elbit Ltd. Production models of *Merkava* have been fitted with a muzzle reference system to allow rapid checking of sight alignment without leaving the vehicle.

Mobility is often held up as *Merkava's* weakest design

characteristic. It is powered by a Teledyne Continental AVDS-1790-5A V-12 engine developing 900 horsepower; transmission is through an Allison CD 850-6-B system. Wheel travel is 210-mm compared to 159-mm on the *Chieftain* and 381-mm on the *M-1*. It is thought the Israelis were aiming for a strong system able to provide a comfortable ride even over the rocky Golan. If we are speaking of mobility, it is as well to remember that the Merkava can go over ground which other tank suspensions (particularly the torsion bars of American supplied tanks) are too weak to handle. The track is the dry-pin type, consisting of 112 links. The vehicle's weight has previously been overestimated and is now believed to be around 56 tons.

A computer-controlled navigational system designated T-LANS and built by the Tamam division of IAI is fitted. It gives the commander the vehicle's exact position, day or night, whatever the territory, and is accurate to within 125 m over a distance of 50 km.

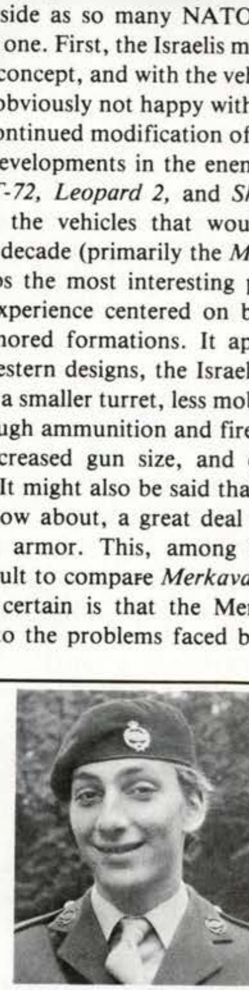
Merkava has already undergone considerable modification since the pre-production stage, and continuing improvements make the exact specification of the *Mk-II* somewhat difficult to ascertain.

The principal area of improvement lies in the field of mobility. A new engine, the Teledyne Continental AVCR 1790 is widely thought to be fitted. The *Mk-III,* which has now begun trials, will enter service by the end of the century. *Mk-III* is intended to give a 50 percent improvement in mobility over *Mk-I*. This will be accomplished by fitting it with a gas turbine engine and hydropneumatic suspension. While the *Mk-I's* mobility represented an improvement over that of Israeli tanks presently in service, a further improvement has been made essential by the spectre of Syrian *T-72s* and Saudi Arabian *Leopard 2s*.

Furthermore, the recent acquisition by Jordan of the British *Shir I* with its 120-mm gun and computer fire control system may mean the adoption by Israel of a larger calibre main armament. A new weapon does not seem readily to present itself. The Israelis do not appear to hold much affection for a smoothbore gun. Israeli sources are remaining tight-lipped about what improvements are intended in the firepower field, which may be evidence of an indigenous development program; on the other hand, it might not be. They have announced, however, that *Mk-III* will be 100 percent better protected than *Mk-I*, which one would suppose could only be accomplished by adopting composite or "Chobham" armour.

The many changes in specification, even on early models, and the public exchanges on costs, delays, and management, all point to considerable conflict in the development of *Merkava*. We might ask ourselves why the project has continued, in the light of these difficulties, and why, at a time when Israel is cutting its defence budget substantially, this venture has not fallen by the wayside as so many NATO ones have. The answer is not a simple one. First, the Israelis must be satisfied with the overall design concept, and with the vehicle's performance. Second, they are obviously not happy with their present tank fleet and feel the continued modification of these vehicles can no longer match developments in the enemy armor (i.e. the introduction of *T-72, Leopard 2,* and *Shir I*). Finally, they do not consider the vehicles that would be available to them over the next decade (primarily the *M-1*) to suit their needs. This is perhaps the most interesting point, considering the Israelis' past experience centered on battles against massed Soviet-style armored formations. It appears that, compared with current Western designs, the Israelis are looking for more protection but a smaller turret, less mobility, improvements in firepower through ammunition and fire control technology rather than increased gun size, and easier replenishments of ammunition. It might also be said that, for all gadgetry on *Merkava* we know about, a great deal more must lurk unseen beneath the armor. This, among other things, makes it extremely difficult to compare *Merkava* with its likely adversaries. What is certain is that the Merkava represents an original solution to the problems faced by the Israelis.

SECOND LIEUTENANT MARK URBAN served in the 4th Royal Tank Regiment and is currently an officer in the (British) Territorial Army. He is a student of International Relations at the London School of Economics.



The Panhard ERC-90 S

by Richard M. Ogorkiewicz

Photos courtesy of SCM Panhard & Levassor

The creation of the Rapid Deployment Force (RDF) and other recent developments have placed new emphasis on the strategic mobility of military equipment. In consequence, there has been a marked revival of interest in armored vehicles that are light and, therefore, mobile in the strategic sense.

There is, in fact, quite a number of armored vehicles that possess these characteristics. However, it is not sufficient for them to be strategically mobile. To be effective they must also have considerable firepower and the number of vehicles that possess this attribute as well as being light is relatively small.

The *ERC-90 S*, developed recently by Panhard, is an outstanding example of an armored vehicle that is both very light and has considerable firepower. Panhard is located in France, in the Paris area, and is the world's longest established producer of combat vehicles. In fact, Panhard has been involved with combat vehicles since before World War I. Much more recently it has produced the eight-wheeled EBR, which has been used by French armored cavalry units for 30 years and which is still one of the most sophisticated wheeled armored vehicles ever built. More recently still, Panhard has produced the AML family of light, four-wheeled armored vehicles that are currently in service in more than 30 different countries.

From all this existing experience with wheeled armored vehicles Panhard has now produced the ERC, which stands for *Engin de Reconnaissance Canon*, or "gun-armed reconnaissance vehicle."

Turret-mounted 90-mm Gun Armament. The ERC is a six-wheeled armored vehicle that weighs only 7.4 metric tons, combat loaded, but which is armed with a turret-mounted 90-mm gun. The gun is a smoothbore, and in this and its caliber (relationship of tube length to bore diameter) it is similar to the guns mounted in several other light armored vehicles, including Panhard's EBR and AML. However, the gun is of a new type, with a longer tube, and is considerably more effective than all earlier 90-mm smoothbore guns.

In particular, the 90-mm/22-caliber gun of the ERC is capable of higher muzzle velocities than the other 90-mm guns. For instance, it fires fin-stabilized, high-explosive antitank (HEAT) projectiles with a velocity of 950 m/s (3,116 ft/s), which gives them a flatter trajectory than other similar guns and increases the probability of hitting targets.

At the same time, the shaped charge of its HEAT projectiles can penetrate 320-mm of steel armor at normal impact, or 120-mm when the armor is inclined at 65 degrees to the vertical. This makes the ERC capable of perforating the armor of battle tanks currently in service.

In addition to the HEAT projectiles, the 90-22 gun of the ERC can also fire high explosive, smoke, and canister as well as training rounds. What is more, unlike all the other 90-mm guns, it fires armor-piercing, fin-stabilized, discarding-sabot, (APFSDS) projectiles. Their muzzle velocity is 1,300 m/s (4,264 ft/s) and they can penetrate plates of steel armor 120-mm thick, inclined at 60 degrees from the vertical, at up to 2,000 meters. At first sight, this might appear inferior to the performance of HEAT projectiles. In fact, it is not because the depth to which HEAT projectiles can penetrate armor is generally considerably different from the thickness of armor that they can penetrate with lethal effect, whereas the armor penetration by APFSDS is usually lethal.

In consequence, the ERC can engage battle tanks with APFSDS rounds at least as effectively as with HEAT rounds. This gives it several important advantages over other vehicles armed with different 90-mm guns that rely solely on HEAT ammunition to defeat the armor of hostile tanks.

Advantages of APFSDS ammunition. The most important of these advantages is that the performance of HEAT projectiles has been greatly reduced by the development of new types of armor. The new types of composite, "special" or "Chobham" armor are already incorporated in the design of tanks such as the German *Leopard 2*, the British *Challenger* and Vickers *Valiant,* as well as the U.S. *M-1 Abrams.* It is generally thought that some kind of new armor is also incorporated in the latest Soviet battle tank, commonly referred to as the *T-80.* All this throws very serious doubt on the antitank capabilities of 90-mm guns that depend solely on HEAT ammunition. At the same time, it enhances the value of guns that can also fire APFSDS projectiles, like the 90-22 gun of the ERC.

Its APFSDS ammunition also gives the ERC the advantage of high muzzle velocity, which implies a flatter trajectory than those of all HEAT projectiles and inherently higher hit probability. In fact, the muzzle velocity of the APFSDS projectiles is such that, at the most likely range of engagements, the gunner of the ERC only needs a telescopic sight that is simple and can be accurately aligned with the gun. However, if required, the ERC can be fitted with more elaborate fire control equipment.

To improve its accuracy, the gun of the ERC is fitted with a thermal sleeve that reduces tube bend. The gun is also fitted with a muzzle brake. This obviously reduces the recoil forces and makes the gun more compatible with a vehicle as light as the ERC. It also represents an interesting advance in gun design because, previously, muzzle brakes were thought to be incompatible with ammunition incorporating discarding sabots. In fact, the 90-22 gun of the ERC is the first example to appear of a gun which has a muzzle brake and fires APFSDS projectiles.

In addition to its 90-mm gun, the turret of the ERC mounts the usual coaxial machinegun. The turret is manned by a crew of two and provides stowage for 20 rounds of 90-mm ammunition. An additional 10 to 20 rounds can be stowed in the hull.

The effective armament of the ERC is all the more remarkable in view of its light weight of 7.4 metric tons (16,280 lb). In fact, in relation to its weight, the ERC has more gunpower than any other light armored vehicle built so far. At the same time its light weight makes it relatively easy to carry in transport aircraft and it is light enough to be lifted by heavy helicopters.

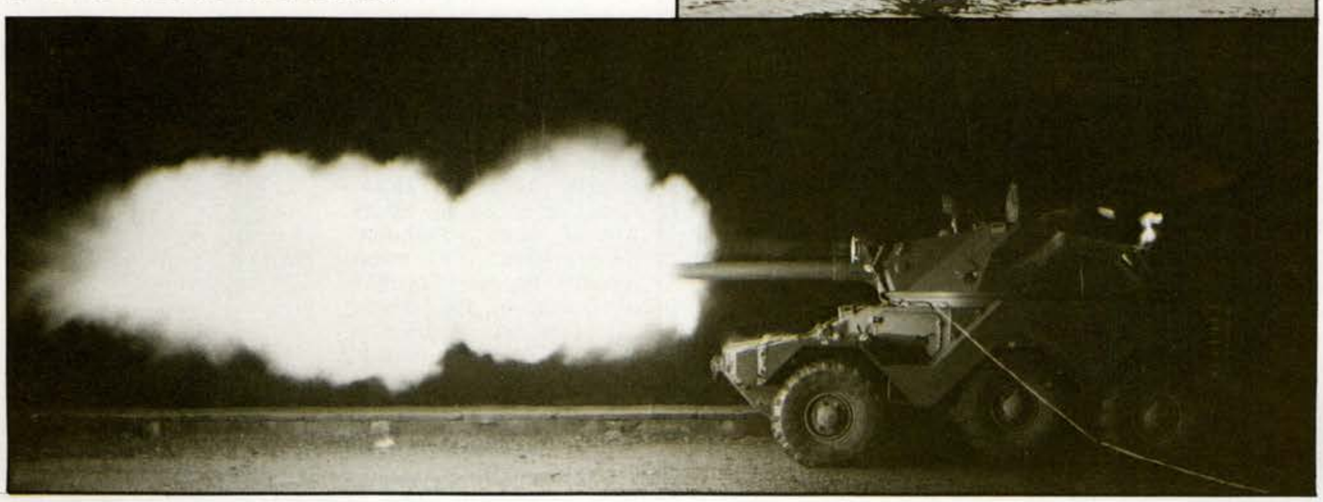
Optimized automotive design. The ERC also has other virtues than its gunpower and light weight. These include six closely spaced wheels, which represent the optimum arrangement for wheeled armored vehicles. Another virtue of the ERC is its drive train, which runs down the sides of the hull so that there are no shafts, differentials, or other drive-line components in the center of the vehicle, either above or below the hull floor plate. In consequence, the top of the hull of the ERC is no higher above the ground than that of an equivalent tracked amored vehicle. This makes the ERC very different from most other wheeled armored vehicles and gives it a significantly lower silhouette.

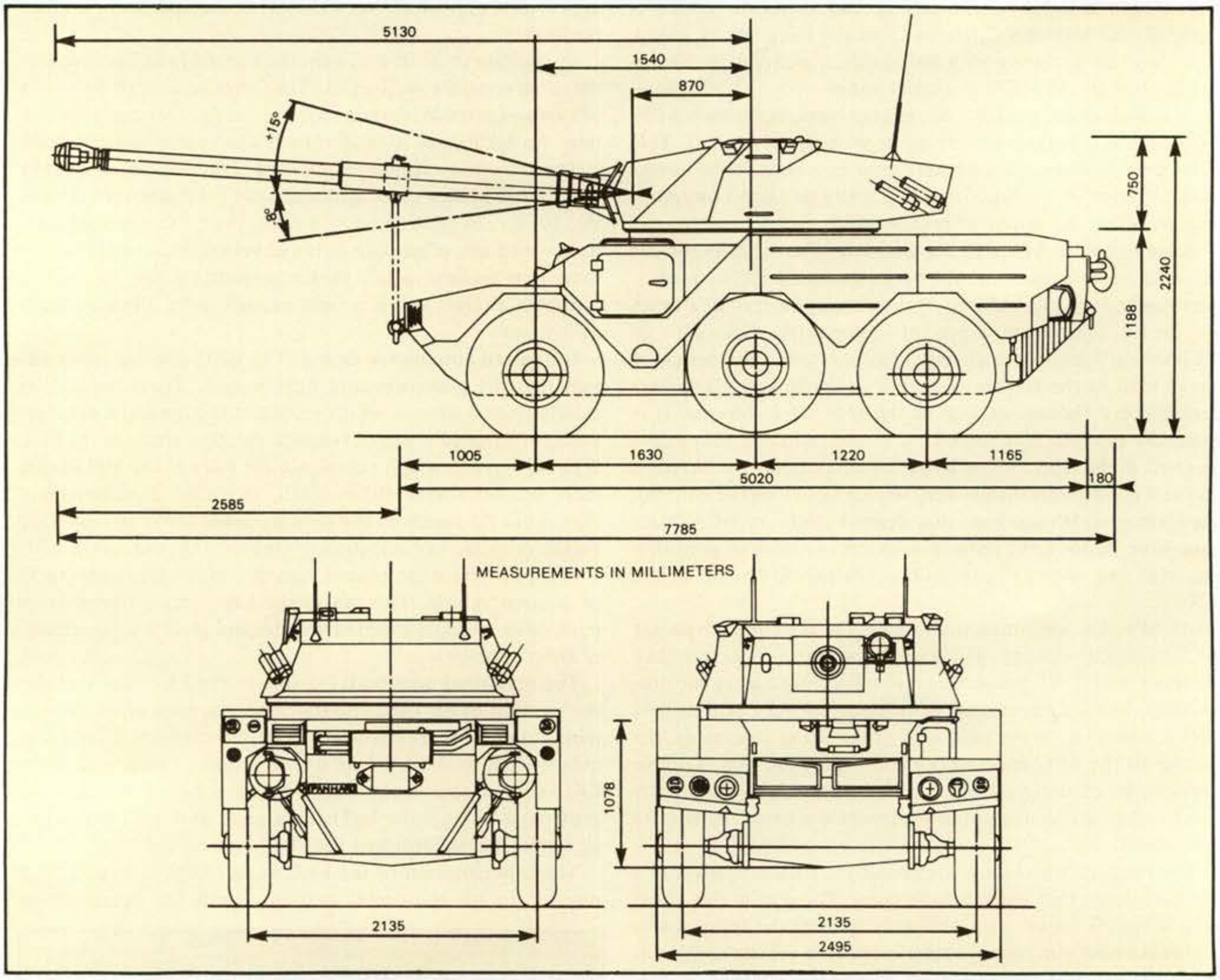
The optimized automotive design of the ERC also includes the location of its wheels on trailing arms, each of which contains a train of gears through which the wheels are driven. The independent location of its wheels' trailing arms makes the ERC comparable again with tracked armored vehicles and provides it with a wider hull in relation to its overall width than all other wheeled armored vehicles.

The sophistication of the ERC design extends to making it possible to lift the center pair of wheels for operation on

(Below) *Panhard* ERC firing its 90 mm gun: note that it can do this even with the centre pair of wheels raised off the ground.

(Right) *Panhard* ERC swimming, using its two hydrojets for propulsion. Note the engine compartment ducts in the raised portion to reduce the risk of flooding.





roads, when four wheels are sufficient and more efficient. Running on four wheels on roads has also made it possible to confine steering to the front pair of wheels and this, in turn, provided more hull width, because the center pair of wheels does not have to turn for steering.

Amphibious version. In its basic form the ERC is not amphibious, but it can ford water up to 1.2 meters deep. However, its light weight makes it relatively easy to convert it into an amphibian. To make it amphibious, it is fitted with sheet metal floats at fender level, the floats being filled with a closed-cell foam to inhibit the entry of water in the event of their being punctured by bullets. The amphibious version is also fitted with two hydrojets. This gives the ERC a water speed of 9 km/h (5.6 mph), which is approximately twice the speed of vehicles propelling themselves in water, as well as on land, by means of their wheels. In addition to the usual hinged splash board on trim vane, there are also two swivelling ducts at the sides of the engine compartment deck that are raised for water operation to prevent the engine being flooded, even when water sweeps over the top of the hull.

All these features make the ERC one of the most interesting light armored vehicles to have been developed recently. Its characteristics are of particular interest in relation to the requirements for armored vehicles that are light and, therefore, strategically mobile but that must, at the same time, carry effective armament.

The French Army has recently adopted the Panhard ERC for the armored regiment of its RDF. A version of the ERC called *Lynx* has also been ordered by the Marines of the Argentine Navy and by Mexico for its cavalry regiments.

RICHARD M. OGORKIEWICZ is a consultant on armored vahicles and also lectures on mechanical engineering at the Imperial College of Science and Technology in London. In addition to England, he has lectured and advised on armored vehicles in many other countries, including Brazil, Israel, Japan, Republic of Korea, South Africa, Spain, Sweden, Switzerland and, most recently, Peoples' Republic of China. In the United States he has lectured at TARADCOM and other U.S. Army installations and participated in the Armored Combat Vehicle Technology Program as well as combat vehicle studies for the Defense Advanced Research Projects Agency. He is also the author of two books and about 300 articles on armor, including 39 in ***ARMOR***, beginning 30 years ago in the July-August 1950 issue.

A Cure for the "Cross-Attachment Blues"

The recommendation of the Division 86 studies will bring many organizational changes to the combat arms, including a four-tank platoon for armor units. But there will be no combined arms battalions. So, company and battalion commanders will continue to operate to the strains of an old familiar tune, "The Cross Attachment Blues."

Think Combined Arms. I had long regarded the words with the reverence due to the accumulated military wisdom of the ages. Now, having learned that my tank company was to be cross attached to an infantry task force, I looked upon them with apprehension, even with a suspicion that eroded my faith in their value.

How could the Old Man do it? How could he trade away his best tank company? My mind rejected the logic of the situation, and entertained instead visions of conspiracies by staff officers who didn't like me anyway. My tank company was to be sacrificed to the principle of combined arms. I analyzed the changes that would accompany integration into an infantry task force, and immediately dreams of armored thrusts, sweeps, and irresistably fast moving tank attacks faded from my mind. My mind's eye shifted to the nightmare of logistics, support of all kinds, and the inevitable parceling out of my platoons—the dissolution rather that the concentration of combat power.

I had long suspected that infantry officers conceived of tanks as a cross between an over-sized bulldozer and a heavily-armored TOW with a long barrel. I was sure my company would be dragged around in driblets, and parceled out as mobile pillboxes.

It was not without trepidation that I went for my first interview with my new task force commander. He seemed professional, competent, even pleasant, but I still could not shake the suspicion that deep in that infantry soul lay the desire to abuse my precious armored assets. Soon my tank company and the infantry task force, to which we were attached, embarked on a major corps exercise, and I was to learn a great deal about "Combined Arms."

In the heat of simulated battle, I quickly lost my prejudices and began to thrive in an environment in which *I was the Armor expert.* I was consulted more and given much more freedom than I might have expected in my parent battalion, which was packed with Armor "experts." Many tank company commanders are apt to experience the initial apprehensions I had upon cross attachment, so I offer some thoughts on organization, utilization of key personnel, and employment of the company to ease those fears.

Invariably a primary mission of the attached tank company is one of support. To provide maximum support to the task force, and still retain a tank-heavy team, I divided my company into four platoons of four tanks each. In matters of supply accountability, billeting, and details, each of the four tank platoons were treated equally. I traded away two tank platoons and gained a mechanized infantry platoon and a TOW section. When it came time for battle, I had nine tanks, three *Dragons,* two TOW's, and a private horde of infantrymen, armed to the teeth with LAWs and assorted noise makers.

Since I had tank platoons with the other teams in the task force, I felt battalion trains was the best place for the *M-88* recovery vehicle. The spare parts and supply truck were also collocated in the trains in case of future cross attachments of my platoons—no matter where they were in the task force they would have access to support. My motor sergeant and sufficient mechanics in the *M-561* wrecker stayed with me in order to provide immediate support to my team.

Tactical organization also required some innovation and blended with my desire to use key personnel in a more effective manner. With some minor modification, the company *M-113* became the tactical operation center (TOC). My communication chief and training NCO had the chief responsibility of organizing the information coming in from the platoons in the team and passing the required reports to battalion. Ideally, as team commander, I would have commanded the tank, and left the operation of the net control station to the *M-113.* However, my desire to increase my responsiveness to the task force commander, and the temporary lack of radios confined me, to the *M-113.* Additionally, the truth of the matter is I never like to be far away from my communication chief, inasmuch as communication is synonymous with control and without it you cannot meet the mission.

I firmly believe that if the motor sergeant and first sergeant are capable, the executive officer should be used as a second in command, and not as a courier for spare parts or as an impassive observer while tank hulls are being dredged up from some bottomless pit of mud. If the team is committed to a large sector in the defense, the XO can extend control throughout a part of the team and bring his experience to the battle. If the commander is in his tank, the XO should be in the TOC. The XO should not be responsible for the operation of the TOC, the communication chief and operations NCO can do that. The XO must ensure that the commander's plan for the battle, or the necessary changes, are effectively communicated and carried out. In this way, he would be best suited to assume command if necessary and maintain continuity in the team's effort. The XO can also play a vital role in implementing a sleep plan that will allow the chain of command to remain up to the stress of continuous operations. The XO's jeep with radio can occasionally serve as an excellent mobile relay when communication becomes difficult, due to terrain or when the team is operating in an extensive sector.

Tactical employment of a tank-heavy team in an infantry task force is generally no different than in the armor task force with the exception that the infantry will normally operate in terrain suited for them not armor. An armor company within an infantry task force can expect a lot of wooded, close terrain. The use of the attached mechanized infantry platoon becomes critical to the employment of tanks. When not engaged in a hasty or deliberate attack, the infantry should be used as scouts and to provide security for the team in close terrain. During the day, an experienced infantry platoon leader can report on the best routes for tanks, detailing restrictions, propositions, and enemy contact. At night, the infantry can provide security through the establishment of outposts, listening posts, and dismounted patrols. The infantrymen of the attached platoon become, not only welcome friends, but essential elements in the safe movement of the tank heavy team.

The single most consistent "fear" of the attached tank company commander is that, in the heat of battle, all or most of his tank platoons may be traded away to other teams, leaving his team mechanized-heavy. This is a reality that underscores the attached tank company commander's need to become intimately familiar with infantry systems and tactics. The real problem, however, is not a personal one. In order to best use the firepower that a tank company can bring to an infantry task force, a standing operating procedure or some other procedure, should exist to rapidly concentrate the tank platoons under the tank company commander. When opportunities exist for a quick strike at the enemy, which can sufficiently influence the task force battle, the tank platoons should come up on the tank team's frequency and rapidly concentrate.

In the defense, particularly, tank platoons can concentrate even under the harassment of artillery fire to ambush an approaching enemy. This mobility under fire is not shared by the other infantry teams who must cling to the ground or leave the area. If the defense is to remain truly active at the task force level, then the ability to concentrate the tank platoons becomes paramount. The infantry task force commander's ability to exploit the mobility and firepower of his attached armor lies in his ability to concentrate the platoons.

So, when ordered to become part of an armor-mechanized team, don't sing the "Cross Attachment Blues," just remember that the:

- Four tank platoons (four tanks per platoon) organization is best suited to the tank company attached to an infantry task force.
- Using the XO as a second in command is important in extending the control and response of the team. The first sergeant and motor sergeant must share the burden of supporting the team with Class I, II III, and V, supplies and recovery.
- The attached infantry platoon in a tank-heavy team is best used in the role of scouts and to provide team security.
- Tank platoons may support the task force by being cross attached to the other teams but some mechanism should be developed to rapidly concentrate the tank platoons to take advantage of opportunities on the battlefield.

The keys to victory reside not only in the words, *Think Combined Arms,* but also in the concentration of firepower. With the tank team organized as I have suggested, and with key personnel used to provide maximum control and response, the team can be brought together to develop the kind of firepower that can influence the battle.

Contrary to my expectations, I found my experience with our sister battalion challenging and exciting. Whenever the battalion commander asks for volunteers to train with the infantry, I smile and reply, "Send me, I need the experience and the infantry needs the help."

MICHAEL R. MATHENY
Captain, Armor
A Company, 1/64 Armor

A Turreted M-113 Is Suggested

We have spent a lot of money and effort on improving the mechanical reliability of the *M-113A1* and *A2*. (hereafter referred to as the *M-113*) Now, we need to address the problem of replacing its antiquated .50-caliber armament, which is no longer effective against the threat vehicles it can realistically be expected to face. This deficiency has forced us to divert a large number of expensive antitank guided missile (ATGM) systems away from their intended role to deal with vehicles that have traditionally been engaged by the heavy automatic armament of the armored personnel carrier. This has spread our ATGMs thinner and degraded our antitank defenses. We cannot afford that.

Therefore, we can no longer ignore the inadequacies of the *M-113's* automatic armament. The *M-113* will probably be around for some time, so it should be equipped with a turret that will accept the same 25-mm *M-242* automatic cannon and 7.62-mm *M-240* coaxial machinegun that are mounted on the cavalry and infantry fighting vehicles (CFV/IFV). A turret for the *M-113* should also have an *M-36E3* passive day/night sight, a ring sight for aircraft engagements, optional stabilization, and its armor protection should be capable of withstanding up to 14.5-mm weapons fire.

This turret would present us with several advantages other than just giving the *M-113* a viable weapon system. Since it would be armed with the same guns as the CFV/IFV, it would ease transition to the IFV and CFV because infantrymen and cavalrymen would be familiar with the weapons, and maintenance of the new vehicles. This would ease the shock of going from a vehicle with no turret and little sophistication (*M-113* with .50 caliber) to one that is very sophisticated. Experience thus gained would speed up the training of IFV and CFV crews, mechanics, and commanders when the CFV/IFV finally get to the field in numbers. Additionally, it would provide the trainers with the same advantages in formulating training programs, since it employs the same weapons systems as the CFV/IFV with the exception of the TOW missile system.

As the CFV/IFV are phased in, the turret-armed *M-113's* could be transferred to Reserve Component (RC) units, which, at present, are not programmed to be issued IFVs and CFVs. This would greatly increase their combat power for a fraction of the cost of a new IFV or CFV. This would also enable reservists called up as replacements in time of war, to step into IFVs and CFVs with only minimal additional training on the TOW missile system of the CFV/IFV turret.

A turreted *M-113* also would be ideal for airborne armor units assigned to the Rapid Deployment Force since it is lighter and smaller than the CFV/IFV, making it easier to air transport and deliver. It would be an excellent counter to the already fielded Soviet armored, airborne infantry vehicle (BMD).

Some would argue that this new turret would be an expense that we cannot afford because the IFV/CFV is appearing on the scene, and that we should be content to wait for the arrival of the IFV/CFV. This argument is only partially valid. While the IFV/CFV will certainly start to become available, the low production rate means that the majority of infantry and cavalry units will be using the *M-113* for many more years. Furthermore, if turret-equipped *M-113's* were given to RC units as the IFV/CFVs are fielded, or if they find an airborne RDF role, it would not be just a stopgap system, but would fill several other useful roles. Procurement of a turret for the *M-113* would be money well spent.

Turrets such as the one described are available or are being developed.

Do we give our infantry and cavalry units a good weapons system now, or do we leave them with a weak ineffective system—and hope we don't need something better till the CFV/IFVs arrive? I say the time for the system is now!

DALE T. EWING
Staff Sergeant
3/12 Cavalry

Why Are We Losing Our Good Soldiers?

We are not retaining trained, experienced soldiers in the numbers we need.

The relationship between recruiting and retention is a frustrating comparison, at best. What does it tell us when we have to recruit 215 new men to show a net gain of 101? Everyone understands that "normal" attrition is going to take place at a certain percentage annually. It's a fact. What I am concerned with is the number of losses we take because we fail at critical points to simply take care of the soldiers we have. The following is an A through Z list of things that happen or don't happen that impact on the troops—and influence their decision to remain in service. They are:

A. The man on guard duty who didn't get fed, or got cold leftovers.

B. The men who watch the officers and senior NCOs issue them orders from afar, while never once seeing them out in front—dirty, and leading by example.

C. The soldier who has briefed his wife about the planned training, but still has her waiting for hours because "somebody" didn't anticipate too well how long the training would last.

D. A soldier who relates a concern of his or hers to the squad leader, and hears, "Yeah, I'll check it out." Did the soldier get a straight answer? How long did it take?

E. The NCOs who are victims of delegated responsibility, but not privy to the authority that goes with it.

F. A soldier whose platoon leader is more concerned about keeping up a nice smoke screen, rather than making any effort to involve himself in fixing what's hidden.

G. A small unit that breaks its collective behind to do well on a field problem, and then sees that the old man is clearly more concerned with when and where the colonel's helicopter will arrive than he is in what they are doing.

H. The troops who are aware of the options available, yet haven't seen or heard about their commander going to bat for them because it might not be good for his career progression.

I. A soldier who is on his fourth trip to the orderly room with a pay problem.

J. A platoon sergeant who couldn't assemble all his troops in a week, even if they were all at home, because he never got around to knowing much about them.

K. The soldier who can't, for his life, tell you his commander's full name.

L. A young NCO who is a master at "ghosting," because he's never been properly trained or coached concerning his job, or how to lead to get it done.

M. The leader who feeds his ego through unending critiques, issued under the guise of experience and good judgement.

N. The unit that does well, yet whose PFCs and SP4s never seem to get any credit.

O. The soldier who has seen his commander twice, once for disciplinary action, and once for a reenlistment pitch.

P. A leader who seeks to inspire others to greatness by berating a subordinate openly, for the benefit of the listening audience.

Q. A "drug store cowboy" who usually is in a leadership position, and has seen/done it all. Generally it is a matter of time before *his* mouth gets *someone else* in trouble.

R. The soldier whose wife never did really know what her husband did in the unit. She was never invited to see.

S. The leader who is willing to take "no" for an answer when the problem only needs a little tenacity to accomplish something worthwhile.

T. A soldier who will go to some length to keep the fact of his military membership from common knowledge, rather than bragging about his company's latest exploit.

U. The "Submarine Syndrome"—riding on the surface, where the brass can see when the water's smooth, but diving deep and running very quietly when the water on top is rough or threatening. All too many officers are in this category.

V. The soldier who hasn't seen a pair of boots that fit right, yet; or a soldier who is "running on cords" because "somebody" didn't see that he needed new ones.

W. A soldier who, during the course of one day, has seen the mission change at least six times, none of which made much sense, and none of which was ever accomplished.

X. The leader who is sure that good "commandership" is the ability to back-bite or show one-upsmanship on his contemporaries over trivia, while the job is whitewashed.

Y. The soldier or young NCO who is boiling over with pent up initiative, yet is inhibited from using any of it because he isn't sure whether his honest mistakes will be accepted as part of the learning and not be held against him.

Z. The soldiers who are just plain tired of "SOS," lack of competence, or the abundance of simple negligence with regard to the people.

For the sake of brevity, the examples were limited to the number of letters in the alphabet, but the list goes on and on. Who is responsible for such things? I could trot out the worn cliches about "the chain of command," or the "guys with the green tabs," etc., but they do not answer the question. The responsibility is with the officer standing next to the guidon bearer—that captain or lieutenant company commander, period. Who could possibly have more to do with retaining the membership of his/her unit?

I submit that company command, like any other, is a labor of love and a business of people, not paper, prestige, or career mobility. That's about as simple as I know how to put it. Part of the retention problem is the unfortunate practice of assigning some officers who are not well suited for the job to command for the sake of insuring a properly punched ticket. Too often, this is done at the expense of the soldier. We need to do away with the idea that every officer *has to be* a successful commander. We have all seen leaders who would be outstanding in command from platoon level through brigade and who should *stay* in those roles. We see others who are super logisticians, bigtime planners, and truly professional staff officers. These people need to stay where *they* can do the most good. This would insure a pool of high quality officers who *want* to be commanders.

Too often we see the company commander who only wants to survive the IG inspection, to get through one more ARTEP, hopefully come away with a decent OER, and then get back to another job that he knows he will be comfortable in. Then there's the desk bound, used-up 03 who has to watch from the window when the companies move out. He knows his majority is close, and that the next shot he will have at command will not come again until much later. If he could write his own script, he would command an armor unit, but he would be glad for the chance to take over an underwater, mess kit repair outfit, if he could call it his own. Somewhere in here it becomes a question of attitude and morale for these misplaced officers. It reflects on their men and their work. Guess who ends up hurting the most? The more times I see this happening the more I wonder why nothing seems to be done to correct it.

I happen to believe that command of a company is one of, if not the best job in the army. Moreso, now that I know I will never command another one. So many things depend on what the company commander causes to happen, emphasizes, or neglects. A major part of the existing retention problem can be solved if:

A. Care and consideration is made when assigning an officer to command a unit!

B. Unit commanders take the time to *know* their men and their personal situations.

C. Commanders *take the time*, or make it, to train subordinate leaders in how to take care of their charges!

D. Commanders do what they say they will do. If they don't, their credibility is shot.

E. Commanders keep their troops totally informed.

This is another list that has no end, but so many items are only a matter of *common sense and caring.*

Another aspect of retention that I think is worth mentioning is the notion that few things that are risky, unconventional, or semi-controversial can be much good. Commanders should *have the guts* to try things that are new, challenging, and demanding, and be willing to accept the lessons that come with innovation. When troops see their commander is sincere, that his intentions in their *behalf* are right, and that he is willing, and proud to go out on a limb for them, they *will* respond in kind 99 percent of the time.

Commanders will find that if they take care of their men, the mission *will* take care of itself. The troops only want what they have a right to expect from their commander—praise when it's deserved, a kick in the grill doors when that's in order, and a genuine concern for their welfare at all times. They may be the only unit you will ever have the high honor and privilege to command. Do your best by them, while you have the time.

SAMUEL T. CONN
Major, Armor
KSARNG

RECOGNITION QUIZ

This Recognition Quiz is designed to enable the reader to test his ability to identify armored vehicles, aircraft, and other equipment of armed forces throughout the world. *ARMOR* will only be able to sustain this feature through the help of our readers who can provide us with good photographs of vehicles and aircraft. Pictures furnished by our readers will be returned and appropriate credit lines will be used to identify the source of pictures used. Descriptive data concerning the vehicle or aircraft appearing in a picture should also be provided.

(Answers on page 60.)

OPMS-EPMS

Manning Tomorrow's Fighting Vehicles Today

The new vehicles and weapons systems that are now coming into the inventory tend to be sophisticated, expensive, and require extensive training in their operation. A soldier who has operated or maintained a system like the *M-1* or *M-2/3 Bradley* infantry/cavalry fighting vehicle (IFV/CFV) in its development and test phase has acquired valuable experience. But the experience may not be sufficient to warrant reclassification, or the appropriate MOS simply may not yet exist. Without some way of identifying skill acquisition outside of the formal MOS structure, a valuable military personnel asset could be lost. In more general terms, personnel management must adjust to keep pace with force modernization.

Responding to this challenge, the U.S. Army Military Personnel Center has introduced a new temporary management tool, the Project Development Identification (PDI) code. The PDI code is a 2-character, alphanumeric designator that identifies commissioned and warrant officers, and enlisted personnel who have acquired a high degree of knowledge or expertise in a specific project, system, concept, or item of equipment, and for whom other appropriate occupational identification has not yet been implemented. The PDI code is not a substitute for an MOS or ASI; nor can it be used to fill the Army's need for a particular type of expertise. It serves to identify qualified personnel at a critical period for the establishment of a training base in the development and early deployment of new military technology.

The first real experience in managing PDI codes in the combat arms came with development of the *M-1 Abrams* tank. Early in 1980, individuals who had been awarded the PDI code "X1" were simply listed on nonautomated rosters at MILPERCEN. Their special skills were not entered on the Enlisted Master File and therefore were not well integrated into the life-cycle personnel management system. This meant that some soldiers who were experienced in *M-1* development and testing were levied needlessly for assignment to units not programmed to receive the new *M-1* tank—a potential waste of know-how.

Since then, a process for managing PDI-coded enlisted personnel has been developed. Requests for award of a PDI code to individuals are initiated by DARCOM (the project manager), TRADOC (either the system manager or the commandant of the proponent school), or the commander of the unit responsible for field testing the weapon or equipment. MILPERCEN's Personnel Coordinator's Office reviews the requests and assures that the proper code is entered on the soldier's record in the Enlisted Master File. At the same time, MILPERCEN's Enlisted Distribution Division (DAPC-EPS-D) receives deployment schedules for the new equipment or system from DCSOPS and determines which TO&E units will require PDI-coded personnel, how many, and when. This information is passed to the appropriate MILPERCEN career branch (in this case, Infantry/Armor Branch, DAPC-EPK-I), which identifies qualified soldiers from the Enlisted Master File, assigns them against the PDI requirement, and notifies the gaining unit (or New Equipment Training Team). Once the MOS structure has been adjusted to accommodate the new system or equipment—for example, introduction of MOS 19K for the *M-1* tank crewman—PDI-coded personnel may be reclassified accordingly and the PDI deleted entirely from the Enlisted Master File.

Like any management system, this one is subject to the rule, "Garbage in, garbage out." A new AR governing PDI codes and associated subcodes has been drafted and should be published by the end of this year. In the meantime, however, those involved in the process should be aware of the following:

- MILPERCEN is committed to making the PDI system work and using it to ensure that qualified personnel are available to the proper units as new weapons systems come on line. This commitment is especially firm with regard to the *M-1 Abrams* tank, the *M-2* IFV, and the *M-3* CFV. Infantry/Armor Branch will continue to devote special attention to managing PDI-coded soldiers associated with these systems. The experience gained in working with the *M-1* program will be applied to insure effective assignment of personnel experienced in the development and testing of the fighting vehicle system. (See Table 1 for relevant PDI codes and subcodes.)
- The majority of PDI nominations to date have come from DARCOM project managers and TRADOC proponent schools. These activities, together with TRADOC system managers and field test unit commanders constitute the critical first stage in the PDI management system. It is important that only personnel actually involved in the operation, maintenance, or application of the equipment be nominated for the PDI code. (This would normally exclude cooks, clerks, and other combat service support personnel in field test units.)
- It is even more important, however, that soldiers who have the experience *are* nominated for the PDI. This requires the cooperation of the activities and individuals indicated in the preceding paragraph in seeing to it that rosters of nominated personnel are submitted to MILPERCEN Personnel Coordinator's Office (DAPC-POC) in a complete and timely manner. The soldier's field personnel record should be specially labeled to indicate the award of a PDI, as is the case with the career management files maintained at MILPERCEN; instructions will be contained in the forthcoming AR.
- The individual soldier needs to know what a PDI

code is, how it is awarded, and what it means for his career. Properly implemented, the PDI can enable the qualified trooper to continue working with and improving his combat skills on the most advanced weapons systems in the world. By so doing, each PDI-qualified enlisted man contributes in a very real way to strengthening the nation's conventional arms capability.

• At the same time, the soldier should know that the PDI code will not unfairly jeopardize his CONUS stabilization and will not automatically make him ineligible for deletion or deferment from overseas assignment. PDI is only one of a number of considerations that determine assignment availability.

Table 1. PDI codes and subcodes available to personnel with experience on the M-1 Abrams tank and the M-2/3 Bradley IFV/CFV.

PDI Code	Standard Subcode and Definition
FI	R, T, and U. Identifies personnel having expertise in fighting vehicle systems (FVS).
X1	S, T, U, and W. Identifies personnel having expertise on *M-1 Abrams* tank.

PDI Subcode	Title and Definition
R	Research and development. Identifies personnel associated with the initial research or design of the system, including concept development, system design and up to development of a prototype.
S	School-trained on the system by TRADOC service school or similar activity. Identifies personnel who have received a formal course of instruction, normally by the TRADOC school that will ultimately have proponency or responsibility for training soldiers to the system. (1) When used with MOS/SSI that normally identifies an operator, this subcode is further defined to identify trained in system *operation*. (2) When used with an MOS/SSI that normally identifies a level of maintenance, this subcode is further defined to identify training in an equivalent level of *maintenance*.
T	Contractor-trained. Identifies personnel who have received formal training by the civilian contracting agency that is developing the system for the Army. (1) When used with an MOS/SSI that normally identifies an operator, this subcode is further defined to identify training in system *operation*. (2) When used with an MOS/SSI that normally identifies a level of maintenance, this subcode is further defined to identify training in an equivalent level of *maintenance*.
U	Unit test personnel. Identifies personnel assigned to a unit (normally battalion or lower) that has been designated to field test the system/item of equipment. Source of training is immaterial. (1) When used with an MOS/SSI that normally identifies an operator, this subcode is further defined to identify *operation* of the system. (2) When used with an MOS/SSI that normally identifies a level of maintenance, this subcode is further defined to identify performance of that particular level of *maintenance*. RESTRICTION TO USE: This subcode should only be assigned to those type of personnel actually involved with the operation, maintenance or application (such as battalion tactical use in the field test). It should not be awarded to nonessential personnel such as cooks, clerks, etc.
W	PM/TSM operational staff. Identifies personnel assigned to the immediate staff of the designated Project Manager or TRADOC System Manager.

• PDIs need to be awarded to soldiers holding appropriate the direct/general support maintenance MOS (CMF 63) as well as combat arms MOSs (CMF 11 and 19). No weapon system, no matter how advanced, can function effectively without adequate maintenance. The time to identify experienced maintenance personnel for systems such as *M-2/3 Bradley* is now.

• Feedback is a vital part of good management. General comments on the PDI process or suggestions to improve it should be forwarded directly to MILPERCEN, Personnel Coordinator's Office (DAPC-POC).

As indicated, the PDI code is a temporary management tool, an administrative field expedient designed to meet a particular need. PDIs have demonstrated considerable flexibility as well. For example, the chassis used to mount the Multiple Launch Rocket System (MLRS) is virtually identical to that of the IFV/CFV. PDI code "F1" was used to identify 63T personnel whose experience with *M-2/3* qualified them to work with the contractor in maintenance of MLRS.

As new systems and equipment come on line, the skills reflected in the PDI code will be integrated into the formal MOS structure. Existing PDIs will be rescinded and new ones established as Army force modernization progresses, generating new personnel demands at the frontiers of military technology. These frontiers continue to advance. With the help of PDIs, the Army life-cycle management will advance with them.

This article was prepared by Captain Gary Woxmonsky, USAR, *while he was on active duty for training with the Infantry/Armor Branch, Combat Arms Career Division, Enlisted Personnel Management Directorate, MILPERCEN.* Ed.

Automated Preference Statement

Assignment officers routinely review officer preference statements when making assignment decisions; however, they are hampered by the lack of an automated interface between the officer preference statement and other management tools available to them. In order to have this capability present in the assignment process, automation must be introduced. In the near future the capability will exist to store preference data for each officer (warrant and commissioned) on the Officer Master File (OMF). If your preference statement (DA Form 483) has not been kept current as specified in AR 614-100 you should submit an updated version before 1 January 1982 so it can be loaded into the OMF and used to screen for preferences prior to selecting officers for assignments. Should you not submit a new preference statement by 1 January 1982, the data from your most recent form on file will be loaded. A mark-sense preference form is currently being developed to replace the present DA Form 483. This form will be field tested next year. In early 1982, assignment preferences will begin to be printed on the Officer Record Brief (ORB) so you can check it during your annual ORB audit. This data will be blanked out for promotion board ORB's.

news notes

Mrs. Omar N. Bradley, assisted by General Edward C. Meyer, Chief of Staff of the Army, breaks a bottle of champagne on an M-2 infantry fighting vehicle to christen the M-2/3 family as Bradley fighting vehicles. The ceremony took place at Fort Myer, VA 20 October 1981. Photo by Major Charles R. Steiner, Jr.

Creighton Abrams Chapter of the U.S. Armor Association

The Creighton Abrams Chapter of the United States Armor Association offers Tankers and Cavalrymen the opportunity to meet with friends, collegues and others who share an interest in Armor.

The Chapter, located in the National Capitol Region, features a quarterly luncheon program at which top military leaders are invited to speak.

Members are kept informed of activities and the latest developments in Armor by a chapter newsletter.

Those who wish to renew old acquaintances or meet new friends are invited to join the Chapter by contacting LTC Bill Highlander, (202) 697-7589.

Battle of the Bulge Veterans Organize

Initial steps have been taken to establish the International Association of the Veterans of the Battle of the Bulge.

Ground and air veterans who received a battle star for the Ardennes Campaign during the period December 16, 1944-January 24, 1945 are eligible for membership in the Association. Others who saw action in this cold-weather fighting in Belgium will be considered for membership on an individual basis.

An organizational meeting will be held at 1 p.m., 16 December, in the Arlington County, VA, Courthouse.

Additional information may be obtained from Clyde Boden, IAVBOB, P.O. Box 5510, Arlington, VA 22205.

Military History Research Program

The U.S. Army Military History Institute is sponsoring an advanced research program in military history. Individuals selected to work as advanced research project associates receive a $500 grant to cover expenses while conducting research and writing at the Institute. Deadline for submission of applications is January 1. Request a form from Benjamin F. Cooling, Assistant Director for Historical Services, Department of the Army, U.S. Army Military History institute, Carlisle Barracks, Pennsylvania 17013.

Improvements to M-60 Tank Fire Control System

The Project Manager for *M-60* tanks has developed four improvements to the tank fire control system that will significantly reduce backlash in the system and lead to improved hit performance and tighter shot groups. The fixes include:

- A M32/32E1/35E1 periscope swap-out program.
- Spacers for the 11-inch arm.
- Reworking the *Oldham* coupling.
- Application of a three-point suspension to the gunner's periscope and *M-118* periscope mount. The modified mount will be identified as the *M-118A1*.

The spacers are installed on the spindle of the eccentric of the 11-inch arm. Spacers are already in *M-60A3s* and recent *M-60A1* rebuilds. Once installed, they prevent lateral movement of the eccentric along the spindle that results when the setscrews are loose and thus eliminates a possible cause of significant random error (almost 1 mil in elevation changes in the gunner's periscope). These spacers (NSN 1220-01-101-1769) have entered the supply system and cost less than $2.00 per set. They must be ordered by each unit and should be installed by the direct support unit. The eccentrics must be aligned at their previous settings and a synchronization test must be performed after installation.

The Oldham coupling rework and three-point suspension fixes must be performed by a depot team, and are already in some *M-60A1* RISE/Passive and all *M-60A3* tanks.

Altar of Battles Dedicated

Formal dedication ceremonies for the "Altar of Battles" were recently held at Freedoms Foundation, Valley Forge, Pennsylvania. The United States Army Field Band furnished music for the occasion.

The Altar is dedicated to the members of the 2d Armored (Hell on Wheels) Division who gave their lives for their country in World War II. It was conceived by Captain James M. Burt, Medal of Honor recipient and one of the heroes of the Division.

BOOKS

ON STRATEGY: THE VIETNAM WAR IN CONTEXT, by Harry G. Summers, Jr., Colonel, Infantry, Strategic Studies Institute, U.S. Army War College, Carlisle Barracks, PA. 1981.

This short book heads the list of required reading for today's and tomorrow's Army leaders at all levels of command and staff. While still in draft, it generated vigorous opposition both from the Army Staff and within the Army War College. The opposition apparently rested on premises that the Army should not stir up painful aspects of Vietnam; that no good would come from the Army criticizing the Army; or that it was not right for the Army to put its imprimatur on one man's work. This last objection surfaced despite the fact that, with the support and encouragement of three successive Chiefs of Staff, the Army War College had collected voluminous data on Vietnam, including a series of monographs, all of which Colonel Summers studied and used as a basis for his writing. Sound judgement overrode the objectors. Their efforts appear to have influenced a foreword to the book written by the former Commandant of the Army War College, Lieutenant General DeWitt C. Smith, Jr., which falls short of damning the book with faint praise but surely makes an unnecessarily deep obeisance to the objectors.

Be that as it may, *On Strategy: The Vietnam War in Context* could be the most important analytical military literature produced by a member of our Armed Forces since Alfred Thayer Mahan wrote his great treatise on seapower, almost a century ago. I say "could be" because its real importance will rest upon how widely it is read by national leaders, civilian and military. There is already evidence that it will indeed be widely read.

Colonel Summers begins by noting that in the Vietnam era "instead of providing professional military advice on how to fight the war, the military more and more joined the systems analysts in determining the material means we were to use." We had "an Army more concerned with management than with military strategy." This was exactly the 18th Century situation Clausewitz attacked in *On War*. With this lead, Summers proceeds throughout the book to test our Vietnam actions against the principles of war as stipulated by Clausewitz. To say that not all his tests are equally impressive is a tribute to the masterfull logic of many of them rather than a denigration of others. Summers' analytical tools are by no means limited to Clausewitz. For example, he cites words from our Field Service Regulations, dating back as far as 1921. Interestingly, he shows flaws that crept into these regulations during the Vietnam conflict.

Every chapter of the book is well worth reading. Its most significant theses, however, are contained in the introduction and the first three chapters. These dwell on the importance of marshaling the national will to fight and the lack of such marshaling and such will during the Vietnam War. Summers draws on numerous sources beginning with *The Federalist Papers* to pinpoint our great error in the Korean War and in the Vietnam War of committing the Army to combat without a declaration of war. "The founding fathers' . . . constitutional requirement for a congressional declaration of war . . . insured public support at the outset and . . . created impediments to public dissent."

This error, this violation of the constitution, together with the account of how we arrived at this situation, and its effects both on our Army and our People, are thoughtfully presented in these first four sections of the book. They deserve careful consideration by every responsible citizen. If one were to fault this part of the book, it would be that too little attention is devoted to the fact that a declaration of war endows the president with his full war powers. In view of the extent to which Lincoln and Roosevelt found it necessary to use these, this is a matter which deserves fuller treatment.

The remainder of the book, using Clausewitz's framework of analysis and quoting many sources, examines the thinking that committed our forces to combat in Vietnam and then scrutinizes the nature and consequences of the strategies involved. In the last chapter, if the account of recent remedial, and soon dated, Army Staff actions were omitted, the final summary would have more coherence and force. Despite such minor flaws the job is well done. There are many passages that deserve to be underlined in red or, better still, engraved on one's memory. A few of them:

"As military professionals, it was our job to judge the true nature of the Vietnam war, communicate those facts to our civilian decision makers, and to recommend appropriate strategies."

". . . tactical success is not necessarily strategic success and tactical failure not necessarily strategic failure."

". . . it was four North Vietnamese Army corps, not 'dialectic materialism,' that ultimately conquered South Vietnam."

"The debate . . . produced a strategic theory that was to have a devastating effect on American offensive operations—the theory of graduated military response."

As has already been demonstrated, there are and will be active participants in the war who will quarrel with some of Summers' points. I would think that when Clausewitz's *On War* was published, his contemporaries disputed many more points than will Summers' peers and I don't doubt their quarreling was more bitter. None of which detracts from the fact that Clausewitz produced a classic, as has Summers.

ANDREW P. O'MEARA
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SAGA OF THE SUPERFORTRESS, by Steve Birdsall. Garden City, NJ. Doubleday & Co., 1980. 346 pages, more than 220 photos, index. $19.95.

This is a comprehensive history of the *B-29 Superfortress* bomber and the 20th Air Force, which flew them during World War II. When built, the *B-29* was the heaviest, most powerful aircraft flying. The design, however, was pushing the state-of-the-art, and this resulted in problems with the *B-29*, both for the designers, and the crews that had to fly them.

Chief among these problems was the tendency for the Wright 3350 engines to overheat and catch fire. The second prototype built crashed in flames during a test flight when an engine fire spread to the wing and fuselage. The problem was caused by inadequate lubrication that wasn't corrected until well into the production run, and by close-fitting engine cowls that restricted cooling air flow.

B-29s first saw service in the China, Burma, India Theatre, where they flew bombing missions against Japan from bases in China. Immense logistical problems—the bombers had to first carry their own supplies over "The Hump" from India—limited the number of missions flown and the number of planes on each mission.

After the Allies took the offensive in the Pacific and captured islands within the *B-29's* range of Japan, runways were built, and the aircraft were redeployed to the Pacific. It was from these islands that the *B-29's* made their major contribution to the destruction of Japan.

Supply problems at the Pacific bases were greatly lessened. New aircraft incorporated changes that eliminated many problems. Engines didn't overheat; and crews were more familiar with handling the aircraft.

B-29s were used to fly precision strikes, incendiary raids, and the nuclear strikes against Hiroshima and Nagasaki that ended the war.

Interesting parallels can be drawn between the *B-29* development program and modern programs. If the *B-29* was being built today, Congress would demand it be halted because of problems experienced and delays encountered. However, when the *B-29* was being built, no such questions were asked, and the problems were resolved and the aircraft built.

This history is well-illustrated. Many of the pinups that decorated the side of the fuselages of the *B-29's* are pictured, as well as shots of the bombers in action, and shots from the aircraft showing results of their missions.

People are not omitted. Much time was spent by the author getting first-hand stories of missions flown. These "war stories" do much to make the work the interesting, informative book that it is.

If you are interested in World War II bombers, or the war against Japan, or are interested in planes, you'll find this book worthwhile. Even if you're not into these things, you'll find parts of this book of interest.

W. RICHARD MORRIS
PS Magazine
Lexington, KY

OPERATION SEALION, edited by Richard Cox San Rafael, CA. Presidio Press, 1977. $8.95.

This narrative by Richard Cox presents the German invasion of Great Britain in 1940 "as it might have been." Based on a war game organized by the Royal Military Academy, Sandhurst, utilizing the original German invasion plans and umpired by a number of distinguished British and German officers, *Operation Sealion* could have been a "thrilling story" as the book jacket claims, but falls a bit short.

The details of the invasion are indeed fascinating, as weather conditions, naval operations, the situation on the landing beaches and the motley invasion fleet are described at great length with amazing authenticity. The combined airborne and amphibious assault takes place as planned and things look bad for "Old England." Many historical figures make an appearance. As Churchill maintains his dogged determination and confidence in final victory and Hitler displays characteristic arrogance, the story builds to a relative climax.

Then, after all the meticulous details of the invasion, the British resistance movement in action, even the plans for the installation of arch-villian Reinhardt Heydrich as "Reichsprotector of Occupied Great Britain," the story moves into "high gear" leaving the reader and the plot behind.

As things begin to go sour for the Germans, Hitler, not wanting to hear of failures, turns his attention to Russia. The author abandons the Sealion Force almost as abruptly, leaving on the beaches the many subplots so meticulously developed. I imagine that once the final military outcome was determined by the Sandhurst computer, the Generals went home, but I am sorry the author didn't take advantage of the situation created and continue with the fates of his characters.

The final part of the book presents several articles reprinted from the *Daily Telegraph* on the theme "what if" with varying opinions and assessments of the situation in 1940.

All in all, I found *Operation Sealion* interesting light reading, notwithstanding the truncation of the story line. If "what ifs" are your inclination, this one is good, but not great.

WILLIAM HANSON
Fort Knox, KY

MODERN COMBAT VEHICLES: 1 CHIEFTAIN, by George Forty. New York. Charles Scribner's Sons, 1980.

For those tankers who are tired of reading tank books that only discuss the tank and ignore the crew, *Modern Combat Vehicles: 1 Chieftain* is their kind of book. The book is the most complete story of the *Chieftain* in one volume yet published. Chapter 10 is titled the crew and, among other things, shows how one crew converted a section of side shield to a very handy table for the crew to use to cook on.

The book opens with a history of the evolution of the *Chieftain* from design concepts to the problems of introducing the tank into service. The book continues with well-written descriptions of the tank and its subsystems. Very good photographs and drawings make the book lucid and understandable. The author has included the only reliable information on *Chieftain* production seen in the United States, indicating that a total of 817 *Chieftain* tanks were produced for the United Kingdom, 930 for Iran, and 150 for Kuwait. Another 1,200 *Chieftain* variants were ordered for Iran but subsequently canceled.

The only major disappointment in the book is the cursory discussion of the *Chieftain L-60* engine. The problems with this engine have been widely reported. The author plainly states on page 83 that he did "not intend to recount in detail the complete unhappy saga of the Leyland *L-60* engine, which has for so long bedevilled the *Chieftain.*" He does give a short summary of the problem and measures taken to alleviate it. Much more information is given on the New Rolls Royce CV-12 TCA engine intended to be used in follow-on tanks.

Short chapters discuss *Chieftain* variants and training aids. In all, the book is a well-written story of the *Chieftain* and is highly recommended for both the novice tanker and the serious tank student. The most noteworthy thing about the book is the relatively low price. While $14.95 may seem high, considering the limited market for this book, Charles Scribner's Sons should be commended for bringing out the book at an affordable price.

GERALD A. HALBERT
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Recognition Quiz Answers

1. **Leopard 2 AV (FRG)**—Current production West German MBT. Armament: 120-mm main gun, two 7.62-mm machineguns; maximum speed, 68 km/hr; maximum range, 500 km; combat weight, 55,000 kg. Crew, 4.

2. **MERKAVA (Israel)**—In production to supplement the country's fleet of *Centurions, M-48s,* and *M-60s.* Armament: 105-mm main gun, three 7.62-mm machineguns. Weight, 56,000 kg. Crew, 4.

3. **Chieftain MKS (UK)**—MBT in current production. Crew, 4. Armament: 120-mm main gun, two 7.62-mm machineguns, and one 12.7-mm machinegun for ranging on some variants. Maximum speed, 48 km/hr. Maximum range, 400-500 km. Weight, 55,000 kg.

4. **Vickers MBT (UK)**—Export MBT in production. Also produced in India. Armament: two 7.62-mm machineguns and one 12.7-mm machinegun. Maximum range, 480 km. Maximum speed, 48 km/hr. Weight, 38,600 kg. Crew, 4.

5. **BTR-60PB (USSR)**—8 x 8 amphibious APC. Crew, 3 plus eight passengers. Armament: one 14.5-mm machinegun and one 7.62-mm machinegun. Maximum speed, 80 km/hr. Maximum range, 500 km. Combat weight, 10,300 kg. Used widely by Warsaw Pact and client states.

6. **Luchs (FRG)**—Current production West German 8 x 8 amphibious reconnaissance vehicle. It was introduced in 1975. Armament: one 20-mm cannon and one 7.62-mm machinegun. Crew, 4. Maximum speed, 90 km/hr. Maximum range, 800 km. Combat weight, 19,500 kg.

This quiz was prepared by SSG David L. Merryman, Threat NCO, USAARMC.

STEEL ON TARGET

On 19 April 1775, a small group of Massachusetts militia squared off against a field of red at Concord Bridge. Initially outnumbered and outgunned two to one by British soldiers and marines, the word of the fight quickly spread and, answering the call, the Minutemen "piled on." Before the day was over, almost 4,000 citizen soldiers had joined the melee and pursued the British force back to their enclave in Boston. The heritage of the citizen soldier seeking peaceful pursuits while maintaining readiness for war was born.

The reserve components today comprise roughly half of the United States armor force. The importance of such a force to the nation is demonstrated in two ways. As a deterrent, the callup of such a force serves as a signal to potential adversaries of the seriousness of the nation's resolve in time of crisis. Conflict has often been averted by this move. When conflict is unavoidable or has already broken out, a combat-ready reserve armor force becomes vital to the successful outcome of the battle. This was demonstrated in the Yom Kipper War where Israeli reserve tankers often found themselves facing overwhelming odds soon after callup. American Guard and Reserve armor crewmen could well face similar odds. But, the Guard and Reserve tanker and cavalryman expects these odds, for his role is to turn the tide when the battle is in doubt.

The critical role played by the reserve armor force demands the highest standards of professionalism and readiness. Sometimes, family, friends and employers don't understand or appreciate the kind of dedication and sacrifice needed to maintain that readiness. But, there is no alternative because when the callup comes, the Guard and Reserve armor crewmen will share the same hardships, dangers, and victories as the Active Army.

ARMOR salutes the Guard and Army Reserve tankers and cavalrymen as well as the tankers of the United States Marine Corps Reserve. It takes a special breed to pursue a civilian career, while at the same time maintaining the readiness necessary to face another field of red—outnumbered and outgunned—and come out a winner. But, should the call go out, the "reserve half" of the equation, like their predecessors at Concord, will enter the fray—and, as word of the fight spreads, they will pile on—and put steel on target. To today's Minutemen we say,

Good Shooting!

Symbolism

The shield is green and white, the colors of the Armored Force. The wyvern represents the deadliness of the tank. The three spearheads stand for three World War II decoration streamers, NORMANDY, MOSELLE RIVER, and ARDENNES, and for the regiment's claim to the title, "Point of the Spearhead." The ermine spots are from the arms of Nantes, Brittany. The annulet ringed with flames represents Bastogne surrounded by enemy fire. The triton shells, used as war trumpets by the early inhabitants of Pacific islands, are scarlet, the color of the Meritorious Unit Commendation streamer awarded for service in the Pacific theater.

37th Armor

Lineage and Honors

Constituted 13 January 1941 in the Regular Army as 7th Armored Regiment and assigned to 4th Armored Division. Activated 15 April 1941 at Pine Camp, New York. Redesignated 8 May 1941 as 37th Armored Regiment.

Regiment broken up 10 September 1943 and its elements reorganized and redesignated as follows: Regimental Headquarters and Headquarters Company, 1st Battalion, and Company D as 37th Tank Battalion, an element of the 4th Armored Division; 3d Battalion as 706th Tank Battalion and relieved from assignment to 4th Armored Division; Reconnaissance Company as Troop E, 25th Cavalry Reconnaissance Squadron, Mechanized, an element of the 4th Armored Division (hereafter separate lineage); 2d Battalion (less Company D), absorbed in 37th Tank Battalion; Maintenance and Service Companies disbanded.

37th Tank Battalion relieved 1 May 1946 from assignment to 4th Armored Division; concurrently, converted and redesignated as 37th Constabulary Squadron and assigned to 3d Constabulary Regiment. Inactivated 20 September 1947 at Weilburg, Germany. Converted and redesignated 11 December 1951 as 37th Tank Battalion and relieved from assignment to 3d Constabulary Regiment. Assigned 25 February 1953 to 4th Armored Division. Activated 15 June 1954 at Fort Hood, Texas. Relieved 1 April 1957 from assignment to 4th Armored Division; concurrently, battalion (less Company A) inactivated at Fort Hood, Texas (Company A reorganized and redesignated as Headquarters and Headquarters Company, 1st Medium Tank Battalion, 37th Armor).

706th Tank Battalion inactivated 20 September 1946 on Luzon, Philippine Islands. Redesignated 25 March 1949 as 71st Heavy Tank Battalion; concurrently, assigned to 1st Cavalry Division and activated at Chigasaki, Honshu, Japan (Company A, only, filled). Reorganized and redesignated 5 August 1950 as 71st Tank Battalion. Inactivated 16 October 1950 in Korea and relieved from assignment to 1st Cavalry Division. Redesignated 14 August 1951 as 706th Tank Battalion. Assigned 25 February 1953 to 12th Armored Division. Relieved 1 April 1957 from assignment to 12th Armored Division.

Headquarters and Headquarters Company, and Companies E and F, 2d Battalion, 37th Armored Regiment; and Service Company, 37th Armored Regiment, reconstituted 1 April 1957 in the Regular Army.

37th and 706th Tank Battalions and reconstituted elements of the 37th Armored Regiment consolidated and redesignated 1 April 1957 as 37th Armor, a parent regiment under the Combat Arms Regimental System (Headquarters and Headquarters and Service Company, 37th Tank Battalion, redesignated as Headquarters and Headquarters Company, 37th Armor).

Campaign Participation Credit

World War II

Normandy
Northern France
Rhineland
Ardennes-Alsace
Central Europe
Western Pacific
Leyte
Ryukyus

Korean War

UN defensive
UN offensive

Decorations

Presidential Unit Citation (Army), Streamer embroidered *Ardennes* (37th Tank Battalion cited; WD GO 54, 1945)

Meritorious Unit Commendation, Streamer embroidered *Pacific Theater* (706th Tank Battalion cited; WD GO 14, 77th Inf Div, 1946)

French Croix de Guerre with Palm, World War II, Streamer embroidered *Normandy* (37th Tank Battalion cited; DA GO 43, 1950)

French Croix de Guerre with Palm, World War II, Streamer embroidered *Moselle River* (37th Tank Battalion cited; DA GO 43, 1950)

French Croix de Guerre, World War II, Fourragère (37th Tank Battalion cited; DA GO 43, 1950)