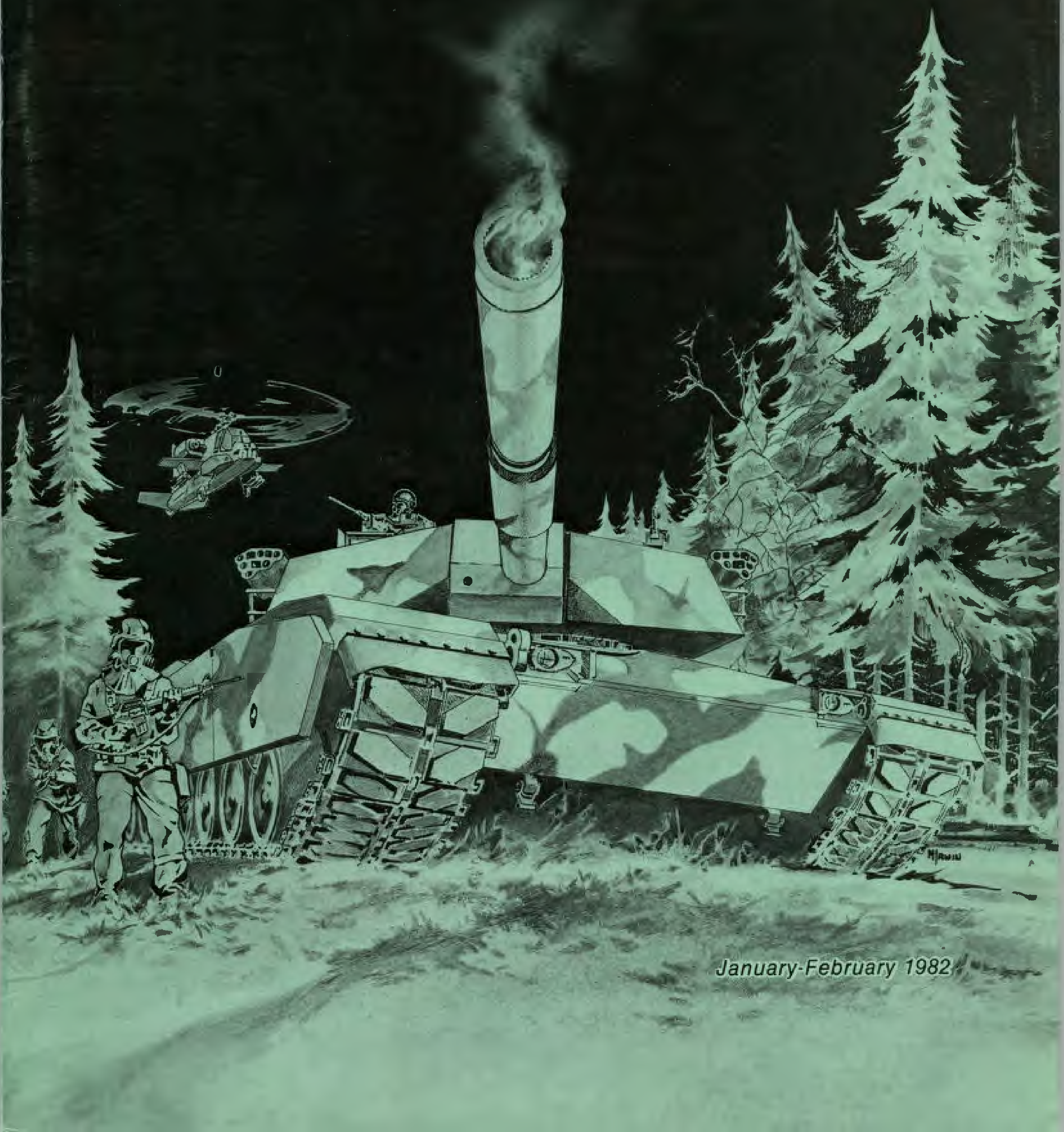
ARMOR

The Magazine of Mobile Warfare



January-February 1982

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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January-February 1982 Vol XCI, No. 1

FEATURES

DEPARTMENTS

COVER

The new fighting vehicles that are now entering production will vasyly increase the maneuver capability of our combat forces. Beginning on page 26, Major Michael S. Lancaster discusses how the Armor Force will employ that mobility in future "AirLand" battles.

LETTERS

"Sergeants for Europe Program" Proposed for Reserve Component

Dear Colonel Cisco:

I have read your article in *ARMOR* Magazine with great interest.

Where have all the sergeants gone? Where have all the combat soldiers gone? I can offer some personal examples.

When I went into the National Guard there were 21 people there for inprocessing. Myself and one other individual were volunteering for assignment to combat arms. I went to the tank section of an armored cavalry troop, the other fellow went to an infantry company. The remainder of those people went to headquarters, medical, transportation, and maintenance companies. I'm positive that if they had been assigned with us, they would have been instant AWOL's or very unhappy short-term deadbeats.

This is an example, but it exists Army-wide. Everyone wants to get a convertible skill—truck driver, mechanic, electronic technician, etc. And, damn few want to go to the combat arms.

Involuntary reassignment is not going to work, as you well know. I am also doubtful of the net effect of reduced grade authorizations. This has caused many problems for us in the Reserve Components (RC). Because of manpower problems, at times I've seen a PFC in charge of a 2-man tank crew. When this condition exists, a tank ceases to be a viable weapons system. If you promote the man to fill the space you still have a corporal or buck sergeant wearing E-6 stripes.

So what is the answer? I don't have it, but I have some definite ideas on the subject. Just recently *Army Times* carried an article about a program called, "Captains to Europe" through which RC captains could volunteer for 24-month tours in USAREUR. If the *Reforger* concept is correct, this is a good idea, but let's carry it one step farther. The Army needs sergeants, so offer RC sergeants the same opportunity.

Now, we have all heard time and again that we must use our resources to the best of our ability. Well, here is an opportunity to use our manpower resources to good advantage.

Many critics will say that the RC soldier is not familiar with the latest equipment, policies, techniques, etc. However, one thing that anyone who has worked with National Guard or Reserve troops knows is that there is no lack, on their part, of determination, dedication, and willingness to do a good job.

I propose a "Sergeants to Europe" program, or Korea, or anywhere else they are needed. RC E-6 volunteers would be sent to Fort Knox, attend the Armor NCO Basic course, and upon completion be assigned wherever they were needed. Likewise, E-7s would attend the Armor NCO Advanced Course. During this process, those individuals found not to be capable of performing effectively would be weeded out. To use one of those management phrases, the bottom line is that you would get a well-balanced, trained, mature NCO for 2 years. The NCO would get the experience and everything else that comes only with being on active duty in his MOS. If there is a "Total Force," let's use it.

These are my thoughts on the subject. What do you think?

MICHAEL D. DALY
Staff Sergeant
32d Inf Bde (Mech) WISARNG

The letter above was addressed to Lieutenant Colonel (Ret) Bob Cisco and is reprinted with permission of the writer.

Error in "Airborne Armor" Article

Dear Sir:

Reference is made to my article entitled "Airborne Armor" published in the September-October edition of *ARMOR*. In the mid-portion of the third paragraph on page 34 an error was made. The sentence as published reads, "the near impotence of light armored troops is apparent." The sentence should have read, "the near impotence of light airborne infantry troops is apparent."

I commend *ARMOR* for its coverage of the diverse, complex, and exciting areas of our specialty. The magazine continues to top the list of Army professional journals.

BOB D. MACKENZIE
Captain, Armor
Clovis, CA

The author's manuscript read, ". . . the near impotence of light airborne troops." The staff of ARMOR regrets the editing error. Ed.

Appreciates Bastogne Article

Dear Sir:

I recently learned from Mr. Clyde Boden—organizer of the International Association of Veterans of the Battle of the Bulge (IAVBOB), that *ARMOR* Magazine would contain a lead article on the "Battle of the Bulge."

As a veteran of that campaign (assigned to the 9th Armored Division) who was involved in the defense of Bastogne I have a deep interest in that event and want to express my sincere appreciation for your interest and effort in releasing an article concerning that campaign.

HENRY F. SPIGNESI
Washington, D.C.

Suggests Demanding Test for Awarding Armor Force Badge

Dear Sir:

I read with interest Sergeant Major Gillis' (September-October 1981) "Driver's Seat" article, "Armored Force Badge is Needed." I enjoyed the background material relating the history of the Armor Badge and can sympathize with his proposal. Armor is the only other ground-gaining branch, besides the Infantry, and as such special recognition (for obvious morale and *esprit* reasons) should be granted.

I am unclear, however, as to how the proposed badge will be awarded. Sergeant Major Gillis states that "awarding the Armored Force Badge should be tied to a score of 80 or better on the Skill Qualification Test." Does this mean that all of the various personnel who would be authorized the badge under his proposal, go through the 19D/19E SQT? If so, to place this award on the same plateau with the Expert Infantryman's Badge (EIB) is a grave injustice. It is well known that a *perfect score* on the EIB test and on the "hands-on" component of the SQT must occur before the EIB is awarded. It is not my intention to demean the Armored Force Badge (AFB), nor to selfishly glorify the EIB. On the contrary, I believe the stiffer the criteria for awarding the Armored Badge the higher esteem it will carry.

Therefore, I propose that an AFB test be devised and implemented in conjunction with the 19D/19E SQT that establishes a rigid set of "hands-on" component-related tasks that resembles the EIB requirements. A *perfect score* on the "hands-on" component tasks, along with successful completion of other Armor requisite skills, would be the criteria for awarding the AFB. In this way the truly outstanding "tanker" will be distinguished from the average ones.

TIMOTHY J. LEYES
Captain, Infantry
Fort Leonard Wood, MO

Support for Armored Force Badge

CSM John W. Gillis
Command Sergeant Major
USAARMC & Fort Knox
Fort Knox, KY 40121

Dear Sergeant Major Gillis:

Your splendid report on the need of Armor Badge(s) should bring results. You have the backing of tanker/cavalrymen across the board.

Having read your article, General Clarke called me to add his continuing support of your Generals Wagner and Davison's endeavors. Some time ago he headed the board that selected the current insignia and "Armor" for the branch.

In 1951, General Clarke tried to save the Armor cap (high-crown style we used to wear on the left; an idea created by General Van Voorhis). Over the years since then, he and others have continued to emphasize the need for the Armor Badge.

Perhaps we'll get the deserved action approved—this time around—thanks to you and your distinguished helpers.

JAMES H. LEACH
Colonel (Ret), USA
Arlington, VA

The letter above is published with permission of the addressee. Ed.

The CFV as a Scout Vehicle is Questioned

Dear Sir:

The current table of organization and equipment for a scout platoon authorizes three sections, each with one *M-113* scout vehicle and an *M-901* improved TOW vehicle (ITV). This is phase II of the cavalry restructuring program. Phase II will provide six cavalry fighting vehicles (CFV) for the scout platoon. What this will end up being is a small armor force, as it is today. The squadron or battalion commander will be tempted to use us as such in addition to his main offensive firepower. This would be fine if it were the scouts main function, but it is just the opposite. Our mission is to see and report, not slug it out with *T-62s* and BMPs. I think we should sit down and ask a few basic questions about the situation in which we find ourselves.

First, does a scout platoon or section need all that firepower? I think not! Our main job is to see and report, so why weigh down our freedom of movement with "horse artillery."

By taking away the ITV and replacing it with another scout vehicle, we increase our observation percentage. Furthermore, the battalion or squadron commander will not be tempted to use us as a main force element.

The *M-901* just doesn't cut it as a scout vehicle. The turret is plagued with problems, and it is too sensitive to use in the hard-moving, critical situations in which a scout will frequently find himself. Also, an *M-901* is easily recognized on the battlefield and will identify the type of element it is in.

I suggest that we replace the ITV with another *M-113* or comparable tracked scout vehicle.

The second question is, will the CFV be able to fit the role of a scout vehicle? Since the CFV is as big as a house and very heavily armed, it is questionable. The CFV will carry two TOW missiles in the launcher and 10 stowed, a 25-mm cannon, a machinegun, and a squad of scouts. I see a pattern forming. Arm the scout and send him out to fight tanks and infantry. There can be no doubt that that is what will happen once the commander sees all that firepower on one vehicle, Now, in each scout section we will have two large, unproven vehicles that are armed to stick it out and fight with a vastly numerically superior enemy. When will we ever learn. Keep the scouts simple and equipped with a vehicle that will keep us quiet, quick, and up with the times. Scouts need the right "horses" to do our job. Don't give us a heavily-armed vehicle and then expect us to slug it out with tanks. We need to keep our cliche: "Sneakee Peakee."

Now, with that opinion out of the way, I wish to ask a question. Why do the 11B series people get a badge for successfully completing the skill qualification test or earning an Expert Infantry Badge and we don't? I think being a tanker or a good scout is a lot harder than it is to walk and "beat the bush." It takes a lot of knowledge and experience to qualify a tank on Table IX, or conduct the multitude of missions expected of a scout; yet, we have no badge to show for our deeds. The only thing we get is an unauthorized patch. I would like to see a tanker badge, or expert cavalryman badge, that shows we have mastered our skills; something that we could wear on our fatigues or class "A" uniforms. Infantrymen have their award. Why not us?

SSG CRAIG C. MOSHER
CSC 3-28 Infantry
APO New York 09358

AirLand Battle—Antidote for "Organized Flight"

Dear Sir:

Captain John D. Rosenberger's article "Organized Flight" in the September-October 1981 edition was well written and brought out some fine points. It did, however, indicate one shortcoming in the Armor Community, that being the timely dissemination of new information. The author insinuated that the active defense is still the doctrine of the U.S. Army. This is not so and has not been the case for some time.

Given the required lead time for publishing this journal, it is understandable that occasionally a bit of information will be out of date. I hope that this is understood by the readers of *ARMOR* and they understand that the doctrine expressed in the final draft of FM 100-5, *Operations*, as well as other field manuals and training texts being published by TRADOC are the current sources of "How to Fight" information.

I believe that Captain Rosenberger, and others, will be pleased by the spirit of the offense found in the AirLand Battle doctrinal literature. The defense (not active, not mobile, just defense) has been relegated to its rightful place—a temporary measure occurring between violent attacks into the flanks and rear of the enemy.

JAMES E. GOOD
Captain, Armor
Fort Knox, KY

Draft FM 100-5, dated 4 September 1981, will not be released to the field in final form for several months. The AirLand Battle, which includes the concepts of the Integrated Battlefield and the Extended Battlefield, is conceptualized in the forthcoming version of FM 100-5 and will be expanded upon as following "How to Fight" manuals are published. See the article beginning on page 26. Ed.

Letter of Appreciation

Dear Sir:

Just a note to let you know how much I enjoy *"ARMOR."* You have a very fine publication. I was glad to send my subscription in last week so that I might begin my sixth year with you. As a minister moving toward active duty as a chaplain in the Army, I find your magazine helpful in two areas. First, it is a professional publication, and it allows me to stay abreast of some of the major trends in the Army. Second, on a more personal basis, I am an avid armor buff. I grew up with armored fighting vehicles (AFV)—my father was an Army career man with 30 years of service, 20 of them as an Armor officer. AFVs never lost a bit of my interest or fascination. Consequently, I look forward to your magazine for information that keeps me up to date in the Armor field.

In your September-October 1981 issue I read with great interest Captain Mackenzie's, "Airborne Armor" because of an incident that took place at Fort Knox in August this year.

I was there for my annual visit with my father. While visiting the museum's restoration area, I was climbing out of an *M-551 Sheridan* when two soldiers walked in, looked up at me in the *Sheridan's* loader's hatch, and asked "Is this that Russian tank?" I'll pray for such tankers—with recognition skills like that, they'll need it. At any rate, I look forward to another good year with "Armor." Thanks again for all the good things your magazine brings me.

REV. GARY W. BROWN
Route 3
Fredericktown, OH

Reminded of Debt to NCOs

Dear Sir:

The July-August 1981 issue of *ARMOR* magazine was, as usual, excellent. The article, "Training Second Lieutenants", by Command Sergeant Major Gillis, was the item which stirred me to write.

It seems like only yesterday when I was a second lieutenant in charge of a firing battery and wondering what the devil I was expected to do or to know. Fortunately, I had an "Old Breed" platoon sergeant who was able to guide me and teach me the things that were necessary. Later, I had a few first sergeants who guided me and taught me how to be a commander. Sergeant Major Gillis' article reminded me of all the things I owe to those wonderful and understanding noncommissioned officers.

The article should be required professional reading for all junior officers and NCOs. There is a desperate need for the knowledge of the NCOs to be passed to the young officers and for the officers to feel free to learn from their subordinates. The first step, however, is to have both parties recognize that the end result must be a *team*. Both members of the team must learn and the product of their efforts will be improved training, better communications, and a more effective fighting unit.

Everyone in the chain of command from the battalion commander and the battalion sergeant major to the platoon leader and platoon sergeant has a stake in the training of lieutenants. Remember that the teaching and learning should never end, even up to the level of the Chief of Staff of the Army and the CSMA.

Thank you, Sergeant Major Gillis for reminding me of my debt to the NCOs in my past. Thank you—all of my NCOs.

JOHN D. SPENGLER
Major, FA
Terre Haute, IN

Training Lieutenants—Who's Responsible?

Dear Sir:

After having read a recent "Driver's Seat" article, I felt compelled to write a response addressing the issue of who is responsible for the training of a lieutenant. I do not believe that the Army is responsible for this training. In fact, I do not believe that the Army trains people to become leaders and good officers.

A lieutenant is most often a young person out of the Officers' Basic Course, who has had a bright "Butter Bar" pinned on his shoulder after taking an oath that commits him to the high standards of his chosen profession. However, he is armed only with the textbook solutions to the canned problems that existed in a school environment. His first major decision involves living up to the standards imposed on him by that oath. The decision to live up to his commitment leads him to his next major decision; how to apply the schoolbook solutions to the real world. How the lieutenant accepts the real world and how he adapts to and interacts with it will ultimately affect his development into a good officer.

Some people assume that a person can be trained to be an officer or leader. I do not believe that to be true. Training implies experience needed to meet the requirements of a specific instance. It is fundamentally a stimulus-response condition that produces unhesitating compliance. There is no room in training for cognitive responses.

Leadership is an individual phenomenon. It is an internalized trait that must be developed by each individual. To be a leader you must first want to lead. Next you must commit yourself to the identification and development of your leadership skills. In the Army there is a further requirement. Before you can expect to lead soldiers, you must understand what it is to be a soldier. Some people believe that being a lieutenant automatically makes you an officer. This could not be farther from the truth. What makes an officer is the initial acceptance of the responsibility imposed on him by the oath he took. In addition, the good officer will actively pursue his own personal development.

When the rank of lieutenant was established, it was realized that not all officers could be leaders. It was also recognized that not all lieutenants would be good officers. The Army provides each lieutenant with 4 years in a controlled learning environment in which he can begin his professional development. After he leaves this controlled environment, he realizes that in order to learn, he must make mistakes. With the mistakes come the jokes, harassment, and criticism, but he drives on. His mistakes are pardoned by the phrase "He's just a lieutenant."

All the outside help in the world, all the lectures and advice will fall on deaf ears, if the lieutenant is not willing to learn. The Army provides the environment and assets for learning. It is up to the lieutenant to use the assets at his disposal and his decision to learn places the responsibility for development on himself.

RICHARD SHIMUNER
First Lieutenant, Armor
Fort Rucker, AL

Why Sergeants Leave

Dear Sir:

Your article "Where Have All the Sergeants Gone?" in the May-June *ARMOR* has prompted me to tell you where this sergeant is going. While I am a 19G rather than a 19E, as addressed in your article, what I've seen the the past few years tends me to believe that my experiences are similar to those of "hard tankers." Armor Branch is losing NCOs to other branches and to the civilian community, not so much because of low pay and career turbulence, although these are factors, but because of boredom, lack of respect, an impersonal personnel management system, and dwindling chances for advancement.

In garrison, there is too much "command presence" for motor stables, skill qualification test training, turret drill, or what have you. It seems that the platoon leader is expected to supervise the NCO giving the training before the lieutenant even knows everyone's name. Even the training schedule seems to be working against the NCO. In most units, the training schedule is made up either by the CO and the training NCO or the CO and the platoon leaders. The tank commander, sometimes even the platoon sergeant, have next to no imput. This freezes the NCO out of exercising initiatives in training, (which is suppose to be one of the reasons the NCO is there), results in frustration, and reduces the NCO's responsibilities to a handful of boring activities, like police call, supervising room cleanup or latrine cleaning. When an officer says, "I shouldn't have to worry about that, that's NCO business," it usually means that "that" is a dull, thankless little chore that still has to be done but is so uninteresting or lacking in impact that the officer wants no part of it.

When I mention lack of respect for the NCO, I am not referring to the troops. Most troops respect an NCO who seems to know his job, is fair, and firm, and stands up for them. The lack of respect I am referring to is the lack of respect the officers have for NCOs. The young officer comes into the unit and his eyes say, "You've been in the Army *12 years*, and you're *still only* a tank commander? Shoot, I can do that, and I just got here." I have gone to Division for, say, an early copy of the Division Training Guidance, and be ignored or snarled at by captains who knew who I was, and then see a platoon leader from one of the tank battalions, looking for the same thing, treated with courtesy.

What is laughingly referred to as the Enlisted Personnel Management System does Armor Branch a lot of disservice. When an NCO is passed over for E-7 in the primary zone, he is never told why. When he is passed over for the NCO Advanced Course, he is never even told he was being considered, let alone why he was not selected. I want to know what I am doing wrong.

The assignment situation mess is bad enough with people heading back to Germany after only 16 to 18 months in the States without being malassigned on top of it, but it's happened to me. When I rotated back to Fort Ord in 1978, after finally getting a *Sheridan* MOS (19G) instead of the old ASI (T or R8), I was assigned to a combat engineer battalion as a combat engineer vehicle commander, then a 19E slot (now it's 12F). The reason? The "19" in my PMOS was "close enough" for the assignment types at the Replacement Detachment. And, what really frustrated me at the time was the fact that there was no agency or person I could talk to who could influence the situation. I have since found out that in most divisions the G-2 is the career manager for all military intelligence specialists in the division and can rectify a lot of malassignments. There is no counterpart for the malassigned Armor soldier.

Why is it that when an officer gets ready to rotate, the adjutant calls in the troop commander, say, and reminds him that Lieutenant So-and-So is rotating in 6 months and his suspense for an award is coming up soon; but when an NCO rotates the recommendation for an award, if any, is made about when the NCO draws his clearing papers?

The lack of recognition extends to promotions. Armor branch is not promoting NCOs to E-7 at the rates other branches are.

Your own figures showed, and they were echoed by *Army Times* recently, that Armor Branch is short of NCOs in every grade except E-7. That makes the prospects for an E-6 look a lot bleaker than in, for example, Infantry or Military Intelligence.

I'm afraid I don't have much in the way of recommendations to solve the problems I've laid out. Educating young officers in what NCOs do might help. So might appointment of an "Armor Career Manager" in each division to resolve things like malassignment. Computer-written letters for those who did not make promotion lists or schools lists, telling them what criteria were used for selection and where the soldier did not meet the criteria, are much too long overdue; as are procedures to assist, not hinder, reassigned soldiers who have submitted joint domicile requests. I have no idea how to increase promotion chances for E-6's, or to improve awards procedures, or even enlisted evaluation reports. In any case, I'm afraid any improvements will come too late in this one sergeant's case. I went looking for greener pastures, and found them.

PETER L. BUNCE
Staff Sergeant
HHC, 4th Bde, 4th Inf Div

Sergeant Bunce's letter was addressed to Lieutenant Colonel (Ret) Bob Cisco, who is employed as a personnel management specialist with the Office of Armor Force Management and Standardization. This condensed version is presented here with Sergeant Bunce's permission. Ed.

Authors Reply to Comments About Soviet Armor Article

Dear Sir:

We are writing in reference to the letters of comment on our article of July-August 1981, "Soviet Armor—Past and Present." While there is not enough space to respond in depth to their comments, we would like to address the following points. First, Captain Halbert's letter:

The armor of the *T-34* could defeat the common German antitank guns at the start of World War II. The key word here is common. The uncommon *Pak 38* could defeat the *T-34* but it was no more common in the German Army at the outbreak of the war than the *T-34* was to the Soviet Army.

We are unaware of the tests run relative to the *T-62* track-shedding problem and will accept that Captain Halbert's information is correct.

Fuel cells external to the crew compartment are certainly a benefit in armor designs. However, we do not believe that the Soviet method of placing fuel cells on the right front fender or sponson of the tank, without armor protection, is an optimum solution.

We disagree violently that a main gun locked in battery for reloading for "30 seconds," as Captain Halbert suggests is not a major problem in combat.

Chart 1 of our article represents our views on Soviet tank family development and not, as Captain Halbert suggests, a chronology of introduction dates. We state in the text that the *T-64* preceded the *T-72* in introduction dates.

The 125-mm gun is listed as a minor modification because it is the first time that we are aware of the Soviets up-scaling an existing gun. In the past, as they up-gunned, they have always gone to a different, mature gun rather than modifying an old-caliber gun.

The reference to the possible use of a BMP-type autoloader was taken from *International Defense Review* because no other information was available at the time the article was written, (July & August 1980.)

Given the premise that we have taken the *T-64* as the possible father of the *T-80*, it is natural that we include the possibility of a turbine engine after reading in the Combined Arms Combat Development Activity's Handbook 550-2, *Organization and Equipment of the Soviet Army*, that a prototype of the *T-80* has been observed with a turbine engine (p. 5-58).

We did not state that the return rollers on the *T-72* were an afterthought, but rather they were a fix to the *T-62* suspension. It is well known that road wheel travel is a desirable trait; therefore, the smaller wheels of the *T-64* allow a greater amount of travel than the larger wheels of the *T-72*.

The point of our article is that the *T-64* is the new tank and will give the major clues in what to expect in the *T-80*. Even though we did not use the specific term, we view the *T-72* as a "backstop" program. We are well aware that the *T-55* was produced in the Warsaw Pact countries and that the *T-72* is also to be produced there. The significance of this lies in the question as to why the Soviets are making this change in policy of only giving their second best to Warsaw and keeping the best for use at home. The significance of a picture of a *T-72* with skirts could be very minimal. Look at pictures of early *Leopard A1s* without skirts and then a few years later with lightweight rubber skirts. This certainly caused a visual change in the tank but could hardly be considered to make it a major new type. (We are not talking about more recent modifications to *Leopard A1* that bring it up to *A1A1* status.)

Captain Halbert indicated that the *T-72* has been a backstop program to fill in while the *T-64* was being debugged, therefore, it would make sense to surmise that, in keeping with the Soviet's evolutionary approach to tank design, the *T-80* would evolve from the latest technology of the *T-64* and not that of the *T-72s* backstop program.

Now for Doctor Volz's comments:

Doctor Volz's, interesting statement that Soviet weaponry development is essentially conservative and evolutionary in nature is the central theme of our argument.

The *T-72* may have been expected in the highest level intelligence circles, but that was not the case Army-wide during the early and mid-seventies.

The designation *T-80* is not ours but rather one that is used by the U.S. Army. With regard to Doctor Volz's contention that T numbers have never been repeated by the Soviets, we would like to draw his attention to the *T-34* light airborne tank of the late forties, (parentage of this tank was a combination of *T-70* and *T-34*).

One would have to go back farther than the *T-34* to find a Soviet tank that ran on a true Christie suspension capable of movement with the tracks removed—a feature notably missing in the *T-34*. While we are aware that the *T-34* was the last Soviet medium tank using coil springs, we prefer the nomenclature "Christie independent type" that John Milsom used in referring to the *T-34/T-62* family suspension in his book, *"Russian Tanks 1900-1970."*

We are not impressed with the Soviets large tank guns; however, we are impressed by the historical fact that the Soviets appear to be taken with the idea of having the largest guns in their tanks.

When the Soviets began developing new tanks following World War II, they also followed their wartime doctrine of not stopping production of a proven design. One reason for doing this was to keep their forces up in numbers while minimizing the strain on a war-devastated economy. It was this "post war shell game" that served as one of the key historical trends for forming the concept of our article. The historical parallel becomes very apparent if you look at the following equation.

T-34/85 = *T-55,62,72* the proven vehicles.
T-44 = *T-64*, the transition vehicle.
T-54 = *T-80* the new definitive vehicle.

The question that we most wanted answered was never really addressed. Why is the *T-72* sold to virtually any country with a couple of Rubles in their defense pockets while at the same time the West sees a steady flow of press releases, direct from Moscow, on the specifications of the *T-72*. The Soviet Army prefers to keep the *T-64* (early seventies technology, according to Captain Halbert) in their Category 1 units in East Germany, and sells the *T-72* to everyone else.

A note of interest—Secretary of Defense Casper Weinberger's recent white paper on the Soviet threat titled, "Soviet Military Power," shows an artist's concept of a vehicle referred to as the *T-80*. The hull configuration and the suspension in this drawing would indicate a *T-64* as the parent, not a *T-72*.

JOSEPH R. BURNIECE
PAUL A. HOVEN
Summit Simulations, Inc.
Minneapolis, MN

More Support for "Vee" Maneuver Technique

Dear Sir:

I am writing in response to Captain Swan's reply in the September-October issue of *ARMOR* to Brigadier General Wagner's article on the "Vee." Captain Swan appears to have a misunderstanding of how the "Vee" works.

I would like to address some of the points that Captain Swan makes. First, Brigadier General Wagner was not trying to convince anyone that the "Vee" is new. It has been used in the 2d Armored Cavalry Regiment (ACR) for over 3 years and has recently been adopted by the 11th ACR and 3d Infantry Division (ID).

Captain Swan also states that the "Vee" forces the commander to make contact with the bulk of his forces. That may have been true of the old Infantry "Vee," however it is not true of the "Combat Vee." If the unit is moving properly, only one element should come into initial contact because the point elements use alternate bounds when enemy contact is expected. The concept of maximum firepower forward is, in fact, a derivation of the overwatch concept.

The "Vee" is not a substitute for doctrine. It is a method of achieving a bounding overwatch capability. The 3 ID has recently published a Maneuver Pamphlet that attempts to bridge the gap left by our doctrinal manuals in achieving a small-unit, cross-country maneuver capability. Anyone interested in a copy of this pamphlet should write to: Office ADC-M, 3d Infantry Division, USMCA Schweinfurt, APO NY 09033.

DAVID S. CLARK
First Lieutenant, Armor
Schweinfurt

Demise of Airborne Armor Predicted

Dear Sir:

I read with extreme interest Captain Bob D. MacKenzie's article "Airborne Armor" (September-October 1981). Airborne armor seems to be getting a lot of attention these days, especially with the increased emphasis on the Rapid Deployment Force (RDF). But I can't help feeling that this interest, mostly generated by proponents of the airborne armor concept, like Captain MacKenzie, is merely an attempt to delay destiny. Airborne armor is going to die for two significant reasons. First, the lack of trained personnel to fight and maintain the *M-551 Sheridan*. As was mentioned all too briefly in the article, Fort Knox no longer trains *Sheridan* crewmen (MOS 19G and 19H) or turret mechanics (MOS 45P). I applaud attempts to stabilize knowledgeable personnel to retain deteriorating expertise and attempts at training 19Ds and 19Es on the *Sheridan*—but for how long can this realistically continue?

This leads me to the second reason for airborne armor's likely demise, that being that the Armor Community has written off the *Sheridan* and the airborne armor concept. By not supporting the concept with trained personnel and with little to no instruction in airborne armor doctrine at the Armor School, Fort Knox has indirectly (or inadvertently) condemned the idea. The fact of the matter is that 4-68th Armor in many ways is a forgotten outfit in the mainstream of the Armor Community.

GUY C. SWAN, III
Captain, Armor
Fort Benning, GA

What Type Armor Does the T-72 Have?

Dear Sir:

I would like to congratulate both Mr. Burniece and Mr. Hoven on their excellent article "Soviet Armor—Past and Present," which appeared in the July-August 1981 issue of *ARMOR*. I do, however, have two points to add to their comments. First of all, I think that it took far too long for someone to bring out the relative importance of the "new" Soviet *T-64* and *T-72* main battle tanks. These two tanks, while appearing to be very similar, are in fact very different and distinct vehicles.

Secondly, in their discussion of *Chobham* armor, and whether or not the *T-72* is in fact fitted with this British developed armor plate, Mr. Burniece and Mr. Hoven fail to mention one very important possibility. Could the *T-72* (and *T-62* for that matter) be fitted with still a different type of armor?

If a close examination is made of the photographs of the tanks that are known to be fitted with *Chobham* armor, it can be seen that the turrets are constructed of very thick armor plates that are welded together. If it could be possible to reduce the number of layers of material in the armor itself to a point that the welding of the plates would not be required, could the turrets be comprised of a "single ballistically, superbly-designed semi-spherical casting," while still incorporating some level of *Chobham* armor's design and effectiveness?

JAMES M. WARFORD
First Lieutenant, Armor
HHC, 2-81 Armor

Getting Back on Track

Dear Sir:

I am responding to Captain Snedden's article, "Equipment Changes for the Tank Company," in the September-October issue of *ARMOR*.

I have witnessed numerous attempts by tank company commanders to use vehicles, other than their tank, as their command vehicle. I have also spoken firsthand to tank company commanders, from both sides, who fought in the 1973 Yom Kipper War. The conclusions drawn from these experiences *confirm* that our present organization and doctrinal teachings are valid.

The crux of these conclusions is that the tank company commander must be a leader and a fighter. He must be able to think on his feet in tight situations, and at the same time be prepared to influence the battle with the most survivable aspect of his tank—a 105-mm cannon. Historically, and today, it is a fact that his tank's cannon may be the decisive factor in key situations. Furthermore, he should maintain the capacity to "do as I do" at every opportunity. This sets the example to subordinates throughout his command. He must share the high risk of being a casualty. Hence, Infantry's motto "Follow Me."

This letter is not intended to stop company commanders from looking for a better way to lead and fight the battle. However, let us make sure that our aim is to lead and fight, and, until something better comes along, "get back on track."

DAVID W. MARLIN
Captain, Armor
U.S. Army Armor School

Researcher Needs Book on 7th Cavalry

Dear Sir:

As a point of continuing research effort over the past few years on the 7th Cavalry, I am in desperate need of a book titled, *"The History of the Seventh United States Cavalry 1866-1925*, by First Lieutenant O.L. Sanders. It is a rare book, long out of print, but necessary for the success of my research on the regiment. Should anyone have a copy, please contact me.

JOHN M. CARROLL
Frontier Military Research Institute
P.O. Box 44
Bryan, TX 77806
(713) 779-6366

More Support for Armor Force Badge

Dear Sir:

I would like to compliment Command Sergeant Major Gillis on his effort to have an Armor Badge approved for wear by Armor and Cavalry crewmen.

I believe all combat arms soldiers deserve to be recognized with a combat or branch qualification badge. Like the Infantry, the Field Artillery, Combat Engineer, and Armor branches need a distinctive award to set their men apart. Combat Arms Badges would become meaningful incentives in an army of look-alike uniforms and peacetime ribbons.

The combat badges must be awarded using the same criteria required for the Combat Infantry Badge. All branch qualification badges should share uniform standards in a common program like the one suggested by CSM Gillis.

CSM Gillis is right—we do need an Armor Badge. It is an appropriate symbol for a hard and dangerous job done well. The same recognition should be given to all soldiers in the combat arms.

NOYES B. LIVINGSTON, III
First Lieutenant, Infantry
49th Armored Division, TXARNG

COMMANDER'S HATCH

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

Overweight and Out of Shape

Are today's Armor officers overweight and out of shape? Some recent facts:

- 50 percent of the Armor Officer Advanced Course (AOAC) students fail their diagnostic Army Physical Readiness Test (APRT)!
- 14 percent of the AOAC officers arrive overweight!
- 46 percent of the Armor Officer Basic Course (AOBC) students fail their diagnostic APRT!
- 8 percent of the AOB second lieutenants arrive at Fort Knox overweight!

We have a problem! As these disconcerting figures and the accompanying graphs indicate, many officer students arrive at Fort Knox in poor physical condition. It should be pointed out that officers from other branches attending the AOAC also fail the APRT and are overweight, and the statistics include officers from all branches even though I speak generically of Armor officers since the majority of each class is Armor. Most of the overweight officers have between 5 and 10 pounds to lose to meet the standards established in AR 600-9, *The Army Physical Fitness and Weight Control Program*; however, a few in each class arrive grossly overweight. The AOBC student has a relatively short period in which to overcome his shortcomings. In addition, the AOAC-Reserve Component classes do not have the 26-week cushion available to the regular AOAC students to make up their physical training or weight deficiencies since the AOAC-RC program is only 13 weeks in length.

Students frequently cite the period of leave between assignments or schools as the cause of their problems on the diagnostic APRT. However, the poor performances on the record tests strongly suggest that the root causes may lie deeper. In most cases, the failing officer has not established an individual physical fitness program or his former organization may have tested or evaluated him infrequently without adhering to the standards established by AR 600-9 and FM 21-2, *Physical Readiness Training*. Of the three events tested, most failing students have difficulty achieving the push-up standards. In part, the failures have been due to improper technique. In virtually every case, however, the individual has been unable to continue the exercise for the full 2 minutes. Not using all the available time reflects poor physical conditioning as well as a lack of mental toughness—both critical deficiencies for our potential armor leaders. An average scorecard for a 23-year-old AOBC student who fails the diagnostic APRT would show the following:

Events	Raw Score	Points
Pushups	34	54
Situps	42	62
2-mile run	17' 30"	63
		179

The USAARMC Physical Fitness Program

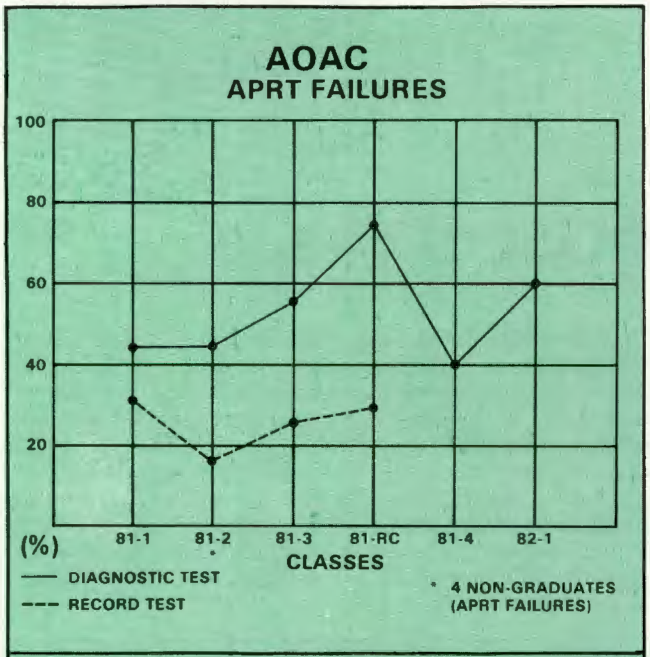
The Test and Evaluation Branch, Directorate of Plans and Training conducts the three-event APRT to insure that a consistently high standard is established at the outset on the initial diagnostic test and maintained on subsequent diagnostic and record APRTs.

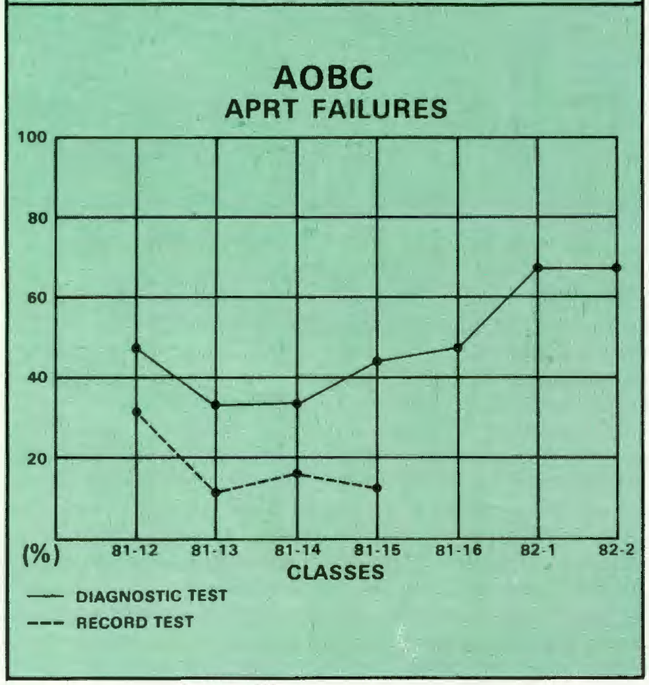
If you are an AOB student, you can expect to receive a diagnostic test within 10 days of your arrival. You will attend a scheduled 50-minute physical readiness training (PRT) session 5 days per week through week 10. After the 10th week your field training requirements will reduce the frequency at the scheduled physical training. All PRT periods are led by fellow students and evaluated by your class advisors. If you are scheduled to attend Airborne or Ranger School after AOBC, you will receive additional training, including water survival and patrolling techniques. Your first record APRT will be administered during your 10th week in the course. Subsequent tests will be administered before graduation if you fail to meet the established minimum standards.

An AOAC student will receive two diagnostic APRT's. The first diagnostic test will occur within 3 weeks of arrival, and the second test will generally be administered near the mid-point of the course. AOAC students also lead their own daily PRT periods. The record APRT is normally scheduled about 5 weeks before graduation, and formal retests are also administered to the AOAC students.

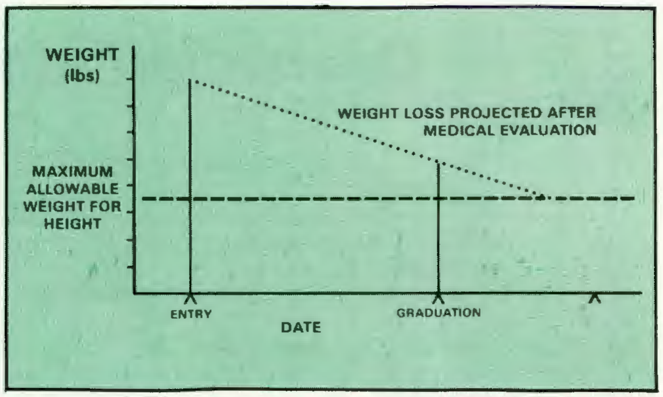
Failure

What are the consequences of failure? The simple truth is that each student must achieve a passing score on the APRT, as well as meet all of the academic requirements, to graduate from the course. Officers who fail to meet the minimum standards are referred to a formal academic board that evaluates all of the pertinent information. The student may be declared a graduate if there are extenuating circumstances. However, in most cases, I forward a letter that identifies the student's problem to the gaining command, and appropriate remarks are included in the student's Academic Efficiency Report.





Although the failure rate on the record tests has been distressingly high, all officers have subsequently passed a retest or been granted a waiver for medical reasons, with the exception of four captains in AOAC 81-2, who were declared nongraduates after repeated failures. Most of the overweight officers bring their weight down to Army standards during the first few weeks of the course. All overweight officers are placed on the overweight program, formally evaluated, and counseled. In some instances an officer may be so obese upon his arrival that the projected weight at graduation is still in excess of the standards. If the officer meets the established rate of weight loss he will be graduated with his class; therefore some officers may, in fact, depart the course overweight. Appropriate remarks are also entered in the Academic Efficiency Reports of the officers with overweight problems. In the future the individual's next commander will be advised of the individual's weight reduction program so that it can be properly continued.



We probably need to consider seriously an Army-wide program that insures nonselection for commissioning or course attendance for officers on an overweight program and deferred entry to those officers who arrive overweight because they were careless during their leave and travel to Fort Knox.

Concluding Thoughts

- Too many Armor officers are arriving for AOAC and AOBC overweight and out-of-shape.
- USAARMC has a rigorous physical training program. However, it is still not a substitute for an individual, lifetime commitment to physical fitness. Get started early in your service and stay with it.
- Officers are expected to do more than just meet the minimum standards. You forfeit an invaluable leadership tool by not maintaining your proper weight and a high level of physical fitness.
- You demonstrate your commitment to high standards by developing the physical strength and endurance to execute each exercise for the entire allotted time.
- We are combat leaders and must take professional pride in our total performance.

DRIVER'S SEAT

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

A Matter of Integrity

We have the same problems with noncommissioned officers and soldiers attending the Noncommissioned Officer Education System (NCOES) courses and Drill Sergeant School, Fort Knox that are discussed in the "Commander's Hatch" concerning officers. Too many are overweight and out of shape! In a recent Advanced Noncommissioned Officer Course, 14 percent were eliminated for failure to pass the Army Physical Readiness Test (APRT). We eliminated 40 percent of the NCOs attending a recent Drill Sergeant Course for failing the APRT or for overweight, and, although this was exceptionally high, the normal 12-15 percent elimination of our "elite" NCOs in this course is too high a failure rate. NCOs are selected for both of these courses from units throughout the United States Army; and in most cases, failure of the APRT was due to their overweight condition.

In addition to the two courses already mentioned, NCOES training at the United States Army Armor Center includes the Primary Leadership Course (PLC), the Primary NCO Course for Combat Arms (PNCOC/CA), and the Basic NCO Course for Combat Arms (BNCOC). Noncommissioned officers and soldiers attending these courses come from a 17-state region within CONUS, and are selected from approximately 33 installations. If the APRT was a current requirement for graduation from these courses, the minimum failure rate would be 15 to 20 percent.

We have a problem! The question is why? It's not enough to say what we have been saying for years, "The commanders are not selecting the right NCO or soldier to attend the school." All the verbage on misuse of quotas, waste of money and resources, and the graphs and charts and other statistics we have used for years merely acknowledge that the problem exists without answering the question as to why it exists.

Why do NCOs and soldiers who are overweight and physically unfit attend NCOES schools? The answer is their NCOs and company commanders have elected not to enforce Army standards. Their battalion and brigade commanders have elected not to give the necessary "command direction" to insure that Army standards are enforced. In short, all leaders in the chain of command and the NCO "chain" have replaced an Army standard with their "personal" standard. Although rationalized in many ways ("my best tanker," "so he is overweight, he can still pass the APRT," "he needs the school to get promoted," etc.), the bottom line is that the leader's decision subverts a standard that is his responsibility to enforce.

Recognizing that failure to support Army standards is the cause of sub-standard NCOs and soldiers attending NCOES courses (and the Drill Sergeant School) makes the best solution to the problem simple. The solution is best stated by quoting one of my past commanders. He said, " 'Zero Defects' is a dumb motto, except in matters of integrity." Selecting only those NCOs and soldiers who meet Army standards to attend these courses is a matter involving integrity.

John W. Gillis

Tank Gunnery Qualification in the 1980's

by Major C.D. McFetridge

During sustainment gunnery in the fall of 1980, the 3d Infantry Division found itself faced with problems typical of any unit conducting gunnery training in USAREUR—too little time, too little ammunition, to few ranges, too much bad weather, and too few crews doing exceptionally well. In response to the effort to get nonqualified crews from the first units in the division back to Grafenwoehr, those of us in the rear of the battalion firing order took some controversial and innovative steps. One battalion fired most of its crews on the night tables before day tables because the nights were longer, but fogged in earlier. Another battalion took one company straight from zero range to Table VII. The results were no worse than any other company and better than most.

I was the S-3 of the first of these battalions. In the many hours spent in the tower with battalion and brigade commanders, it occurred to us that with more units trying to use "Graf" each year, with the reduction of ranges to accomodate the M-1 and Canadian Cup, and the continued decrease in training ammunition, the "old" system of tank gunnery was not going to get the job done. From that assumption, and the discussion of the alternatives, came the concept in the accompanying article. I hope you find it interesting. CDM.

The time has come to revise tank-gunnery, live-fire training. The present program does not meet the requirement to train 100 percent of a battalion's tank crews to achieve minimum combat standards. A more efficient and effective program is needed to insure optimum use of time, personnel and resources. A unit should depart gunnery live-fire training, be it for "qualification" or "sustainment," confident that all crews can perform all required-in-combat tasks and be proficient in the use of all weapons and fire control systems on their vehicles.

The present gunnery program does not train tank crews adequately and has several serious flaws. At best, it leaves crews familiarized with some of their equipment; at worst, it teaches techniques to "beat the range" that could prove fatal on the battlefield. The present system, which is basically a sequential progression from weapons zero through the firing tables, does have some marginal utility in familiarizing untrained crewmen with their vehicles. However, no allowance is made for varying abilities and experience of individual crews. Stabilized, previously-qualified crews get the same range time and ammunition as the novice.

The gunnery tables do not evaluate the crew's ability to employ the full capabilities of the tank. The gunner's *M-105D* telescope is rarely used. This causes an excessive reliance on the *M-32* primary sight. The tank commander never fires the main gun or coaxial machinegun (coax) from his station—and probably does not know how. The *M-239* smoke grenade launchers are rarely even demonstrated and are not required in any task in the tank tables.

The scoring system used to "qualify" tank crews produces some unusual anomalies. By only requiring qualified ratings in 7 of the 10 tasks on Table VIII, a crew can be qualified with serious unsolved problems. For instance, a crew can be qualified without being able to engage coax targets successfully, or any target at night. The tenth task, ammunition conservation, encourages "tricks" to best the standard. Consider, for example, a crew that has expended all caliber .50 ammunition against previous targets and is then confronted with a multiple main gun and machinegun engagement. In combat, the crew would engage the machinegun targets with the main gun. On the gunnery range, a wise crew, knowing they cannot be rated qualified in any case, will not engage the main gun targets and save four main gun rounds for ammunition conservation. An even worse case is that of a crew that qualifies on all six tasks during the day but only saves two or three rounds for ammunition conservation. The crew *risks* its qualification if it fires the main gun at night and *guarantees* qualification if it fires only the machinegun engagement and saves the main gun ammunition. We have trained a crew not to perform!

The method of teaching rapid engagements is also poor. The tank that fires first will usually win the battle. The corollary is, of course, that the target must still be hit regardless of the number of rounds fired. With the current tank tables, a crew that misses with its first round(s) must carefully and quickly consider the decision to continue the engagement. It may prove wiser to cease fire, go unqualified for target hits, and save ammunition, than to fire again and destroy the target but take too much time. The difference between 30 seconds and 40 seconds is meaningless to a crew on Table VIII. All too often a crew returns from down range confident they have destroyed all the targets only to find themselves unqualified because they exceeded the time standards by 1 or 2 seconds on some of their engagements. Speed on engagement is important, but there are better ways to measure it.

The most significant shortfall with the present program is that it does not produce trained crews, it only identifies them. Unqualified tank crews go home having been told they cannot do their jobs and must wait another 6 months to have a chance at proving they are "combat ready." If we are truly outnumbered, we cannot afford to enter combat with 10, 20, 30 or 40 percent of our tank crews unable to meet minimum combat standards. Does a tank battalion that qualified 50 percent of its crew at gunnery practice rate itself C-4 for training until the next gunnery session? What can we do to raise that percentage of qualified crews to 100 percent?

To qualify all crews, it is first necessary to identify those crews needing training, and the type of training required. A suggested gunnery program for achieving this goal follows.

After zeroing, each crew will negotiate Table VIII "cold." The proposed Table VIII will consist of 10 engagements that approximate combat conditions as closely as possible. All fire control systems and weapons must be employed at some time while the table is being negotiated. The 10 tasks will be graded GO or NO GO. Crews that successfully complete all 10 tasks will qualify. Those crews that do not successfully complete the 10 tasks with a GO rating will move to Table VI for additional training. There they will be coached individually by company master gunners and those tank commanders who "tested out" the first time down range. The training will concentrate on *identified* weak areas. When the crews are retrained to meet the standard, they will renegotiate Table VIII to qualify in the 10 tasks. Ammunition saved by not firing all crews through Table VI and Table VII will be used to retrain weaker crews on those engagements. Depending on range time and ammunition available, a crew should qualify in all tasks again. If necessary, the crew may fire only the "NO GO" tasks to meet "GO" standards. This process could conceivably be repeated, as necessary, until all 54 crews "qualify" on the 10 tasks.

Conditions and standards for qualification in the 10 tasks are very important. They should be uniform, but not to the extent that crews are penalized because suitable ranges or training areas are not available. The objective is to simulate combat engagements, use all systems, and service all targets. Some of the present Table VIII target arrays remain in the proposed table, but many have been modified (figure 1.) Significant features are summarized as follows:

- Tank targets can only be destroyed by the main gun.
- Troops engaged with the main gun receive only 1/5th coverage per round.
- All targets must be destroyed by target hit except troops. Troops are supressed by 3/5th coverage.
- Trucks, BMPs, helicopters, ATGMs, or whatever you want to call them, must be hit by the main gun or caliber .50 machinegun to destroy them.
- Main gun ammunition is allocated at a rate of 1.5 rounds per tank target.
- Main gun ammunition is 50 percent TPDS, 50 percent HEAT, or HEAT and HEP mixed. There are insufficient TPDS rounds to engage all tank targets, even with all first round hits.
- Ammunition and weapons selection is the choice of the tank commander.
- Time for engagements is measured on a sliding scale. Time begins when all targets are displayed or the vehicle takes offensive action.

TASK*	TYPE ENGAGEMENT	SPECIAL REQUIREMENTS	TIME ALLOWED	NUMBER ROUNDS	REMARKS
1	2 Tanks, frontal shots 1,000-1,200 m. main gun	Ballistic shield must be closed before beginning this engagement	18 sec 26 sec 34 sec	2 3 4	Use of *M105D* telescope is mandatory.
2	2 Tanks, hull down 800-900 m main gun	STAB engagement	18 sec 26 sec 34 sec	2 3 4	
3	1 Tank frontal shot 1000+ m Troops at 800 m 1 Truck at 1,100 m multiple main gun and machinegun	Truck may be engaged with main gun or cal. .50; tank target with main gun only	30 sec 38 sec 46 sec	1, 105-mm 2, 105-mm 3, 105-mm	100 rds coax and 50 rds cal. .50 are allocated.
4	3 Tanks 1,800-1,900 m main gun and *M-239* Grenade	As firing tank approaches firing point, tank stops, TCE dismounts, is picked up by safety/control vehicle. When target is designated, tank buttons up, pops smoke, moves to firing position and engages. Targets appear as smoke clears.	28 sec 36 sec 44 sec 52 sec	3 4 5 6	6 *M-239* smoke grenades. May use less if supply or range requires.
5	1 Tank, frontal shot 1,200 m Main Gun	Ballistic shield must be closed. STAB may be on. Gunner indexes battlesight. TC may fire battlesight or precision. Gunner must turn around. TCE verifies.	10 sec 26 sec	1 2 3	TC fires from his station.
6	2 Moving tanks, frontal shots and 1 moving tank 1,200-1,300 m main gun	NBC conditions. All hatches closed except loaders. Time begins when all targets are exposed.	26 sec 34 sec 42 sec 50 sec	3 4 5 6	Suggestion: HEAT is easier to sense with NBC mask on.
7 1 N	2 Tanks, frontal shots 1,000 m 1 truck 900 m main gun, cal .50	From indirect lay to direct fire. NBC engagement. TCE evaluates range card procedure. Must be correct to get a GO. IR illumination. Tank target main gun only, truck with main gun or cal. .50.	28 sec 36 sec 44 sec	2 3 4	50 rds cal. .50 allocated.
8 2 N	2 Trucks, 900 m Troops, 800 m cal. .50, coax	NBC conditions. Indirect illumination. Hatch may be open. Trucks may be fired on with main gun or cal. .50, but TC must announce proper fire command. TC requests illumination by using proper request for fire.	30 sec 38 sec	100 cal. .50 100 coax 1, 105-mm 100 coax 2, 105-mm	Main gun not recommended, but may be used on trucks, either machinegun on troops.
9 3 N	1 Tank, frontal shot 1,000 m 1 Moving tank 1,100 m main gun	Indirect illumination. TC need only call "Repeat" for illumination.	18 sec 26 sec 34 sec	2 3 4	
10 4 N	1 Tank 1,300 m main gun 1 AT gun 1,200 m main gun or cal. .50	Main gun fired with *M-105D* telescope, ballistic shield closed. TC calls "Repeat" for indirect illumination.	20 sec 28 sec 36 sec 44 sec	1, 105-mm 50 cal. .50 2, 105-mm 3, 105-mm 4, 105-mm	Any remaining cal. .50 or main gun ammo may be used until targets are hit.

Figure 1. Tank Table VIII (Modified)

- Time for engagements is measured by the number of rounds fired. The crew has 10 seconds to fire the first round and 8 seconds for each subsequent round.
- Time for machinegun engagements is computed at 10 seconds for all nontank targets.
- Twenty minutes is the goal for negotiating the course day or night. Crews that take longer must be evaluated at 20 minutes by the range OIC to determine whether they are capable of completing the course. Proposed specific tasks, conditions, and standards are listed in figure 1.
- A tank crew evaluator will accompany each vehicle when it negotiates any part of Table VIII. The TCE scores and times the engagements, acts as safety observer, verifies legitimate vehicle malfunctions, and confers with and resolves any discrepancies in scoring with the safety officer and/or range OIC. The TCE then debriefs the crew, gives them the results of their firing, and points out departures from doctrine. He also makes appropriate suggestions for improvement.
- Alibis are awarded only when a malfunction occurs that is beyond the crew's ability to correct, using the vehicle's operator's manual and Prepare to Fire checks, and that would preclude the vehicle from safely negotiating the course. Discretion by the battalion or brigade commander is called for here in ruling out alibis. The goal is to teach and produce satisfactory crews.

> ***"We must change our system or accept 10, 20, 30, or more, percent of our tank crews as being 'not combat ready.' "***

Numerous advantages are offered by the proposed gunnery program. It will:

- Accurately reflect the crew's ability.
- Put significantly greater pressure on pregunnery training that is inherently cheaper than live-fire exercises.
- Concentrate scarce ammunition, range time and trainers on the weakest crews.

All the crews will complete the gunnery program having met minimum combat standards defined by the scoring system. The unit will return from gunnery with a good diagnosis of the adequacy of its home-station gunnery program and can begin planning immediately for emphasis on specific objectives for the next home-station training period. Crews will return from gunnery with high morale—confident in themselves and their equipment. Finnally, the new program decreases artificial standards and "tricks" that are used to "beat the course."

As with any program, there are potential disadvantages that must be overcome. Different requirements for training will make control of personnel more difficult. A possible solution would be to focus the retraining effort at platoon level. Every platoon leader and platoon sergeant would be responsible for working with their weak crews until all the platoon's crews qualify. This would reverse the present tendency to disrupt the platoon chain of command when the unit goes to the tank ranges. It would ensure that weak crews get maximum attention during home-station gunnery training, and put the platoon chain of command firmly back in the training picture.

Another area of concern is the proper use of those crews that initially qualify. They should not be detailed to support crews that are being retrained because this, in effect, penalizes them for doing well. Instead alternate training in small arms, demolitions, and other activities that fully uses the training areas and ranges should be scheduled for the qualified crews.

The requirement for TCEs is an additional problem, but one that can be overcome. To be effective, TCEs *must* be highly-qualified NCOs, who are, or have been, tank commanders. Those are precisely the type of NCO of which every unit is desperately short. Some possible candidates for TCEs include the following:

- The senior armor crewmen authorized in tank battalion headquarters and combat support companies.
- The first sergeant—the supply sergeant can hustle soup and coffee for a couple of weeks. Besides, by doctrine, the first sergeant is the senior enlisted trainer in the company.
- Experienced E-6 and E-7 tank commanders with less than 90 days left to serve in the unit. Their replacements should not miss the training benefit of a gunnery cycle. What good does it do to have a tank commander return from the qualification course and jump in a jeep to go to the rear to out-process?
- Selected staff-level senior NCOs who can be spared from the S-2, S-3 and other sections.
- Qualified TCE's from a sister battalion or squadron may be the best solution if they can be spared by the donor unit.

The least desirable personnel for use as TCEs are the battalion or company master gunners. While they are the obvious choice, the detrimental effects of their removal from the unit's gunnery program outweigh the benefits accruing to individual crews. Bear in mind that only six TCEs are required for 24-hour operation and, after all, who is too good to train the troops?

Proper ammunition programming also needs special attention. Units will not know exactly how much ammunition will be needed to retrain weak crews until after Table VIII is negotiated initially. However, with the proposed program, ammunition will not be wasted on excellent crews but used for weaker ones. Clearly, only those crews that need to fire will be shooting and they will fire only what is needed to meet combat standards. It is probable that some types of ammunition, coax, for instance, will be excess to requirements. Other types may be needed in larger quantities. As the data base grows, it will be possible to predict ammunition consumption with greater precision.

The need to revise the tank gunnery tables is clear. The present gunnery program does not optimize manpower, ammunition expenditure, time, or training facilities. The proposed concept complements Army doctrine, concentrates on those crews that need training, and untimately will conserve the steadily diminishing training resources at our disposal. We must change our system or accept battle with 10, 20, 30 or more percent of our tank crews "not combat ready." Can we afford that?

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An Armored Task Force Executes a Hasty Attack

by Lieutenant Colonel Harry W. McWilliams and Captain Timothy E. Donovan

This article describes the actions taken by a tank battalion task force during a movement to contact and the conduct of a hasty attack. It also highlights the advantages that accrue to a tank battalion task force using current organization and weapon systems but with four maneuver companies. As you read, you should note the flexibility four companies afford (standard organization with Division 86 tables of organization and equipment) and visualize the enhanced capability of units using weapons systems being fielded now — such as the *M-1 Abrams* tank and the *M-2/3 Bradley* infantry/cavalry fighting vehicles.

The task force described here is participating in an exploitation. It could however, be an armor task force in Europe moving to occupy its assigned initial position in the General Defense Plan. It is organized with two company teams and two pure tank companies, giving the commander flexibility in a relatively vague situation. The commander chooses to move rapidly over multiple routes in a dispersed formation.

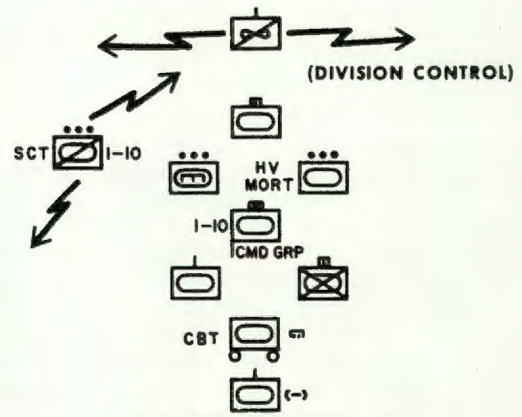
The lead team advances with platoons on multiple axes, using appropriate overwatch techniques. The engineer platoon and an air defense platoon, which the brigade commander has placed in direct support of the task force, as well as the forward air controller (FAC) and fire support coordinator (FSCOORD) move with the task force while providing support.

The task force commander has organized to give the lead team four platoons (three tank, and one mechanized infantry) to insure sufficient combined arms combat power to maintain momentum in the event of enemy contact (figure 1). He has also given the attached mechanized infantry company a platoon of tanks, for, if contact is made, this team may be used in the assault and must have the ability to deliver a high volume of fire at enemy armored vehicles with tank main guns — and with machine guns, if the infantry dismounts to clear dug-in enemy infantry. The two remaining tank companies are pure, and with the tank company minus (now a two-platoon company) assigned the mission of rear guard and right flank security. The battalion scout platoon screens to the left front of the task force. It also maintains contact with the adjacent divisional cavalry squadron and the air cavalry troop that is screening the brigade's advance.

The task force's heavy mortar platoon is positioned well forward in the column to deliver smoke or immediate high-explosive suppressive fires on enemy units encountered by the scouts or the lead team. The engineer platoon is also positioned forward to assist in breaching obstacles, while the air defense platoon is interspersed throughout the task force. The four *Vulcans* mounted in *M-113* armored personnel carriers (APC) protect the lead elements against enemy attack helicopters and tactical air, while the five wheeled-vehicle-mounted *Stinger* teams, with their greater range, but more limited protection and mobility, are distributed in depth.

The task force commander is in his tank, accompanied by a command group in armored vehicles so that he can respond immediately to any rapidly developing situation. The XO also moves in a tank and is positioned to best assist in conducting the battle as directed by the battalion commander. The S-3, is moving with the main CP, and has planned control measures such as check points, axes of advance, and phase lines based on a map reconnaissance of the area ahead of the task force. The S-2 uses all available intelligence agencies to assist in "seeing" the potential battlefield ahead, and works closely with the operations officer in planning for any contingency.

The FSCOORD has planned priority targets on clearly identifiable terrain features to facilitate the rapid delivery and adjustment of indirect fires. The brigade commander has directed the 155-mm direct support (DS) artillery battalion commander to dedicate a six-gun battery to the lead company team. This method of artillery support opens a dedicated fire direction net between the lead team commander through the accompanying fire support team (FIST) and the dedicated battery's fire direction center (FDC). The battery commander has a part of his battery laid on designated priority targets in support of the scheme of maneuver.



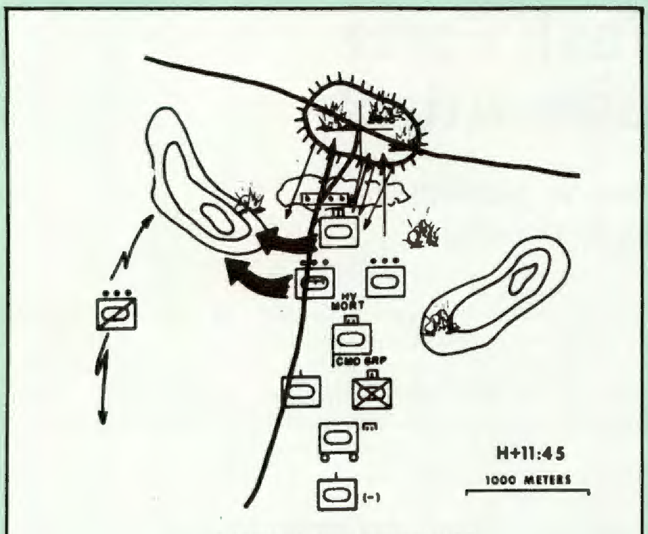
MOVEMENT TO CONTACT

Figure 1

The task force's combat trains move with the task force under the control of the S-4 and are organized to accomplish rapid recovery and limited repair of combat vehicles, immediate resupply of ammunition and fuel, and medical evacuation. The headquarters company commander, is prepared to coordinate the response to the logistical requirements of the task force from the field trains.

As the task force continues its movement, the division's air cavalry troop, screening forward of the brigade, reports a possible company-sized enemy force in a strong point at a key road junction approximately 3 kilometers ahead. This information causes the lead team to switch from traveling overwatch to the slower, but more deliberate, technique of bounding overwatch. The remainder of the task force continues to move in traveling overwatch. The brigade commander assesses the size of the reported enemy force, and the importance of the road junction to the accomplishment of his mission, and orders an attack on the enemy position.

Meeting engagement. As the task force approaches the road junction, the lead elements come under heavy direct and



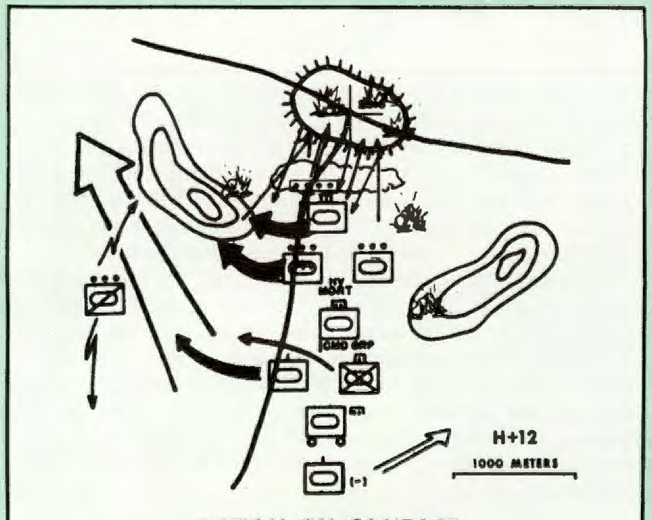
ACTION ON CONTACT

Figure 2.

indirect fires. The lead team commander immediately deploys his force and returns fire. Because enemy doctrine calls for the use of chemical rounds mixed with high-explosive artillery rounds, individuals automatically assume an increased mission-oriented protective posture (MOPP). When the exact chemical threat has been determined by vehicle and small unit commanders, they modify the MOPP level as appropriate. The lead team commander reports the contact to the task force commander and employs all available weapons to engage and destroy the enemy.

While the tanks in contact place suppressive fire on the enemy, the team commander moves the force to the left to covered firing positions on the high ground (figure 2). He receives immediate and continuous artillery support from the dedicated 155-mm artillery battery, as well as smoke from the heavy mortar platoon, to suppress enemy fire. This fire enhances his ability to deliver accurate tank gun fire on the enemy position, using the thermal sights of his *M-60A3* tanks.

As the engagement continues, the team commander reports that the type and volume of antitank guided missle (ATGM) and tank gun fire being received confirms the air cavalry troop's report that the enemy force occupying the road junction probably is a motorized rifle company reinforced by a platoon of tanks. The task force commander makes a rapid estimate and determines that continued movement into the strength of the position will result in unnecessary losses, and probably would not be successful. However, maintaining momentum of the attack is critical, so he decides to conduct a hasty attack to exploit the enemy's weak flanks.



ACTION ON CONTACT

Figure 3.

Hasty Attack. The lead team continues to concentrate direct and indirect fires and serves as a fixing force, holding the enemy's attention and keeping him in position while the following company and team maneuver to the left to exploit the enemy's flank (figure 3). The task force commander, mounted in his tank, positions himself with the maneuver force so he can *personally* influence the most critical part of the attack — *the destruction of the enemy on the objective.* The rear guard tank company is ordered to the right to deliver additional tank gun suppressive fires, deceive the enemy as to the task force's intent, *and* to join in the assault, or exploit the success of the attack if necessary. The executive officer is directed to take charge of this company and the fixing force team. The task force commander and XO are now leading elements of the task force in combat actions. These actions are possible because this task force was organized with four maneuver elements.

For security, the S-4 leads the combat trains to dispersed, covered positions behind the fixing force and insures that increased local security measures are also taken.

The XO is prepared to assume overall direction of the battle if necessary. The S-3 remains with the main CP, monitoring the overall operation and reporting to higher headquarters. The FAC accompanies the task force commander to direct immediate tactical air support (TACAIR). He is mounted in the air liaison officer's (ALO) *M-113* APC provided by the army but equipped with Air Force radios capable of netting with close air support aircraft. The ALO remains with the main CP using the FAC's wheeled vehicles.

Once the maneuver begins, the task force commander releases the dedicated artillery battery as the FSCOORD requests additional fires directly on the objective, as well as the enemy's routes of withdrawal. Based on requests from the FSCOORD, the DS artillery battalion S-3 also plans fires on the objective that are to be initiated when the maneuvering force begins its assault. The engineer platoon, with its attached combat engineer vehicles, goes with the maneuver force to breach obstacles and reduce fortifications on the objective. The *Vulcans* trail the maneuver force while the *Stingers* protect, in priority, the main CP and combat trains.

The scout platoon continues to screen the task force's left flank, but also begins to move beyond the objective to direct artillery fire and warn of possible counterattacks. The maneuver force moves rapidly by the most direct, covered route to a position from which it can assault the flank of the enemy position (figure 4).

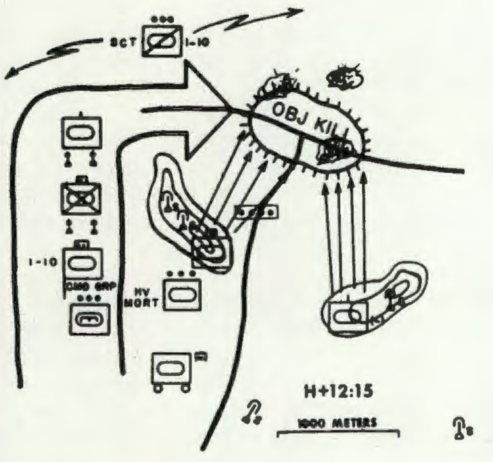
The Assault. The infantry team commander positions his weapons platoon to deliver antitank TOW missile overwatch fires and 81-mm mortar fire to support the assault. The DS artillery battalion and the mechanized infantry mortars concentrate high-explosive fires on the objective, while the task force heavy mortars provide smoke that will obscure the friendly forces from enemy fires but still permit the use of tank thermal sights.

The XO, under the direction of the task force commander lifts or shifts *direct* suppressive fires, while the task force commander controls TACAIR through the FAC. *Indirect* suppressive fires are lifted or shifted by the infantry team commander, through his FIST, when he is ready to dismount and clear the objective of dug-in enemy.

The assault on the objective is executed violently, with the tanks leading, to shock, overwhelm, and destroy the enemy!

Tank machineguns, as well as main guns, are used to suppress light infantry antitank weapons and destroy tanks and APCs, while dismounted infantrymen clear wooded areas and dug-in positions. The two companies that are suppressing the objective with direct fire may join in the assault, or maneuver to destroy withdrawing enemy forces (figure 5). This is done at the direction of the task force commander, but under control of the XO, who continues to act as his deputy battlefield commander. The task force now fights *through* the objective and consolidates on the move to maintain momentum.

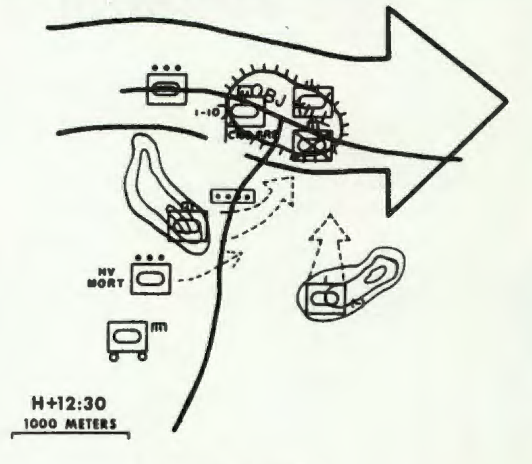
Once the objective is cleared, and the commander is satisfied that combat actions have ceased, the task force combat trains are brought forward under the direction of the S-4 to resupply ammunition and fuel, as well as evacuate casualities and disabled vehicles if required. This is done away from the objective and dispersion is maintained to avoid presenting a lucrative target for nuclear and chemical weapons. Priority for Class III and V supplies is based on the expenditures resulting from the battle.



HASTY ATTACK

Figure 4.

Platoons may stop for resupply once they have fought through the objective, but the bulk of the task force continues to move. The commander of the Task Force reports to the brigade commander that he has now cleared the objective of enemy forces and is continuing his mission to the north.



THE ASSAULT

Figure 5.

Concluding Thoughts. Basic tactical concepts used in mounted offensive combat as well as several key fundamentals of modern battle were highlighted during this attack. The commander:

- Positioned himself forward, in his tank, to insure that he could personally assess the situation and influence the battle.
- Concentrated all available direct and indirect fires to overwhelm and destroy the enemy during the final assault.
- Attacked rapidly, on the move, and continued his mission to insure that his task force retained the initiative.
- Used all available combat and combat service support — infantry, tanks, artillery, Army aviation, and Air Force TACAIR — to accomplish the mission.
- Delegated authority to responsible subordinates (XO, S-3, S-4, HHC Commander, Infantry team commander) to insure timely execution of all combat tasks.

The foregoing article represents the opinions of the authors as to how a four-company tank battalion should be task organized and employed in a hasty attack. If readers disagree, that is great, because the article was written for the specific purpose of developing a dialogue concerning offensive operations. New equipment and Division 86 structuring will provide the innovative commander with more opportunities to develop successful offensive techniques and tactics.

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The Adiabatic Engine Revolution

by Colonel Herbert H. Dobbs and Doctor Walter Bryzik

The available technology in being at the time a new vehicle development is undertaken will largely determine what new capabilities can be achieved in the new system. The development of future operational concepts and the development of new technology to support those concepts are parts of a reiterative process wherein each draws inspiration and ideas from the other. In practice, very considerable lengths of time (and sums of money) are required to turn technical concepts into developed hardware in the form of usable vehicle components (figure 1). Therefore, it is critically important for those working with future operational concepts to maintain an awareness of technical developments which may be a decade or more away from practical hardware. It is only through such understanding that the entire Army community, user and developer, can effectively plan to insure that we get the maximum combat capability that can be achieved at any future point in time.

Today, far more revolutionary possibilities for future close-combat vehicles are visible than in the early 1960's when we started into the development cycle that is now culminating in the fielding of the *M-1 Abrams* tank and *M-2/3 Bradley* fighting vehicles. Now, thanks to basic developments during the past two decades in mechanics, materials, and electronics we are on the verge of significant improvements in propulsion, suspensions, weaponry, survivability, and maintainability/supportability. The major focus of this article will be on a discussion of one of the leading developments in the propulsion area.

It takes more time and money to develop a new propulsion system for a vehicle than it does to develop any other single part of the vehicle. In most cases, vehicle developments are built around existing engines and transmissions. At worst, if the vehicle development is to be completed in anything like a reasonable length of time, the majority of the powertrain development work must have been completed before development of the vehicle system is initiated.

A Brief History of U.S. Tank Engine Developments. Although the power range of concern has moved up over the decades, the problem has been with us since the beginning of World War II. Under the pressures of a wartime emergency, with no time available to develop suitable powerplants, we adopted several expedient approaches to powering our first generation of modern tanks. The initial choice for the *M-3* and *M-4* tanks fell on the Wright *R-975* 9-cylinder, 400 horsepower, air-cooled, radial engine, which was already in production for use in aircraft. Several twin-engine installations also were used during the early years of the war in order to support the voracious appetite of wartime production lines and still provide adequate horsepower for close-combat vehicles. By the end of World War II a more suitable tank engine was available, and later versions of the *M-4 Sherman* were powered with the Ford *GAA-III* water-cooled, flathead, 450-horsepower, V-8 engine, sometimes referred to as the "Easy 8."

Development of a second generation of U.S. Army combat vehicle engines had already begun by that time. The result of this work was the series of Continental (now Teledyne Continental) engines that power the majority of our tanks to this day.

Work on our third generation of close-combat vehicle engines began in the late 1950s, first with the very-high-output (VHO) diesel engine family, and then with development of the Continental variable-compression-ratio (VCR) diesel engine. The VHO never reached the stage of being a serious contender for fielding. The *VCR-1360*, however, was joined shortly thereafter (1964) in development by the AVCO Lycoming *AGT-1500* gas-turbine engine that is installed in the *M-1 Abrams*. Both of these competing third-generation engines were considerably more innovative and involved considerably greater technical risks, than their predecessors had. For that reason, it is appropriate to briefly examine the time and cost required to bring them through the development cycle. The fourth generation of engines, both diesels and turbines, whose development we are now beginning, is certain to require as much time and, considering inflation, a great deal more money. The improvements that will be made, however, greatly exceed what was possible during the last cycle of engine development.

Engine Development Costs. Nearly a decade, from the early 1960's until the beginning of the *XM-1* tank's competitive validation phase on July 1, 1973, was required to develop the two competing third-generation engines. During this time approximately $40 million was invested in *AGT-1500* and

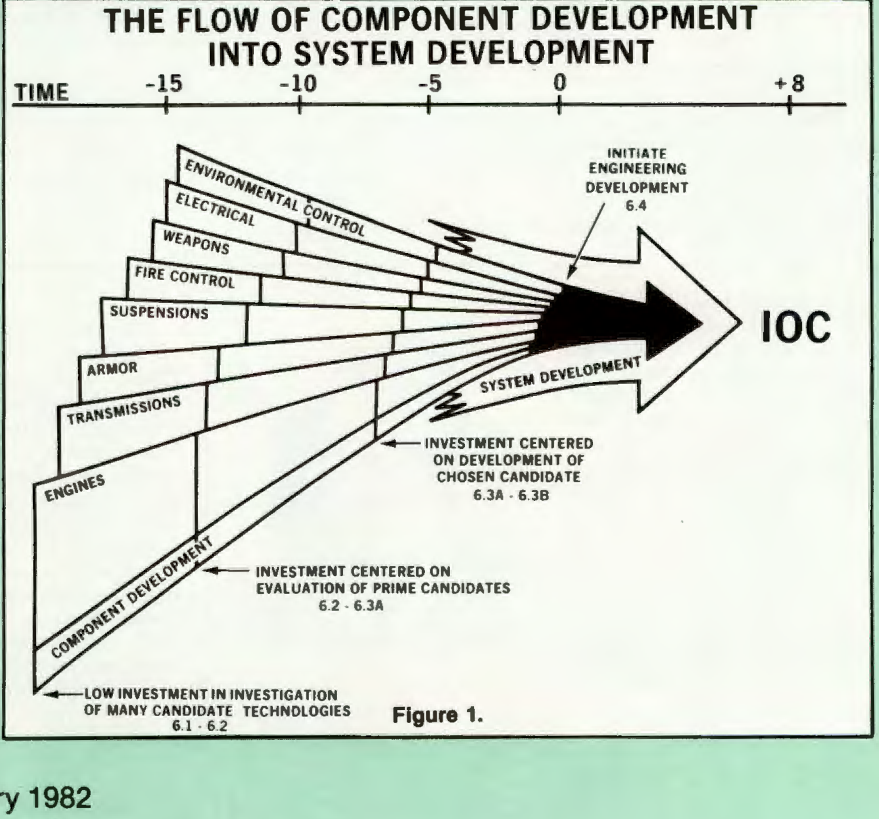


Figure 1.

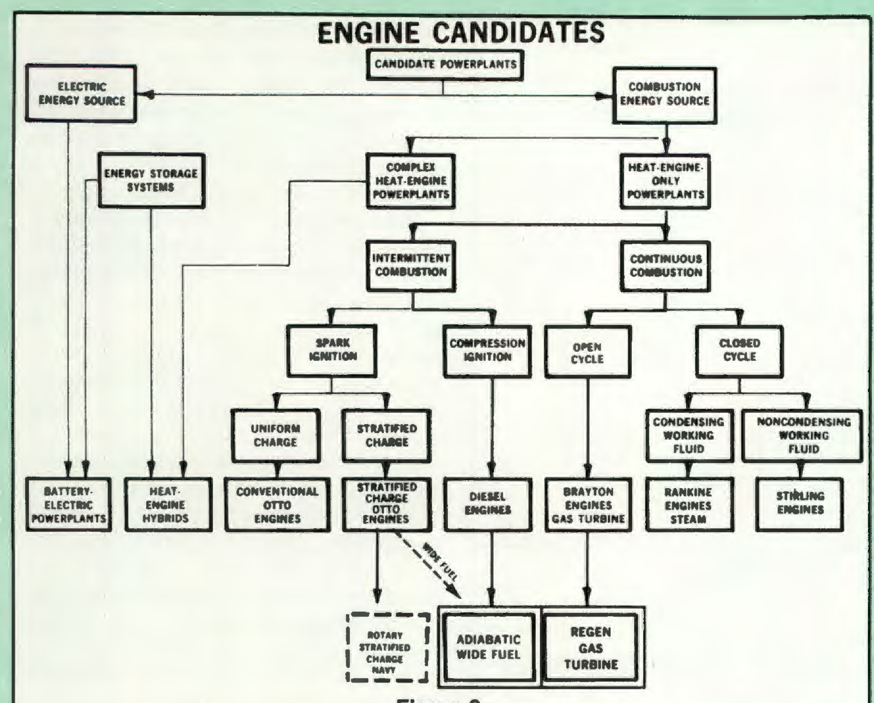


Figure 2.

some $50 million in the *VCR-1360*. Both development times and costs could have been reduced somewhat if the programs had been fully funded throughout the development process. But, it is a fact of life that technology-base development programs are not the first priority concern in the material development process. Unless an appreciation of the problem can be convincingly portrayed, future component development programs can be expected to experience the same sort of cost and schedule growth for the same reasons and with the same consequences. The dual development program approach taken during this third engine development cycle was a prudent but costly one due to the innovations involved. The probability of having a new engine available when needed was greatly improved. It will be even more desireable to follow such an approach in the cycle we are now beginning. The cost of doing so, however, will be very significant.

From a system point of view, the total cost of a new propulsion system must include both production tooling costs and vehicle integration costs. Responsibility for continued development of the two third-generation engines passed to the *XM-1* Project Management Office with the beginning of the *XM-1* competitive validation phase. Before completion of development of the *XM-1,* roughly an additional $82 million was spent in completing engine development and integration of the *AGT-1500* with the *XM-1,* and some $95 million went into production tooling for the engine. The total direct cost, to bring the *Abrams* gas turbine engine to production has been in the neighborhood of $217 million—a cost that is typical for a low-production-rate engine development throughout the automotive industry. The initial development and systems integration costs of the alternative candidate engine were in addition to this, of course. Similar costs for a high-production-rate engine, such as for a passenger car, can easily exceed a billion dollars.

New Development Goals. Our third generation engines essentially doubled the power available from the same weight and volume devoted to the powerplant. This has given a phenomenal increase in performance in the *Abrams* and despite its critics, the turbine can be expected to be a more reliable, more easily maintained engine. What then are our goals for the next cycle in engine development? What do we expect to get for the enormous investment that will be required? The simple technical answer to those questions are: smaller size, higher efficiency, and reduced complexity. However, the impact of these changes on our basic objective in combat vehicle design will be combat effectiveness. The goal for the first of these changes is to reduce the space for the propulsion system (engine, transmission, air induction, cooling, accessories and fuel supply) to half of what it is in the *M-1* while maintaining the same power output. This will permit a significant reduction in vehicle weight and size, with consequent greater mobility and survivability. In the second area, our objective is to reduce fuel consumption to less than 50 percent of that of the *M-1*, with a consequent reduction in logistic dependence and an increase in cruising range. In the third area, we expect to be able to eliminate both cooling and lubrication systems from the diesel engine, providing significant improvements in reliability and availability, that brings us to the "The Adiabatic Engine Revolution."

The spectrum of possible engines for propulsion of future military vehicles is very broad (figure 2). However, the financial resources available for engine development are considerably more limited, and not all engine development possibilities are equally promising at any given time. Consideration of the state-of-the-art and the advantages and disadvantages of various engine types has led to placing research emphasis for ground vehicle engines on the gas turbine and the high temperature adiabatic diesel. Development work on other types of engines, such as the rotary engine, being done under Navy guidance, is closely monitored, but the two types of engines emphasized here appear to have the greatest promise. The propulsion system of a typical combat vehicle today occupies approximately 40 percent of the under-armor hull volume. This is shown schematically in figure 3, with the shading in the lower diagram indicating the amount of volume that would not be needed for a fully-developed adiabatic engine in a future main battle tank.

Background of Adiabatic Engine Technology. Ever since the famous French scientist and Army Officer Nicholas Carnot (1792-1832), published his paper, "Reflections on the Motive Power of Heat," it has been recognized that the key to high engine efficiency is high temperature operation. Carnot's work established the idea of cycles in the study of heat engines, and laid the foundation for the Second Law of Thermodynamics.

In the study of thermodynamics, the adiabatic process is defined as a no-heat-loss process, hence, the adiabatic engine name implies a no-heat-loss engine. Figure 4 shows a simplified cross-section of the turbocompound, adiabatic, diesel engine. It should be noted that this engine is not completely adiabatic, or without heat loss, in the true thermodynamic sense; however, the engine is without conventional forced cooling and strives to minimize heat loss. Following the engine flow path, air enters the turbocharger (is compressed) and then enters the insulated, high-temperature combustion chamber of the piston unit. Insulated combustion-chamber components include those previously noted. Combustion occurs and useful energy is extracted from the piston unit. The high-temperature, high-pressure exhaust gas is then expanded

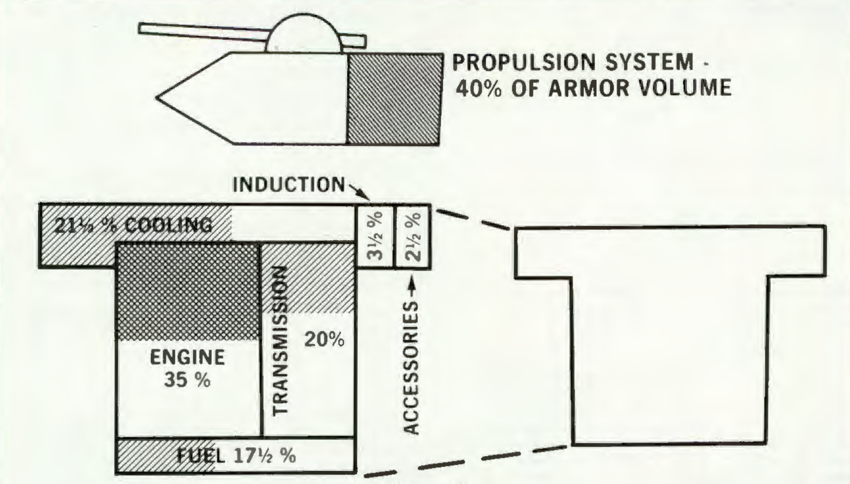


Figure 3.

ADIABATIC DIESEL ENGINE

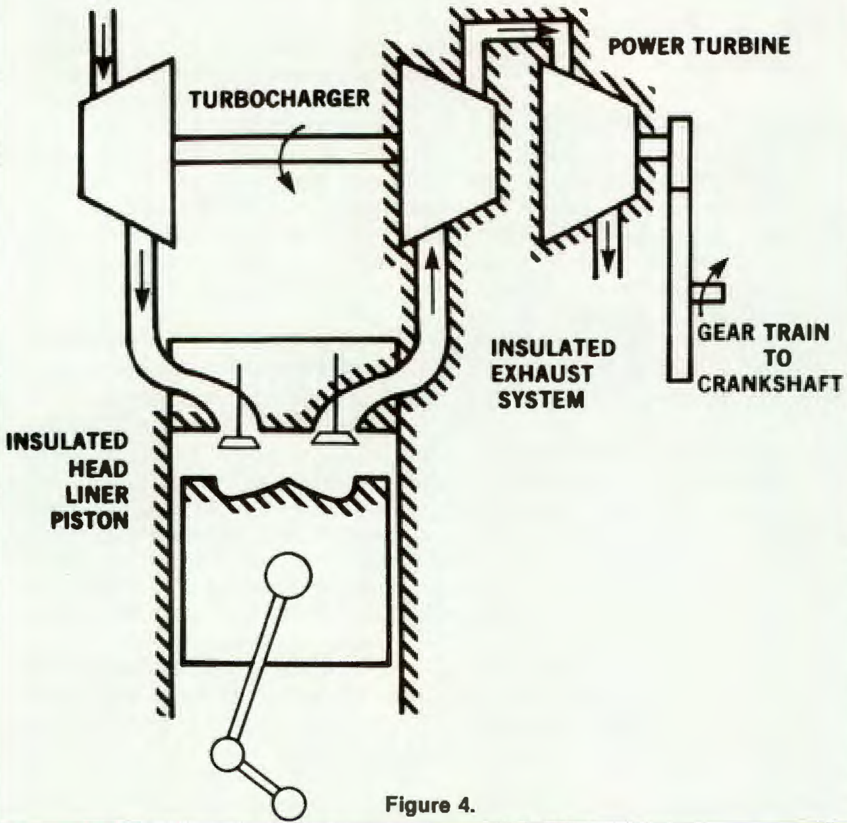


Figure 4.

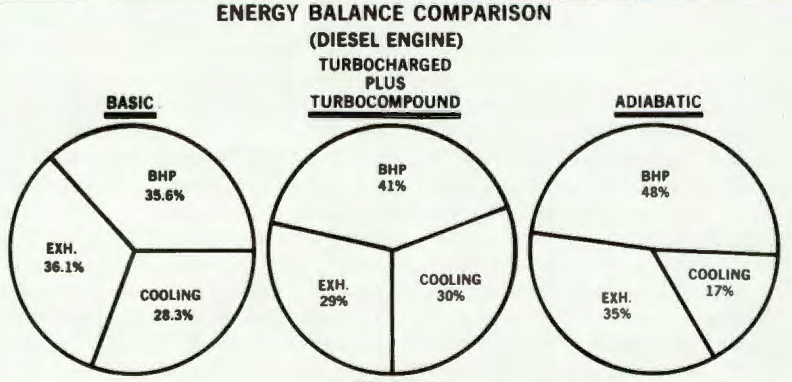


Figure 5.

through two turbine wheels to extract as much as possible of the remaining energy. One wheel is used to drive the compressor, and the second is connected by gears (turbocompound system) to the engine crankshaft to further increases the useful power output of the engine.

The limitations of high-temperature operation have always been dictated by the temperature limitations of available materials. However, in the past 20 years, significant progress has been made in developing low-cost, high-strength ceramic materials capable of withstanding much higher temperatures than metals. Therefore, the Department of Defense and other Government agencies have invested hundreds of millions of dollars in efforts to build ceramic engine components. Now, gas turbine engines, such as the *AGT-1500* in the *M-1*, are being produced with ceramic coatings on critical high temperature parts. These ceramic coatings serve as thermal barriers and permit higher temperature operation. However, solid ceramic components, which would permit even higher temperature turbine operation, still appear to require several more years of development.

Five years ago the U.S. Army and Cummins Engine Company, building upon aerospace gas-turbine technology, began a program to develop an adiabatic (no heat transfer) compression-ignition engine. The key to the adiabatic engine was the application of the new high-temperature metals and ceramic materials.

The R&D community expected that the application of high temperature materials to a reciprocating engine would be a more difficult task than applying such materials to gas-turbine engines. To the surprise of all, the opposite has been found to be true. Despite the more complex motions and forces in the reciprocating engine, the stresses are fortunately mainly compressive (which ceramics, like other nonmetallic, stone-like materials, can better tolerate) and far lower than in a spinning turbine rotor.

Initial success came relatively quickly, first with single-cylinder test engines and then in early 1980 with multicylinder engines. Preliminary baseline performance of the adiabatic demonstrator engines over the past 2 years has demonstrated a level of fuel consumption approximately 30 percent better than current, highly-efficient diesel engines. This represents a thermal efficiency close to 50 percent, never matched anywhere in the world, even by the best large central power generation plants ever built. By greatly reducing lost energy, and essentially eliminating the need for a conventional cooling system, the adiabatic engine can either dramatically improve fuel economy or increase power for the same fuel input; thereby significantly reducing specific weight and volume, while offering improved noise and multifuel characteristics. Work on manufacturing methods and technology indicates that at high-production rates (20,000,000 lbs/year) the cost of processing ceramic components may be as low as .10¢ to .20¢ a pound.

Adiabatic Engine—Description and Advantages. The adiabatic engine insulates the diesel combustion chamber with high temperature materials to allow "hot" operation with nearly no heat transfer. The "hot," or insulated high temperature components, include piston, cylinder head, valves, cylinder liner, exhaust valves, and exhaust ports. The additional power and improved efficiency derived from an adiabatic engine are possible because thermal energy, normally lost to the cooling water and exhaust gas, is converted to useful power through the use of turbomachinery and high-temperature materials.

By greatly reducing lost energy and essentially eliminating the need for a conventional cooling system, this engine can dramatically improve fuel economy and provide approximately a 40 percent reduction in weight and volume for the same horsepower fuel. Further, from a system standpoint, the component volume of the total propulsion system in figure 4 could be reduced by 40 percent overall. Obviously, the availability of such an engine would have great positive impact on future vehicle designs, particularly upon the design of military tactical and combat vehicles. Elimination of the engine cooling system, including cooling fans, radiators, hoses and shrouds, would produce a remarkable increase in reliability and maintainability. The engine would not be sensitive to most conventional cooling-system damage and extreme environmental conditions.

Fuel economy improvements translate into increased vehicle range and reduced logistics concerns. Specific weight reductions allow improved vehicle response, while less vehicle volume allows reduced armor cover requirements, reduced vehicle weight, and new innovative designs with improved survivability characteristics. The adiabatic engine's high temperature operation also gives smoother combustion and a wider range of acceptable fuels.

With this engine, the entire philosophy of combat vehicle design becomes far less restrictive. Concerns regarding satisfactory locations for cooling grilles, air passages, and associated equipment are eliminated. The cost of the engine is expected to be equal to or less than its cooled counterpart since engine radiators, cooling fans, water pump, seals, hoses, and costly water jackets would be eliminated.

Fundamentally, the adiabatic engine is more efficient than a conventional diesel because it converts the heat energy in fuel into additional, useful output. Three pie-shaped energy balances of various configurations are shown in figure 5. The first shows a conventional, turbo-charged diesel engine with one third of the fuel energy being absorbed by the coolant, one-third going to the exhaust, and one-third going to useful energy (or power). The center chart represents an engine that utilizes turbocompounding. Here the fraction of exhaust energy decreases, while useful energy proportionately increases. The last chart represents an engine that uses insulated, high-temperature components, combined with turbocompounding, to further increase the usable energy while proportionaly decreasing waste energy. Thus, the potential for increasing the useful work of the same fuel is greater for adiabatic, turbocompound engines.

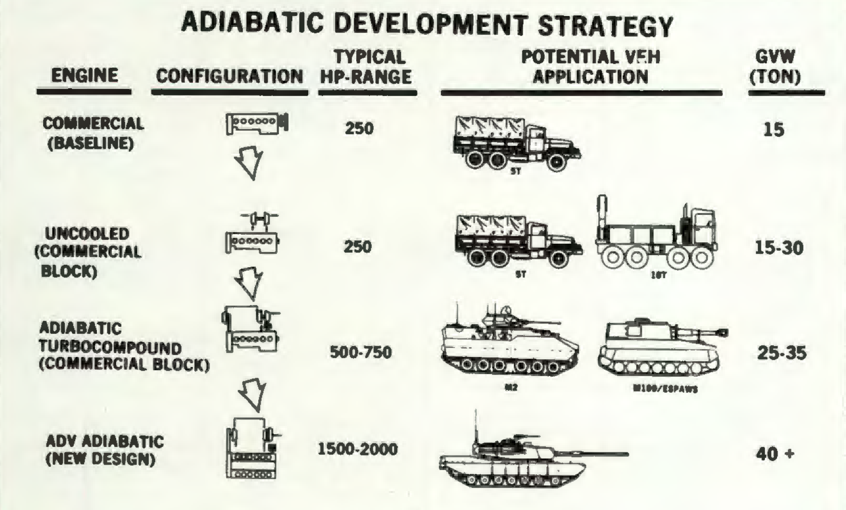
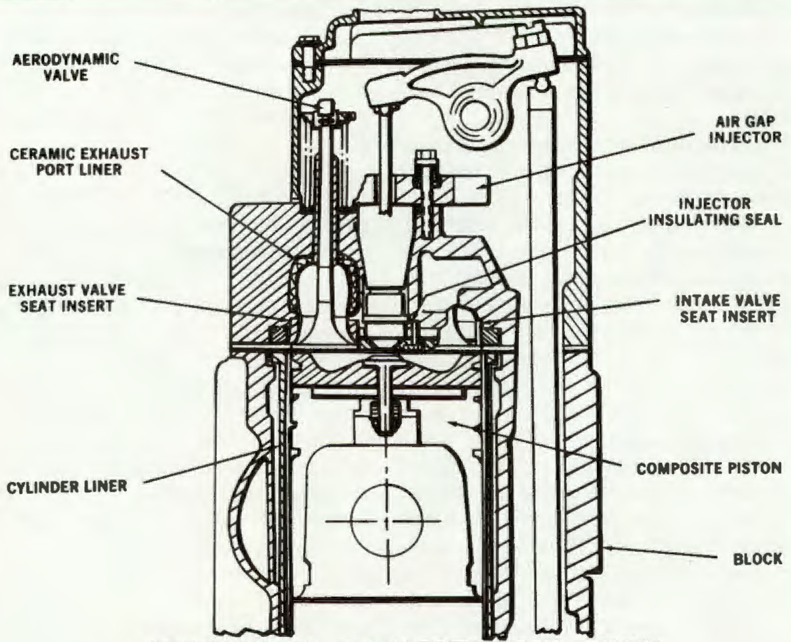


Figure 6.

Adiabatic Development Program. Successful development of new technology requires a coherent program methodology. The general development methodology of the adiabatic engine program will follow the schematic of figure 6. Once a design component has passed a bench-screening test, it is proof-tested in a single-cylinder engine under actual operating conditions. If the final component design survives single-cylinder proof testing, it is then ready for preliminary multicylinder performance testing. Upon satisfactory completion of that step, the component is transferred to a final demonstrator engine for performance and endurance evaluation. Presently, single-cylinder component optimization has been completed; multicylinder-feasibility demonstration testing is continuing, and preliminary results are very encouraging.

A cross-sectional view of a developmental feasibility-demonstrator, adiabatic engine is shown in figure 7. Insulating a diesel engine combustion chamber presents some very difficult engineering problems because the chamber may experience surface temperatures exceeding 2,200°F and peak combustion pressures up to 2,000 psi, occuring over high-frequency stress cycles. The ability of a material to retain strength at high temperature and pressure over long periods of time is essential. Ceramics have such properties, and thus they will be used where necessary to supply these material capabilities. Progress with respect to demonstrating the feasibility of adiabatic engine technology has been revolutionary and dramatic. Demonstration of a 0.285 lb/bhp-hr fuel economy level at 450 hp on the feasibility demonstrator, multicylinder engine was accomplished early in 1980. As already noted, this fuel economy level is approximately 30 percent better than current diesel engines and has never been matched by any heat engine anywhere in the world. The initial single-cylinder-engine component development program was satisfactorily completed in 1980. During the test, piston, cylinder head, valves, ports, manifold, and associated parts designs proved to be acceptable. The development of a satisfactory lubrication package to be used in feasibility demonstrations also has been completed, and endurance demonstrations of over 1,000 hours of the tur-



CROSS SECTION OF ADIABATIC DIESEL ENGINE

Figure 7.

bocompound unit for the adiabatic engine have been made. Also, an engine endurance test, using many of the ceramic components developed under the adiabatic engine program, has successfully completed over 250 hours.

Potential Adiabatic Engine Impact. Use of the adiabatic engine in both military and commercial applications has great potential impact. Figure 9 shows how adiabatic type engines might be applied to a range of military vehicles. An uncooled version of the commercial 250-hp engine now used in the 5-ton truck, incorporating some ceramics and turbocharging, could be applied to 5 ton and 10 ton trucks and would provide large improvements in fuel economy and reliability and maintainability (RAM). By adding a turbocompound unit and more ceramics, it is technically feasible to build a 500-700-horsepower engine, based on a commercial engine block for combat vehicles of 25-35 tons. However, an adiabatic engine for the next main battle tank will require a new design that discards the conventional cast iron engine block and produces an adiabatic engine that is competitive with the very good power-density of gas turbine and rotary engines. Nevertheless, the adiabatic engine should prove to be very competitive with those rivals for powering the next MBT.

Projected production dates for various spinoffs of adiabatic technology, and the expected fuel economy of these various configurations are shown in figure 8. Turbocompound diesels, with the fuel economy shown. U.S. Army began demonstrating an uncooled engine in a 5-ton truck in late 1981 and similar engines are expected to be produced by 1987, while the fully adiabatic turbocompound diesel is projected for production in 1992.

The success of the significant pioneering work performed by the U.S. Army Tank-Automotive Command (TACOM) and Cummins Engine Company within the adiabatic engine technology area has generated tremendous new interest in this approach to engine design within the Federal Government, industry, and academia. Within the Government, but outside the DOD, the Department of Energy (DOE), in conjunction with NASA-Lewis, has programmed basic high-temperature material research funds and is currently in contract negotiations with Cummins as a first step in examining adiabatic engines for possible application in passenger cars and small trucks. Outside the Government, the number of university and industry investigations of various facets of this promising, high-payoff technology area have increased greatly during the past 2 years. Nearly all companies producing engines now appear to have developmental programs underway in the area.

Future Plans. Design, fabrication, and development of the next generation adiabatic engine has begun, with emphasis on product engineering development and performance excellence. Full-test evaluation of this engine is scheduled to begin in FY 83. Basic support and component development will, of course, continue in parallel with the above efforts. An example of the basic support for the Adiabatic Engine Program is shown in figure 9 as the "minimum friction" adiabatic engine. The emphasis in this design is on minimizing friction throughout the engine by using such components as gas bearings, "ringless" pistons, low-friction, "dry" ceramic bearings, and solid lubricants. This version of the engine is projected to incorporate all the advantages of the current adiabatic engine, further improve fuel economy to a 0.25 lb/bhp-h4 BSFC-level (approximately 55 percent thermal efficiency) and eliminate the engine lubrication system as it is now known.

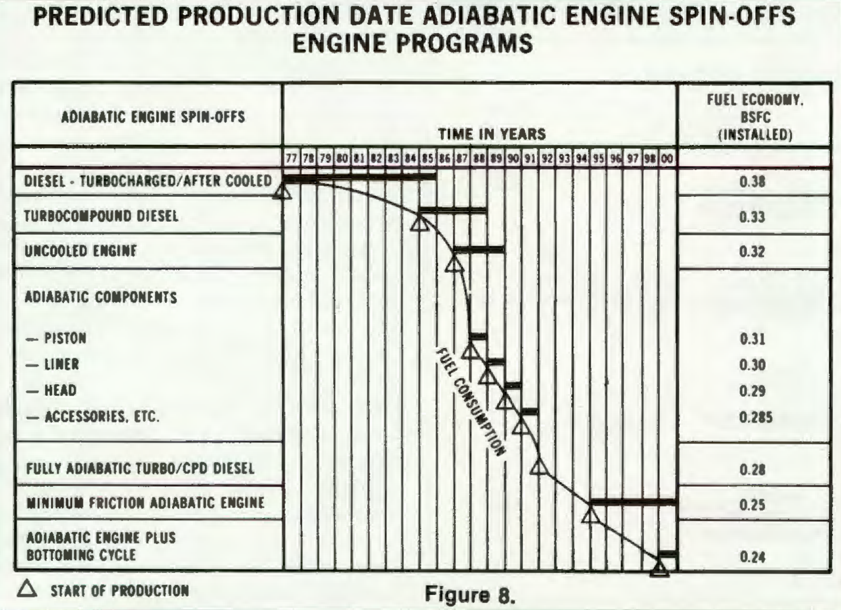


Figure 8.

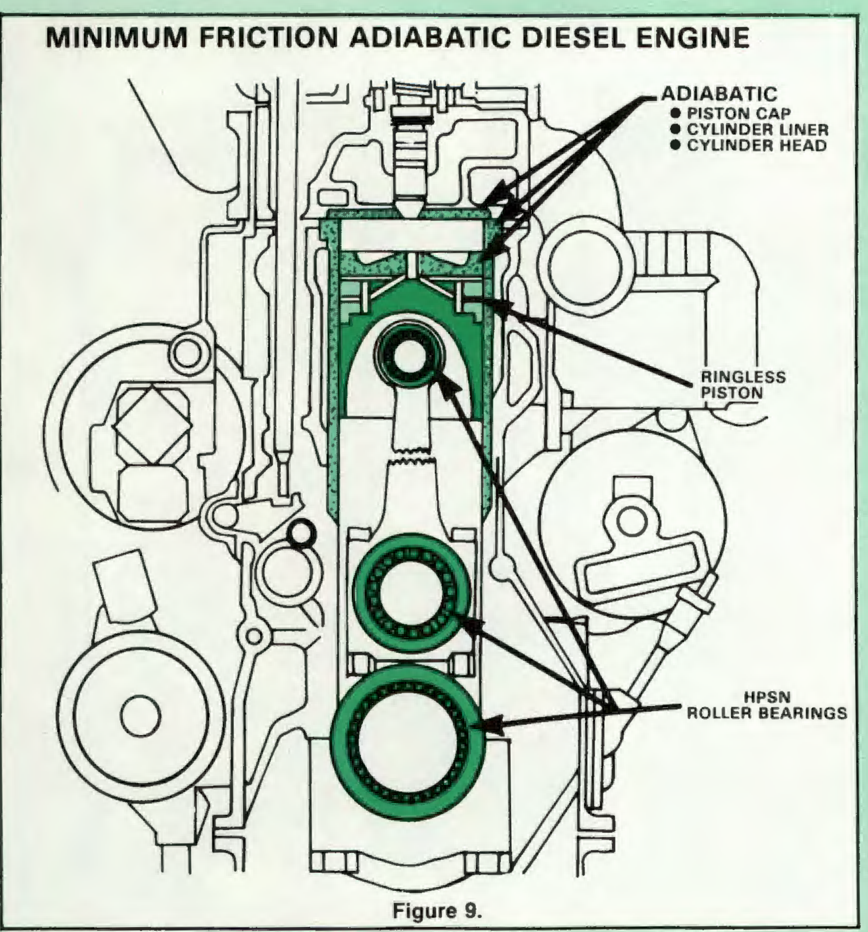


Figure 9.

Contracts for competitive design studies for the next MBT propulsion system have been initiated. This action will begin the development program for providing the engine for the expected successor to the *M-1* in the late 1990's, and the adiabatic engine is expected to be a strong competitor for that job.

Summary. Work on Adiabetic Engine Technology Programs by the Propulsion Systems Division, (TACOM) and Cummins Engine Company has produced revolutionary breakthroughs in the engine technology area, with additional dramatic results anticipated in the near future. The adiabatic engine has already demonstrated that it is the most fuel-efficient engine in the world today, with a 30 percent fuel economy improvement over current, highly-efficient diesel engines. The adiabatic engine, even in its initial configuration, promises further significant reductions of about 40 percent in specific weight and volume in relation to the entire propulsion-system package. Successful development of the engine will allow large improvements in RAM by eliminating the cooling system and potentially eliminating the lubrication system as well. Furthermore, the efficient combustion process of this development should improve multifuel characteristics and reduced exhaust heat signature. The adiabatic engine's compact size and high power-density will make it possible to significantly reduce combat vehicle size, weight. and survivability. The program represents one of the highest priority research efforts at the TACOM, and the program is expected to ultimately provide a revolutionary component that will be the foundation for dramatic improvements in future combat vehicles.

COLONEL HERBERT H. DOBBS received his commission through the ROTC program at the University of Minnesota from which he graduated in 1954 with a degree in Mechanical Engineering (ME). He also holds an MS and PhD in ME from the University of Michigan. He is a graduate of the DWSMC Project Management Course, C&GS, and the Army War College. The majority of his career, however, has been spent in research and development, including tours with ARMCOM, MICOM, and TACOM. Since August 1978 he has been Director of the Tank-Automotive Systems Laboratory at TACOM.

DOCTOR WALTER BRYZIK received a doctorate in Engineering from the University of Detroit, and a master in Business Management from Central Michigan University. He spent 2 years at the Ford Motor Company in Automotive Engine Research, and since 1968, he has worked for the U.S. Army Tank-Automotive Command (TACOM) in the area of Propulsion Systems. He is the program engineer for the Adiabatic Engine Program. He has published over 20 articles on propulsion systems and frequently is a consultant to industry, academia, and other government agencies. Dr. Bryzik is also an instructor at Wayne State University, Detroit, Michigan, where he teaches advanced graduate engine and combustion courses.

Footnotes

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Dimensions of Mobility

by Colonel Andrew P. O'Meara, Jr.

Mobility has many dimensions, the most important of which is our appreciation of troop-leading measures, that facilitate the exercise of initiative by free men in battle. The key to unlocking our combat potential rests upon our ability to exploit mobility, decentralize command and control, and force the cumbersome Soviet war machine to depart from the only battle plans they are capable of winning—the set piece battle.

The Army has entered a period of historic change. New weapons systems that possess great potential for dominating future battlefields are entering our equipment fleet. Our challenge is to understand that potential and to translate it into opportunities for defeating our opponents on future battlefields.

Military history points to several periods in which a decisive shift in firepower and mobility have allowed armies to alter the *status quo* and forge military victories that have decisively shaped history. Gustavus Adolphus seized upon technological changes in the 17th Century and translated those changes into new artillery organizations and tactics that shattered the larger Spanish Squares of the Imperial Armies and ultimately altered the balance of power in Europe. Other great captains have altered the course of history through ingenious tactical leadership, which enabled their commands to surprise and defeat their opponents with a degree of boldness undreamed of in earlier years. Napoleon was such a leader. Both approaches to obtaining decisive advantages in combat power — achieving technological superiority and creating a decisive advantage through bold tactical employment — can be translated into victories on the battlefield.

We do not know the nature of the battles that await us as we enter the final decades of the 20th Century. We do know, however, that new weapons entering the U.S. Army provide us with a technical edge that represents a potential for achieving decisive advantages on future battlefields. That potential will never be realized unless it can be united with skilled crews who can unleash the full potential of our weapons, and unless the imagination and boldness of our leadership can envision opportunities to exploit the potential that is within our reach. This article addresses the challenge of visualizing the unique character of emerging weapons systems and optimum employment techniques so that we may better exploit the leverage these weapons systems can exert upon the battlefield.

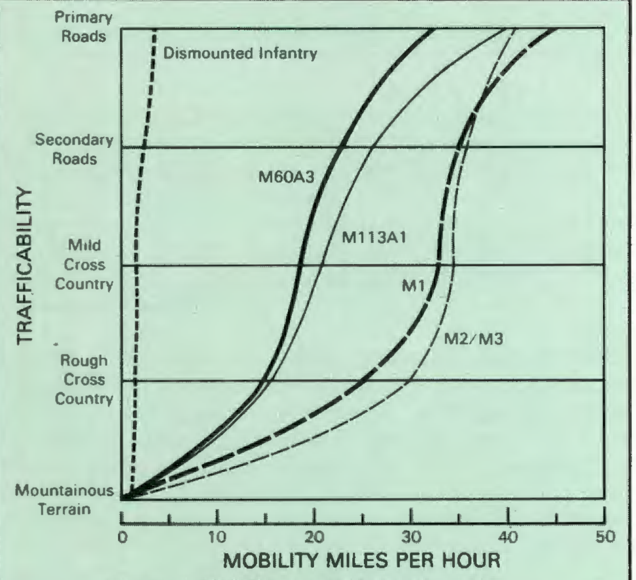


Figure 1. Relative mobility/trafficability.

The Immutable Foundation of Military Art. In these days of dynamic change we are accustomed to coping with new ideas, and our ability to deal with change represents an important dimension of our society as it comes to grips with the challenges of modernization. Our propensity to accomodate change, however, should not delude us into false premises concerning the fundamentals of military science and art. The boldness, mobility, unity of command, and combat power of Napoleon's army was predicated upon a correct appreciation of historic military relationships that are timeless. These relationships are captured in principles of war that do not change. Future battles will be won using the methods of Napoleon, which will be adapted to the opportunities to be found upon the battlefields of tomorrow.

The appearance of new weapons systems neither alters the validity of the principles of war nor does it upset the balance of power in battlefields unsuited to the characteristics of our newest weapons systems. Infantry—"The Queen of Battle"—will continue to dominate battlefields uniquely suited to its employment. Mountainous terrain, heavily forested areas and urban areas will continue to be the exclusive domain of the rifleman. Not only must we recognize terrain where new weapons systems can offer decisive advantage to well-trained crews under bold and imaginative leadership, but we must also be careful to recognize areas where they have little leverage.

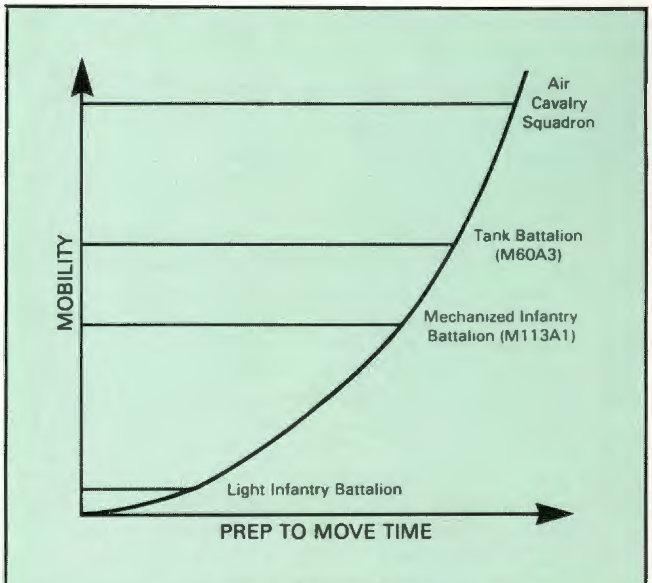


Figure 2. Responsiveness.

Trafficability. Figure 1 graphically displays the impact of trafficability upon a range of weapons systems. The curves for the *M-1*, *M-2*, and *M-3* weapons systems demonstrate a significant mobility advantage over earlier weapons systems. Conversely, dismounted infantry retains its undisputed dominance in areas characterized by mountainous terrain as well as in restricted areas that provide no opportunities for lateral mobility of tracked and wheeled vehicles. The first step necessary to unlock the great potential of new weapons systems is the recognition of those areas well-suited to their employment. Missions to subordinate units must be keyed to this recognition and task organizations should be tailored to allow the unit to unleash its full potential.

The Table of Organization and Equipment (TO&E) of our units determines the mobility potential of the organization. Equipment-intensive organizations are restricted by areas unsuited to their employment. Moreover, such units require more time to prepare for tactical operations. Maintenance, refueling, and resupply operations require large investments of time for highly mobile tactical formations. Figure 2 depicts the responsiveness of three types of organizations. Given little warning, the light infantry unit can respond quickly to a change in mission. Conversely, air cavalry units normally require a significant lead time to preposition logistical supplies, rearm, and refuel in preparation for a significant change in mission. The tank company or mechanized infantry team faced with a major change in mission also requires additional time to coil its logistical resources and project its combat power.

Troop-Leading Procedures and Unit Mobility. Given adequate time to resupply and prepare for action, the more sophisticated weapons systems possess greater agility and have a far more extensive span of operations. Figure 3 shows the unique advantages of enhanced mobility of air cavalry, armor, and mechanized infantry formations, which allow them to project their combat power rapidly across vast battlefield distances. These characteristics necessitate unique troop-leading steps to unlock the full battlefield potential of highly-mobile organizations. The commander must keep in mind the unique characteristics of each organization and must compensate for their limitations by tailoring his troop-leading steps to ensure the organization is fully prepared before initiating a major change in mission. Given adequate preparation time, air cavalry can rapidly project combat power over vast distances. Tank and mechanized infantry formations can also respond with great agility over great distances when warning orders allow necessary preparation to precede their commitment in combat operations.

Techniques to Enhance Mobility. Well-trained armor units continually anticipate new missions. Resupply actions begin as soon as the unit has secured its objective. Reports are rendered and refueling, rearming, and feeding commence. Casualties are evacuated and replacements are brought forward to the unit. These actions enable the unit to respond rapidly to either an enemy counterattack, or a new mission assigned by the parent unit.

A major change in mission for mechanized or armored units normally involves extended marches to preposition the unit for the new mission. Such mission changes must be supported by battalion or squadron staff planning and coordinating. March routes are identified, and supplies are positioned well forward along the route so that units can be topped-off prior to crossing the line of departure. If changes in the task organization are directed, the staff must provide detailed instructions to the units concerned, including the new communication and electronics operating instructions and the tactical standing operating procedure of the parent organization. These steps necessitate a well-trained staff and they require lead time, which must be anticipated by the division and brigade staffs in their troop leading steps. Early warning orders ensure adequate planning time to prepare the unit for the march. The headquarters directing the mission should provide the necessary coordinating instructions, anticipate march and refueling times, direct the routes of march, and assign refueling areas that do not conflict with other unit missions. Particulars of the mission—attack positions, line of departure, objectives, and graphics to support the new mission—also should be provided.

A well-trained tank or mechanized infantry task force should be able to routinely execute a night march of 100 kilometers to execute an attack at first light. Moving at 25 kmph, the unit requires 4 hours plus refueling time (30 minutes) to accomplish the move before final movement to attack positions. The battalion staff must not take an inordinate amount of the preparation time before issuing detailed orders and instructions. Following the dispatch of a warning order to subordinate units, the battalion staff should be prepared to issue the order in approximately 1 hour. If the higher headquarters has fully anticipated the requirements of the new mission and has provided detailed instructions, the battalion staff can quickly draw up the order, with graphics, so that the commander can meet with his commanders to issue his order.

Given 8 hours to execute such a mission, a well-trained battalion can carry out the order with precision while allowing subordinates adequate time to perform their own vital troop-leading steps. The sequence of key troop-leading steps is:

H-8	Warning order
H-7	Order issued to commanders at tactical CP location
H-5	March commences
H-1	Refueling operations
H hour	Attack commences.

The key point is that such operations consume a lot of time, even for superbly-trained armor units. The operation requires detailed training, careful planning, and adequate lead time. Projecting our logistical tail so that it is positioned and ready to support the teams of the task force also consumes time that must be anticipated.

The air cavalry unit normally requires even more time to marshal its logistical tail and resposition its forward area refueling and rearming operations. Conversely, the air cavalry unit can move 100 km in minutes as opposed to hours, but again, detailed coordination and instructions from the parent headquarters are vital to the success of the operation. The light infantry unit is more mobile than its mechanized sister units in the sense that it can shoulder its weapons and packs, and commence its movement with fewer delays for staff and logistical units to perform their vital roles before the unit is committed. Conversely, the light infantry's range of combat power projection is reduced unless an air mobile operation is directed. Needless to say, the preparations for an air mobile operation require more time and must be planned in detail.

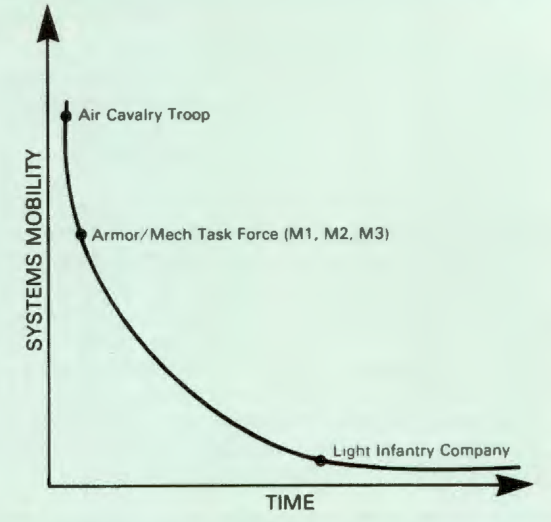


Figure 3. Unit agility and span of operation.

Mobility has many dimensions. The most-mobile tactical units require greater preparatory time unless the mission can be executed within the range of the existing combat loads carried aboard their vehicles. In order for the unit to achieve its full potential, it must be trained to execute the mission and, more importantly, our senior commanders must be able to operate on the wavelength of troop-leading steps tailored to the needs of each type of unit assigned to their commands. They must train themselves, their staffs, and their subordinate commanders to issue orders in a sequence that allows each type of unit to prepare and unleash its full combat power. The great challenge to our leadership in the Division '86 organization is to fully recognize the mobility potential of all subunits and to employ elastic troop-leading steps that fully recognize the mobility potential of each type of unit. The commander who commands tank companies, air cavalry units, and light infantry units must possess great mental flexibility to unlock the full potential of each of his subordinate units.

Given adequate warning time to prepare for commitment, the air cavalry commander needs great latitude and operates best with fragmentary orders to allow his subordinates to fully exploit the unrivaled mobility they possess. Operating within the framework of the commander's concept of operation and using decentralized techniques of command and control, such units are ideally suited to exploit the windfall of war by allowing great latitude to those in contact with the enemy.

At one time or another, most commanders make the mistake of giving orders to attachments from another branch that are poorly written in terms of allowing the unit to perform its intended function. I have been guilty of issuing orders to attached air cavalry units that failed to fully address their logistical requirements and were too restrictive once the engagement commenced. Units possessing high-speed attack capabilities require great latitude once the operation is under way so that they can employ the full range of their mobility and exploit unforeseen opportunities. The windfall of war is highly perishable. The exposed flank, or the poorly-defended avenue of approach, can best be exploited by the commander on the spot without a major change in mission. Such opportunities may disappear rapidly in highly-fluid tactical situations. The key to exploiting such opportunities rests upon the confidence that the commander has in his subordinates—confidence that permits him to decentralize control and allow them greater latitude in their operations.

The mission and the commander's concept of the operation provide the glue that ensures unity of effort. The commander must describe in detail how he envisions the way in which the battle will unfold. Once he can no longer anticipate the flow of the battle, his subordinates must clearly understand his overall mission and be given the latitude to contribute to his objectives, based upon the unique judgements that can best be made at the scene of contact.

Operations Orders and Plans As General Von Moltke pointed out a century ago, no plan survives initial contact with the enemy. The initial plan is a common starting point that is soon overtaken by events; therefore, commanders must be well forward to see and direct the action. Once the battle begins to unfold, each subordinate commander must be guided by the concept of the operation of the overall commander and the mission of the unit. Our operational control and our battle plans must complement the degree of mobility and the agility of the unit. Restrictive control measures and highly-centralized control deny our subordinates the opportuniy to take advantage of the unforeseen, and allow golden opportunities to slip through our fingers because of the speed with which the battle develops.

Unrestrictive Graphics One of the most useful techniques we can employ to enlarge the subordinate commander's maneuver room is to use more graphics in the operations order than are required to accomplish the mission. Additional positions added to our graphics along the approach to contact, on the flanks of our objective, as well as positions of opportunity far beyond the objective, allow us to respond almost instantaneously to unforeseen opportunities. A change of mission, an order to continue the attack, a blocked route of advance, a secondary attack making exceptional progress—each offers the commander a challenge that can be easily dealt with, given graphics of opportunity. Such graphics facilitate rapid fragmentary (FRAG) orders to subordinates to allow them to shift their posture and exploit the unforeseen.

Multiple positions are designated which permit FRAG orders to be issued almost instantly to permit a rapid change in direction and to focus combat power on the battlefield. Unrestrictive graphics, such as those illustrated in figure 4, are selected by the S3 during the preparation of the order. The positions should focus upon the keys to unlocking mobility. Unrestrictive graphic control measures designate terrain features that subordinates must acquire in order to project combat power into the interior of our opponent's battle position. In a fluid situation, the mobile commander fights to achieve dominance on key avenues of approach and to gain control of terrain features. Defiles, bridges, fords, and passes become key terrain that the commander must seize to unlock valuable avenues of approach into the vulnerable rear areas of his opponents. In such battles, high ground and obstacles to movement are seldom key terrain, and when possessed by the enemy, such real estate should be smoked and bypassed with great rapidity. This tactic permits us to avoid costly battles of attrition that preclude us from exploiting our mobility advantage against less mobile enemy formations. The object of the mobile battle is to turn the flank of the enemy unit, isolate and bypass his prepared battle positions, and force him to fight on ground we select. The highly-mobile unit seeks to achieve decisive advantage by rapidly pouring its combat power into vulnerable enemy formations where they are least prepared to react. Such battles seize the initiative, sever the enemy's communication, and force him to accept combat on terms for which he is poorly equipped to fight.

The Russian Army has historically fought battles under conditions that allow little opportunity for initiative to be exercised by subordinate commanders on the battlefield. The Russians seek to achieve a favorable decision through massive employment of artillery and carefully-rehearsed and tightly-controlled battle plans that commit large units in attacks to inundate their opponents. On the defense, they dig in and are capable of withstanding great punishment.

These characteristics have been noted by every opponent of the Russians over many years. Charles XII of Sweden enjoyed great success against the Russian Armies of the Tsar; however, he was ultimately defeated in ill-advised attempts to overpower Russian redoubts at Poltava. In 1812, Napoleon wasted the cream of the *Grande Armee* at Borodino through his attacks upon immobile and heavily-fortified Russian fortifications. In World War II, the Germans wasted much of their offensive striking power in senseless attacks upon the highly fortified Russian communications centers of Stalingrad and Moscow. The leopard does not change its spots. In the next war, the Russians' proclivity for waging attrition warfare in massive attacks or in attrition battles, in which their soldiers are deeply entrenched, will be accentuated. Such battles do not call upon the platoon leaders and the company commanders to make choices on the battlefield or to exercise initiative. On the contrary, initiative is ruthlessly eliminated by a police state such as the Soviet Union. Consequently, their only hope for success is to define the terms of combat and to force their opponents to do battle on their terms.

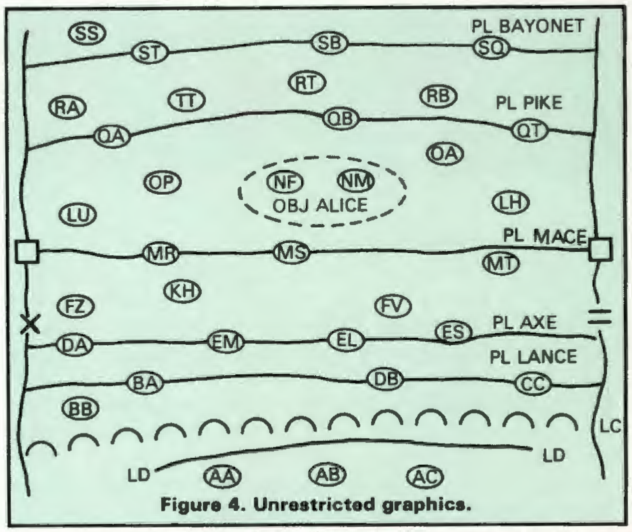


Figure 4. Unrestricted graphics.

The great strength of the United States and the Western European armies is that they are composed of free men. Our subordinates are taught to think, they are accustomed to ask why, and they are rewarded for exercising initiative. Herein lies a supreme advantage that cannot be duplicated by the Soviets in a future war. Alexander the Great beat the Persians because of his ability to wage imaginative, bold battles against a relatively immobile foe. He was supported by the incomparable fighting characteristics of the Greek free men he led in battle. The Western Powers today must also capitalize upon the character of the free men, whom we shall lead into battle. They are uniquely suited to strike at the Achilles' heel of Soviet military formations. Our style of leadership must unleash their initiative so that the mobility of their equipment is matched by the superb mobility of their thought.

The Armor Force ir

by Major Micha

There is an old saw that argues that "there is nothing new under the sun." Indeed, there are time honored principles that underlie every branch of knowledge. While these principles may not qualify as philosophical "truth," they are grounded in sufficient experience to warrant confidence in their validity. Sound military doctrine always relies on such principles — the principles of war — that armies have often paid a bitter price to learn. The successful *Blitzkrieg* of World War II, with its mechanized, combined-arms warfare, represented a doctrinal application of the same principles and concepts that had been applied by successful light infantry in World War I — units as radically different from the *Panzer* forces as Germany's light, mountain infantry whose campaigns are described by Rommel in his book, *Attacks.* Both Clausewitz and Jomini discuss the defeat mechanisms for which *Blitzkrieg* provides such a dramatic example.

Doctrine and its parent concepts represent, then, at any point in time, the result of a considered application of principles to the exigencies and characteristics of the environment to which they will be applied. The U.S. Army's "Active Defense" and the more recent concepts for the "Extended Battlefield," "Integrated Battlefield," and "AirLand Battle," represent the same considered approach to an environment. The remainder of this article includes both an examination of these latter concepts and the environment that led to their formulation, as well as some of the salient impacts that the concepts will have on our current armor force and the one that we are building for the late 1980's and 1990's. This article is the first of a number that will discuss in detail the role of Armor in the AirLand Battle. It is quite obvious that it is impossible in an article of this length to include in great detail the background and ramifications of many of the subjects covered.

Because we will spend some time discussing environments and background before getting to a detailed discussion of the AirLand Battle, we owe you at least a brief definition of the terms so that you can keep things in perspective. AirLand Battle is an "umbrella" concept that embraces both the notions underlying the "Integrated Battlefield" and those underlying the "Extended Battlefield."

"Integrated Battlefield" is less a concept than it is a recognition of the realities of modern warfare. The "Integrated Battlefield" describes conflict in which a spectrum of lethal weapons are used to destroy or otherwise render ineffective an enemy force. This spectrum, almost a litany, comprises nuclear weapons, chemical weapons, conventional weapons, and radio-electronic combat. Additionally, "Integrated Battlefield" embraces the variety of ways that can be used to bring these destructive forces to bear and the operational countermeasures required to survive to fight on this battlefield.

The "Extended Battlefield," in brief, embodies operations that are conducted within the framework of a strategic defense in which the enemy is attacked

the AirLand Battle

el S. Lancaster

to the full depth of his formations, with the explicit goal of initiating early offensive action to bring the conflict to a favorable conclusion. The concept requires the use of national and joint service air and land assets for both target acquisition and attack, hence the notion AirLand. Having said all this, let us review the bidding to see how we arrived at this point.

Before examining the specifics of our worldwide threat or the concepts that we believe will most effectively deal with this threat, we need to examine the environment that will characterize war in the 1980's. This environment will affect units and soldiers on both sides of any conflict and is largely characterized by the words lethality, mobility, and nonlinearity.

That war is lethal in the normal sense of the word is a statement of the obvious; yet modern warfare will be so extraordinarily lethal that we need to reexamine our expectations. The U.S. Army began doing this at General Abrams' direction shortly after the end of its involvement in Southeast Asia. Chapter Two of the original "How to Fight" Manual, FM 100-5, *Operations*, is a clear recognition of change. The small unit commander can kill at ranges in excess of 2 kilometers with his tanks and in excess of 3 kilometers with his ATGM's. The advent of the attack helicopter with its deadly precision missiles further lengthens the direct fire duel. Precision indirect fire weapons increase the hazard for individual systems well into the unit's rear area. New families of mines with a variety of emplacement techniques, triggering mechanisms, and terminal effects will disorganize and delay forces that encounter them. Add to this the neutralization or destruction of entire units by utilizing chemical and nuclear fires and massive electronic combat, which may be very effective against U.S. Army formations with their heavy reliance upon electronic communications, and this confused battlefield becomes a reality. Future developments in weaponry will usher in a new threshold of destructive potential. The commander who can harness this lethality and exploit the mobility of new weapons will quickly gain and then maintain the initiative.

Mobility will characterize warfare in the 1980's. Our fighting forces have always had a comparable, or better, tactical mobility than our opponents. Yet "comparable" has become the "byword." North American and European armies, including the Warsaw Pact, have been mechanized or motorized to a large extent since World War II. Now, however, modern military technology and a worldwide military sales phenomenon have put sophisticated armored fighting vehicles and other modern, combined arms weapons systems behind every bush, rock, and sand dune. Today we possess a solid capability with our maneuver forces in the field, a capability that will be vastly increased with the introduction of our new armored fighting vehicles that are now entering full scale production. It is axiomatic, however, that *force* mobility contributes to force effectiveness, not

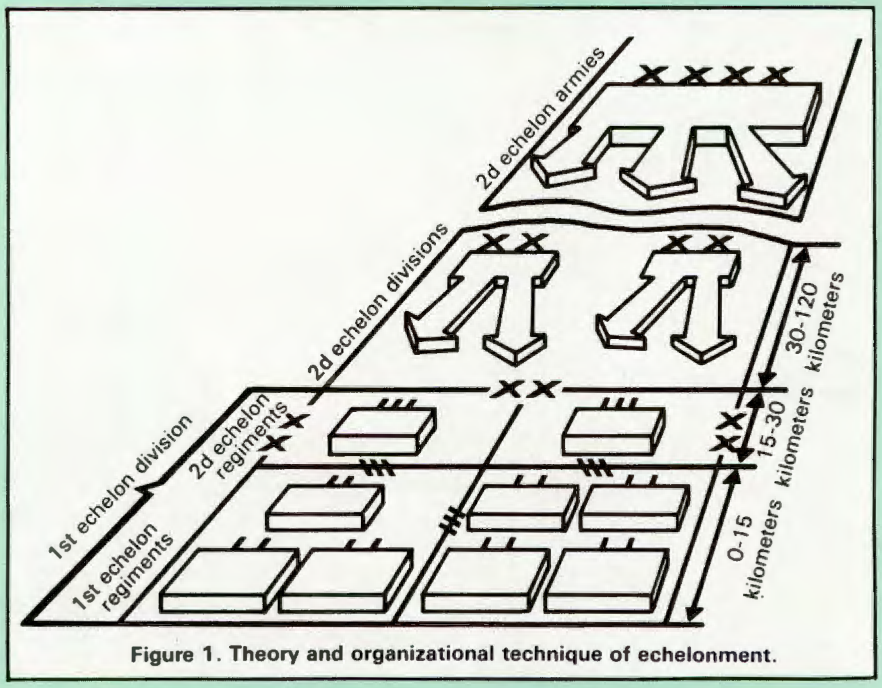


Figure 1. Theory and organizational technique of echelonment.

just the speed and reliability of *individual* fighting vehicles. Unfortunately over the years we have had a tendency to become so defensive minded that many commanders have forgotten, or never knew, what maneuver really means.

While it is true that some armies that possess modern weapons find their combat capability diminishes quickly because they cannot support these weapons, such is not universally so. It is assuredly not true of Soviet and Warsaw Pact forces. These forces have a tested, mobile combat and logistical support system that greatly enhances their force mobility. The Warsaw Pact also possesses other systems that constitute force mobility and affect force effectiveness, including extensive bridging, countermobility systems, and efficient command, control, and communications (C^3) — many of which are armored to survive with the other maneuver and combat support systems. Our force mobility has improved in the past decade, but not at the same rate as that for the Soviet forces.

We create the nonlinear battlefield environment of the 1980's when we combine increased lethality and increased mobility. A nonlinear battlefield is one upon which combat is typified by a discontinuous forward line of troops. The normal notions of "front" and "rear" areas no longer apply. For certain if we fight against Soviet forces, ruptures of sectors and the subsequent isolation of units will often occur. Soviet doctrine, coupled with the sheer size of its forces, only exacerbates the dilemma. Fighting on this lethal, mobile, and nonlinear battlefield under a complicated NATO C^3 structure and supported by fragile and lengthy air and sea lines of communication demands combined arms organizations that are designed to optimize unit cohesion.

If we can summarize this environment, the threat will carry out attacks to the front, flanks, and rear of battalions, brigades, divisions, and corps. A chaotic fog of battle will result from this battlefield environment, compounded by the integrated use of nuclear and chemical weapons and electronic warfare. There will be massive destruction of materiel, incredibly high expenditures of ammunition, and mass human casualties. Communications will be tenuous or nonexistent. Brigade, battalion, and even, in some instances, company commanders will fight independent, local battles without reliable communications with their commanders. Operations may continue day and night without letup for extended periods. The organization, equipment, manning, readiness, and initiative of the soldiers at the beginning of the battle will largely predetermine success on the next battlefield.

The Enemy

There is little doubt that in any war we fight, and in which we commit forces of a corps or larger, our enemy will be Soviet and Warsaw Pact forces or Soviet forces and some of their more sophisticated clients. It is to this level of threat throughout the world that the AirLand Battle concept is directed. Given that this is true, then we can surely expect to have to cope with Soviet style organizations and operations. We can expect to be defending against a massive attack conducted by forces possessing both tactical and strategic initiative, if not strategic surprise. Inevitably, our initial efforts are reactive.

Key to both the Soviet style of offensive combat and to the AirLand Battle concept is the Soviet theory and operational technique of echelonment (figure 1). Echelonment is one way to attain what amounts to principles of war to the Soviet military: *mass, momentum,* and *continuous combat.* Breakthrough is the goal, to be followed by exploitation, whether the Soviet force masses for a conventional, stylized breakthrough attack or the advance is more balanced on multiple axes. It is with the more balanced offensive that the echelonment technique provides the most difficult challenge.

Echelonment provides a great advantage in tactical flexibility and maintenance of the initiative, since the Soviet commander can reinforce where he is successful or he can bypass our forces tied down in contact.

Extended Battlefield

From the foregoing pictures of the threat, the U.S. Corps commander must accomplish three separate but interrelated tasks on an integrated battlefield, whether in Europe or elsewhere. He must:

- Provide subordinate maneuver commanders the forces to accomplish their missions in the covering force and main battle areas.
- Prevent or delay the employment of follow-on forces by the enemy sufficiently to allow forces in contact to maintain the forward defense.
- Unhinge or disrupt the integrity of the enemy's operational scheme sufficiently to seize the initiative, go on the offensive, and force the enemy to ground or destroy him completely. Accomplishing these three tasks in the "time windows" posed by Soviet doctrine demands simultaneous undertakings that must be rigorously practiced in peacetime and unhesitatingly applied when hostilities commence.

The first of these is to "see deep" and begin immediately to disrupt, delay, and destroy elements of the follow-on echelons to prevent their premature arrival in the main battle area. The second undertaking commences as the assault echelons close; they must be struck quickly, causing them to halt and defend, when they fail to achieve their objectives. The third is to mount an offensive against assaulting echelons to destroy them and better prepare the ground against succeeding echelons. This throws the whole scheme of the attack awry, perhaps unhinging the entire frontal effort.

Both General Starry in his article, "Extending the Battlefield" and Lieutenant General Richardson, Deputy Chief of Staff for Operations and Plans, Department of the Army, in his article, "Winning on the Extended Battlefield," in *Army,* have made use of some of the comprehensive analysis from the *Fire Support Mission Area Analysis* to graphically present the effects of successfully executing the "extended battlefield" concept. It is easy to see the two vital payoffs of the concept — providing maneuver battalions, task forces, and squadrons, space and time to fight the defensive battle and creating windows to mount offensive action (figure 2).

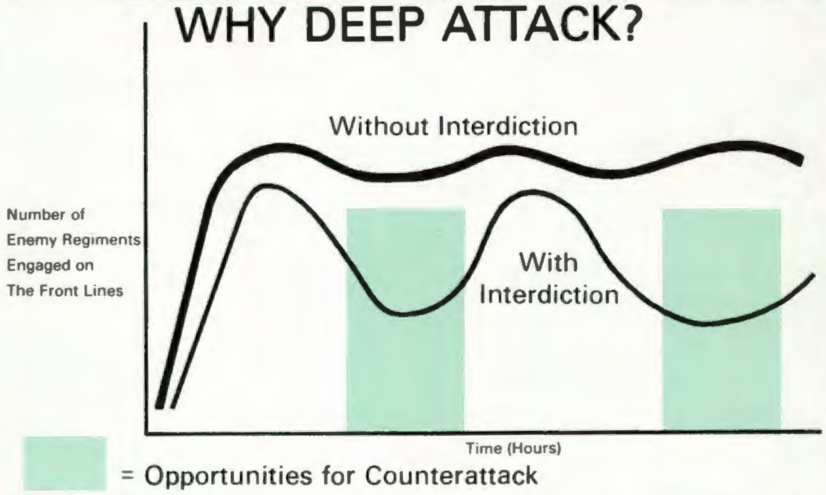


Figure 2. The seeming paradox in the Army's new doctrine of selective deep strikes against the succeeding echelons of an attack is in the requirement for an outnumbered defensive force to turn some of its scarce weapons on enemy troops that have not yet closed the front lines. The answer to the riddle is in the graph above, which shows the vital relationship between the second- and third-echelon units and the ability to sustain the attack. The darker, uppermost curve in the graph shows that the attacker's front line strength is little affected over time, if the already outnumbered defender forgoes interdiction of the follow-on forces. Although the leading offensive units are badly chewed up by the primary defense, all but a fraction of the losses are made good from later echelons as they arrive. The steeper curves of the graph's lower line represent the strength of the attack's cutting edge when part of the defensive firepower is shifted to succeeding echelons from the beginning. The front line losses cannot be made up so completely or quickly, creating time "windows" (shaded areas) for counteraction when the attacker's strength may drop below that of the defense. The relative proportion of the curves is based on extensive computer simulations of corps-sized European battles carried out by the Army's Field Artillery School.

Lieutenant General William R. Richardson, "Winning on the Extended Battlefield," Army 31:6, June 1981, p. 42.

As senior commanders orchestrate their battle, extending the battlefield in distance (looking and attacking deep), time (looking and thinking ahead), and resources (marshalling the fire support, logistic support, and maneuver units) they are wresting the initiative from the attacker. At the preplanned moment, the counterstike commences. The defeat mechanism involves both destruction and disruption. The AirLand Battle, combining the Extended Battlefield concept and the weapons systems constituting the Integrated Battlefield, will allow us to win. The enemy commander faces the following reality:

He has been forced to deviate from his orders in time, direction or desired level of combat effectiveness.

He has been faced with a rapidly changing situation as a result of our deep attack. The changes have been so fast and frequent that he has been unable to determine our intentions and unable to revise his plan.

His decision process has been repeatedly interrupted and reinitiated. Attack of his command and control system has multiplied his confusion. He senses he has lost the initiative.

Unknowingly, he reaches the point chosen for the decisive collapsing blow. Friendly preparations have placed fire support, logistic, and maneuver elements in position to finish him rapidly. LTG William R. Richardson, "Winning on the Extended Battlefield," Army 31:6, June 1981, p. 42.)

AirLand Battle

The *AirLand Battle concept applies now,* it is not something tailored specifically for our current force with 1986 materiel inventories or for a force structured on the Army 86 designs. In fact, "imperative" is the word that must characterize our attitude toward instituting AirLand Battle as an operational concept for the 1981 force. Subsequent changes that occur with the fielding of new materiel or restructured organizations will increase capabilities that already exist.

While in terms of execution, AirLand Battle is applied by corps, division, and brigade commanders. Applying the concept on the ground conveys an urgency to battlefield activities in the purview of battalion and squadron commanders. The first, and probably most important, is command and control.

Command and control has always been most critical in combat. All other things being equal, cohesion, efficiency of effort, and tactical success are largely a measurement of the effectiveness of command and control. If it is possible to imagine a scheme that places an absolute premium on this battlefied function, then AirLand Battle must be that scheme. While AirLand Battle in concept represents straight-forward simplicity and unity of effort, it demands real time recognition of conditions, intelligence acquisition, and near instantaneous execution of orders. Opportunities to attack are fleeting, and the winner will be the commander who recognizes them quickly and attacks with all the resources at his command

Given that the window for taking the initiative will be shortlived and that it is most likely that electronic interference and dedicated artillery will make every effort to subvert our command and control, there are several countermeasures that we must undertake from company or troop level through corps level. These activities involve minimizing the disruption of our command and control by Soviet radio-electronic combat.

Preplanning is essential. Our staffs should be 48 to 72 hours ahead of current operations in their detailed planning. Staff planning must be at least this far ahead for effective target destruction or disruption with conventional or nuclear weapons. But it is even more essential that planning be that far along so that the capability to attack is ready when the fleeting opportunity presents itself.

The attack and maneuver schemes designed at each echelon must be simple ones. Excessively complex schemes will likely never get off the ground in an environment that allows only the simplest and fastest of signals to pass. It is of the utmost importance for company and battalion commanders to have an intimate knowledge of brigade, division,

Conceptual Highlights

- Conduct detailed reconnaissance within and to front, flanks, and rear of division.
- Assist movement of divisional units.
- Facilitate command and control for division commander on the integrated battlefield.
- Position and monitor sensors.
- Conduct NBC reconnaissance.
- Provide circulation control.

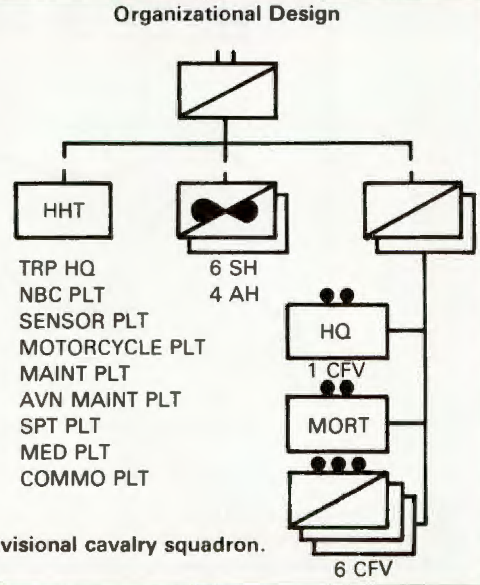


Figure 3. Divisional cavalry squadron.

and corps operational schemes and their own role in the scheme. These subordinate commanders must understand the operative conditions indicating the commencement of whatever role they are to play, ranging from strongpoint defense to counterattack, so that they can undertake their role in the absence of specific commands to do so. Finally, the preplanned, simple schemes that everyone understands must include several alternative schemes with operative conditions for each. While there is no doubt that all this is a difficult proposition, more than anything else, it requires a state of mind, a unity of purpose that is achieved with unit cohesion and endless practice at all levels. Initiative on the part of individual commanders is absolutely necessary to assure that no chance for success is overlooked.

This mental flexibility will not exist unless we begin training our commanders to be constantly alert to exploit opportunities when they arise, so long as the action accomplishes the mission. Too many commanders have not developed the requisite state of mind to change a carefully developed plan when an opportunity for success arises. The key must be the ability to visualize the part any unit plays in the overall scheme of battle, e.g., company in battalion and brigade scheme, battalion in brigade and division scheme and brigade in division and corps scheme. The commander who does not constantly plan ahead for every possible contingency and then react boldly when opportunities present themselves will not be a winner.

A wrinkle of the command and control function that has not received the level of attention and proficiency that is required is battlefield identification. Everyone must know all the players, and not just to avoid fratricide. Recognition and prompt reporting of what is observed at the Forward Line of Troops (FLOT), including specific identification of vehicles and activities, provides verification of intelligence estimates for planning at higher echelons and the ability to recognize the conditions that signal the commencement and execution of preplanned courses of action.

Beyond the command and control issue, there is another aspect of AirLand Battle that will impact heavily at the battalion level. A concerted effort using every capable and available system, will be made to engage second-echelon forces at long ranges to disrupt and to delay their arrival in the main battle area. Corps, division, and brigade commanders will likely be employing their available assets. This means that there may be fewer artillery fire missions available to the battalion. This problem will be alleviated to an extent by eight-gun batteries and the fielding of the Multiple-launched Rocket System (MLRS). Attack helicopter assets, or some fraction thereof, are likely to be diverted to deeper targets. Most assuredly there will be fewer close air support sorties available. The battalion commander is going to have to fight the battle at the FLOT with what he has, gaining every last bit of effectiveness from his own direct and indirect fire systems.

Despite the disadvantages of mortars — vulnerability to detection and counterfire, limited range and lethality — this indirect fire system may well be on occasion our primary indirect fire support. The Armor Center has for some time seen the mortar as a primary delivery device for obscurants or illumination; if less fire support is available, we may need to change this notion. Additionally, we should investigate what technology is available to increase the effectiveness of mortars and to overcome their disadvantages. It may be the time to reexamine the concept of battalion fire support in the form of the 120-mm or other heavy mortar.

Another function that must receive increased attention at the battalion and squadron level is the mobility-countermobility function. We must become experts in mine warfare and obstacle construction, as well as clearing. At present we are not because we do not train adequately or think enough about these functions. Mobility is the "bread and butter" of the armor force, whether in the offense or the defense. Unfortunately, in our training we do not make it hard enough on ourselves to move. Using mines and other obstacles to direct enemy maneuver units into fire traps, while retaining sufficient resources to move to positions for placement of direct fire on these enemy units, will to a great extent offset the fire support problem. Even a greater problem is the capability of our units to neutralize enemy minefields and reduce the obstacles during our offensive operations. We can only perfect these operations by constant practice, utilizing training mines and actual obstacles. Too many units habitually simulate these actions in training.

On the subject of mobility, our armor commanders need to reexamine their thinking with respect to movement and maneuver. AirLand Battle makes it critical not only to stop the assaulting echelons, but to attack and destroy them by violent offensive action. We cannot afford to drive into our well-protected firing positions, hunker down, and stay there. Even in the defense, we must carry the battle to the enemy force. The assaulting echelons would like nothing better than to gain their objectives by bypassing our positions unmolested. Protected, defilade positions are important for survivability, but static survivability means nothing if assaulting echelons are not destroyed. Movement is probably as important as a protected position for survivability and more important for destroying the enemy.

Remember too, that AirLand Battle embraces the "Integrated Battlefield;" chemical and nuclear warfare are very much a part of this concept. Despite the emphasis that chemical warfare is receiving, we do not perceive sufficient urgency among our maneuver unit commanders to plan for and practice the techniques of warfare in a contaminated environment. When was the last time you conducted a CPX under full mission-oriented protective posture (MOPP) for an entire CPX? Have you ever had your protective equipment on?

All of it? For how long? *The hour has come.*

For the time being we need to reevaluate the way that we do business. We must shake off our dependence upon electronic communications and reliance on outside help in the direct fire battle. We need to preplan more and more carefully, making use of mobility and agility to survive. We simply must come to grips with fighting in a contaminated environment.

The Army 86 Armor Force and AirLand Battle

When the Army 86 organizations are fielded, new capabilities will be added to an army well-trained in undertaking AirLand Battle. One of the organizations to be converted, the division cavalry squadron (figure 3), will, among other things, provide much increased command and control and force mobility within the division area. Working with scout platoons in brigades and battalions as required in a communications strained environment, the division's cavalry squadron provides vital functions for the division commander in addition to traditional route, zone, and area reconnaissance. These functions are to facilitate command and control, conduct line-of-communication (LOC) surveillance, and assist movement of divisional units in the division's area.

The squadron's ground troops, augmented as necessary by the air cavalry troop, provide a constant surveillance of major LOC in the division's area. These cavalry units position their scouts to provide continuous surveillance of and reconnaissance on these LOCs. Often the troops will be augmented with sensors, ground surveillance radars, and nuclear, biological and chemical reconnaissance squads. Contaminated areas and other obstacles to movement are identified and located, and bypasses are determined. Using this LOC intelligence information, the cavalry units assist movement of maneuver and support units. They can either directly lead the unit along an unblocked route or provide the information to the supported unit's staff or scout platoon.

When the division commander is unsure of the location and tactical situation of a major subordinate unit (e.g., a brigade) the ground or air cavalry troops can be used to establish a command and control link. A troop, or one of its platoons, can be used to carry the division commander's request for information or instructions to the subordinate unit. On a confused, nonlinear battlefield this task may require the troop to overcome pockets of resistance and to bypass friendly and enemy units. The use of cavalry for this role will be particularly important when the enemy jams command nets or uses chemical or nuclear weapons.

The Cavalry Brigade, Air Attack (CBAA) becomes a fourth maneuver brigade in Division 86. This brigade, with staff resources comparable to a ground maneuver brigade (figure 4), can marshal assets for the division or brigade battle at the FLOT or maneuver its own battalions against the enemy at the FLOT or across it. This flexibility gives the division commander a new capability to undertake his multiple requirements for AirLand Battle.

In the pure interdiction role, the CBAA alone or in conjunction with *A-10* aircraft, forming joint air attack teams, can measurably assist the scheme of corps and division commanders to structure the battlefield in space and time, keeping second-echelon units from arriving at the FLOT too early and beginning the physical and mental dislocation articulated by Lieutenant General Richardson, quoted earlier. The purpose of the dislocation and the interdiction is to prepare the ground for offensive action.

Here the CBAA may be able to bear the full fruit of its organizational design. The Army 86 organizations were designed primarily to employ a host of advanced systems, the CBAA included. It's time to find out whether the new systems and organizations can pay off for us and how to best employ their capabilities.

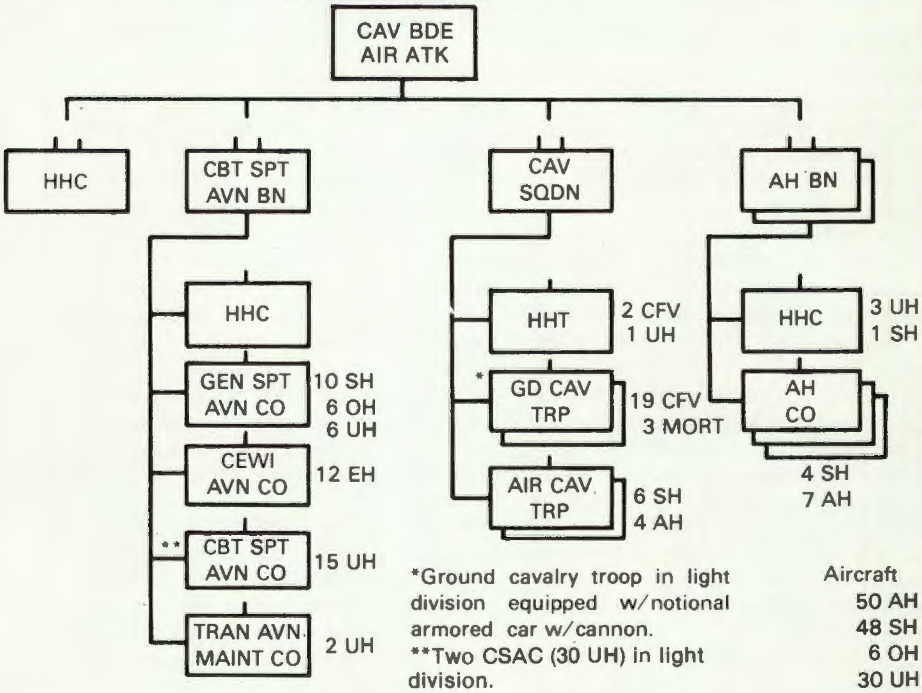
The CBAA has the same staff capabilities as any ground maneuver brigade. The theory behind this is that it needs the capability to maneuver its own units, that keeping attack helicopters massed is better than providing "penny packets" to each and everyone. This organiza-

Conceptual Highlights

- Provides unity of command for all division aviation.
- Organized for how we fight.
- Separates fighters from supporters.
- Separate organizations for attack and recon.
- Increased leader to led ratios; experience of key commanders.
- Increases combat power.
- Provides similar CBAA design for heavy and light divisions.

Helicopter Abbreviations
AH—Attack
SH—Scout
OH—Observation
UH—Utility
EH—Electronic

Organizational Design



*Ground cavalry troop in light division equipped w/notional armored car w/cannon.
**Two CSAC (30 UH) in light division.

Aircraft
50 AH
48 SH
6 OH
30 UH
12 EH
146

Figure 4. Cavalry brigade, air attack.

Conceptual Highlights

General: Provides corps commander a self-contained force of combined arms and services capable of independent operations as an economy of force.

Covering force:

- Force the enemy to deploy and confirm direction and strength of division attacks.
- Provide time for the main body to deploy forward and laterally.
- In the offense, prevent surprise, establish contact, and protect main body from detection/engagement by enemy.

Main battle area: Provide a force for corps commander to weight battle: represent the signature of a division.

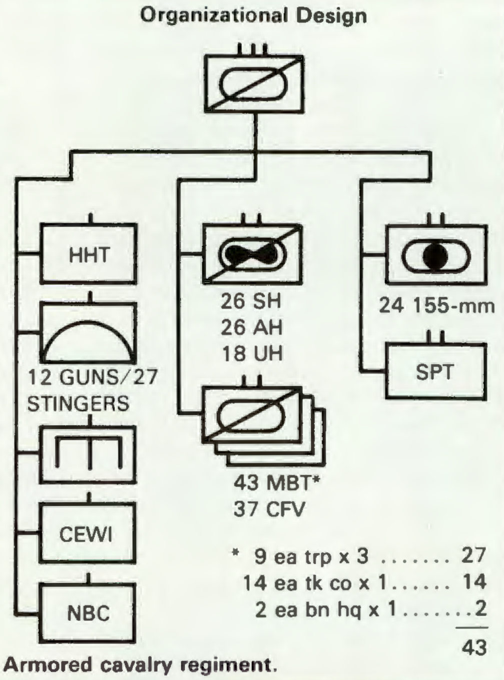


Figure 5. Armored cavalry regiment.

tional design provides further benefits as well. While the CBAA is not tailored to provide combat service support to ground maneuver units, it can take operational control of a ground maneuver unit for a period of time for a particular mission. Two vignettes describing this can be found in the CBAA's *Operational and Organizational Concept*, published in November of 1980 and discussed in some detail in the proceedings of the 1981 Armor Conference.

It's time for us to "bite the bullet" on the CBAA. The potential is within this organization to use its own advanced air platforms and take operational control of units equipped with the extremely agile *M-1 Abrams* tank and the Bradley *M-2/3 Bradley* fighting vehicles when required to carry out violent, high-speed attacks against second-echelon enemy forces, either for the purpose of causing disruption and dislocation or for the purpose of exploiting disruption and dislocation caused by other interdiction means. There is, however, a traditional prejudice in our force against aviation maneuver units; whether deserved or not will not be debated. Given AirLand Battle, the conceptual opportunity exists to employ an extremely mobile and potent strike force, make up of the CBAA's attack helicopters, operating with USAF *A-10s* — for which concepts already exist[1] — and the new family of armored fighting vehicles.

Let's find out, rather than falling back on traditional views, whether such a unit can be formed and operated against second-echelon forces. We can do high-resolution gaming and combat simulations to examine procedures and problems, but that will never provide the answer we need. Let's put this organization on the ground and "see" if it works. Such a test may tell us that the CBAA cannot control a large, ground operation, but that another kind of headquarters could or, on the other hand, we may deflate an old prejudice. The AirLand Battle concept cries out for this kind of capability. We have the potential with both organizations and weapons systems to undertake such a task — especially where the objective is the destruction of an enemy force.

The Corps 86 organization and concept provide another boost to our ability to fight the AirLand Battle. The Armored Cavalry Regiment (ACR), part of Corps 86, has been reinforced (figure 5) and now can provide the nucleus around which the covering force can be built. The regiment is designed to be reinforced with assets such as additional attack helicopters, field artillery, and tactical aircraft. As a "self-contained" economy of force unit, a very potent covering force can be built that is employed by the corps commander. Given special conditions of METT, divisions can still control the covering force in their sectors.

Whether in the defense or the offense, the ACR provides the covering force without significantly reducing the combat power of the divisions. The fact that the regiment has so much organic combat power provides the additional benefit of making it easier to keep the regiment intact after the covering force fight. Therefore, it makes the unique capabilities of the organization (reconnaissance and security) available to the corps, rather than allowing the regimental headquarters to become just another maneuver brigade headquarters.

Conclusion

In conclusion, let us simply highlight a couple of things that you have read. The battlefield that we may face in the next decade represents the most difficult challenge ever presented to armies. Lethal, confused, and moving at an exhausting pace, this battlefield will measure the mettle of any army and quickly turn up anything found wanting. We are in a position now to begin serious preparation for this battlefield. We have articulated a concept that provides a scheme to win. The key is to train and educate our soldiers and their leaders to execute the concept in an environment that is designed to thwart them. Our equipment is good and getting better; our combat organizations are flexible and potent. We can put the lie to Bobby Burns' notion about "The best laid plans of mice and men," through efficient, systematic, and comprehensive training that is designed to build cohesive organizations made up of trained soldiers and leaders who can live, fight, and win on the Integrated, Extended Battlefield now.

Footnote

[1] TACP 50-20/TRADOC TT 17-50-3, *Joint Air Attack Team Operations*, 30 April 1979.

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The Best Tank Ever Built

by Lieutenant Colonel (Retired) Royce R. Taylor

How good is the *M-1 Abrams* main battle tank? To find out, the author spent several days at Fort Hood interviewing the soldiers who should know — the men of the 2d Battalion, 5th Cavalry, 1st Cavalry Division, who had recently finished putting the *Abrams* through Operational Test III. For the benefit of units who are about to trade their *M-60* tanks in for the *Abrams*, here is what the "Black Knight" tankers had to say.

The *Abrams* is the best tank ever built. That is the concensus of the men who will fight in it, command it, and, if need be, die in it. From private to general they emphasize that the *M-1* is a *new* tank and should not be compared to the *M-60*. The *M-1* is, in fact, the first completely new U.S. tank fielded since the *M-48* in 1954.

> ***"I am a great beliver in this tank. I have been a tanker for over 28 years, and I am familiar with most main battle tanks of the world's major armies. By every measure of operational performance, the Abrams tank is a clear winner. There is just no other tank in the world with its mobility or firepower, or certainly, its survivability."***
>
> Major General Richard Lawrence
> Commander, 1st Cavalry Division
> Fort Hood, Texas

First, some general comments, and then on to discussions and opinions concerning the tank's crew stations, specific features, and tactical employment of the tank. Some typical remarks of expereienced tankers follow:

"The fire control has to be one of the most outstanding things about the tank. Firing in the stabilized mode is great. When we went down range last week on a daylight run, the number of first round hits we scored would sure ruin the other fellows day — in fact he wouldn't have a day at all."

"It's a lot better tank than the *M-60*. It has a lot of modern features that the *M-60* doesn't have that make the tanker's work a lot easier maintenance-wise. And I love the way it shoots."

"After we complete our initial training, it only took about a month to become completely proficient in maintaining the tank."

"I like its mobility. It has speed, it'll stop on a dime, and turn in a heartbeat."

"My crew and I had a lot less trouble learning how to operate this tank than we did the *M-60.*"

Turning to the crew stations, this is what drivers can expect. Regardless of whether or not they have had *M-60* driving experience, they can pass the test after 1 week of training. But they shouldn't expect to really become proficient until they have participated in several road marches and cross-country operations. Initially, drivers will find that the brakes are sensitive, and they will not be sure about what speeds can be used to negotiate specific types of obstacles such as ditches and bumps.

At Fort Hood, tank commanders (TCs) and drivers alike point out that the speed of the *M-1* makes it extremely important for the driver to anticipate the TC's directions. Likewise the TC must develop confidence in his driver's ability to sense what is needed, while he devotes most of his attention to fighting the tank. At 40 mph there isn't time for detailed directions for maneuvering the *Abrams.*

The features most often praised by the drivers were the T-bar controls and reclining driver's seat. When talking about the T-bar (combination of throttle and directional control), the drivers were enthusiastic about the tank's instant, positive response to the controls, particularly the tremendous accelera-

tion. They like the seat because it positions the driver so that his head is comfortably positioned for viewing his instruments and provides good visibility outside the tank.

The drivers did note two areas for improving their station, however. They recommended more support for the neck area of the seat and improved ventilation, especially during the main gun firing when gasses sometimes build up. These driver comments are based on extensive driving experiences over a period of about 9 months. During that time, the test incorporated situations that required road marches of from 90 to 130 kilometers, execution of a tactical exercise, and a withdrawal entailing another 50 or more kilometers.

Gunner's Station and Fire Controls.A tanker occupying the *M-1's* gunner's station for the first time need not be concerned about the new fire controls. Although his primary thermal imaging sight (TIS) involves some highly sophisticated technology, the gunner is not faced with a mind-boggling array of knobs, switches, and instrument dials. He need only to switch the power on and put it in the STANDBY mode, run through a system self-test, and wait for a READY light. When the light comes on, the gunner turns the sight to ON and adjusts the focus, contrast, sensitivity, reticle and symbol knobs to get a clear picture. The TIS can be operated in either the WHITE HOT or BLACK HOT modes to give the sharpest target definition under varying conditions.

Gunners will also be impressed with the new digital solid-state computer that automatically receives the range from the laser rangefinder, and compensates for lead, crosswind, and cant so that the gunner needs only to maintain the correct sight picture and fire. However, some information must be fed into the computer on an as needed basis that was not needed in the past, such as ammunition temperature, air temperature, and atmospheric pressure.

To operate the laser rangefinder the gunner needs only to lay on target, press a button to activate the laser, and read the range displayed in his sight.

The fire control system has also been used in a unique role, on occasion, to maneuver the vehicle when the driver's periscope becomes obscured or his night vision device fails, or there is not enough ambient light. In such cases, the gunner uses his TIS to lay the gun in the direction of travel and then tells the driver which way to turn to keep the gun centered over the front slope to maintain a heading, and whether to slow down or speed up to maintain interval during a road march.

Gunners, platoon leaders, and tank commanders cited the stabilization system as the most significant improvement in the armament system, even when compared with the add-on stabilization of the *M-60* series. The battalion Master Gunner said, "I've seen and fired tanks with other stabilization systems, but non compared to this one. That alone sells me on the vehicle."

The Master Gunner also discussed the impact of the *M-1's* speed on platoon gunnery and training. For one thing a range with much greater depth will be needed. At least 5 to 8 kilometers will be required to give the platoon leader more time to accomplish the things he needs to learn and do as a leader. The *Abram's* speed is also going to require new fire commands. At those speeds, the platoon leader does not have time for the type of fire commands that are used now that take up a lot of time in radio traffic. A lot is yet to be learned about fire distribution. There will not be time for fire commands, and it will be necessary to develop SOPs or battle drills that accomplish fire distribution without the platoon leader having to issue fire commands. These techniques are addressed in FM 17-12-1 (Draft), *M-1 Tank Gunnery,* and Training Text 71-1/2 (Draft), *Abrams Battalion, Company, and Platoon.*

Loader's Work Made Easier. Loaders will find their work is easier on the *M-1* even though they may think, at first, that their station is a bit cramped. They also have to learn a new maneuver when they remove a round from the bustle rack and turn it to load. However, a knee switch that automatically opens the door to the ammunition rack will enable them to easily meet the 5-second standard set for loading the main gun. In fact, after 3 months of gunnery, the loaders at Fort Hood were reloading the gun in 3½ to 4 seconds. Loaders may be somewhat concerned initially about loading the HEAT round, but experience has shown that it can be loaded with the same ease as the SABOT.

Loaders at Fort Hood also noted that the provision for an elevation disconnect while in the stabilized mode eliminates the problem of trying to load a gyrating breech. The gunner flips a switch, loads, repositions the switch, and the gun automatically returns to the aiming point on which the gunner has layed and is ready to fire.

The *M-1* is Maintainable. All of these comments about operating the tank lead, of course, to a discussion of maintenance and maintainability. To a man, crewmen, commanders, direct support maintenance personnel, and staff officers of the 2-5th Cavalry agree that the *M-1* is maintainable.

However, in every discussion of maintenance, one point was stressed. The days of the "shade tree" tank or turret mechanic are over. Short cuts, field expedients, and trial-and-error trouble shooting are out. Mechanics can no longer listen, feel, shake and wiggle, or "sense" a fault. They must follow the maintenance manuals and procedures to the letter. Short cuts will only lead to problems later.

As for crew maintenance, platoon leaders, tank commanders and crews all agreed that the *M-1* is easy to maintain.

"The tanks that came down here got the hell beat out of them, but they stood up to it — 90-kilometer road marches for a solid week straight for instance — and they kept on 'truckin' ".

But, they too, stressed the need to "follow the book." In this regard, one platoon leader mentioned that although the *Abrams* is equipped with instrumentation that shows the operational condition of all components, the crew must still make routine checks.

During the test, it became apparent that track tension was one particular item of before-, during-, and after-operation maintenance that required strict attention. A platoon leader had this to say on the subject: "The forces that the idler wheels take during high-speed road marches and cross-country operations are tremendous and the tracks are bound to loosen up. Whenever you stop during a road march or have a lull in tactical operations, you have to check the track tension. Initially, we didn't do that, and we threw several tracks. Now, when we halt we go through what we call our 'Indy 500 Pit Stop.' We check the track tension, oil, precleaner, road wheel hub sight gauges, and shock absorbers — all in less than 5 minutes."

DS Maintenance Keeps the *M-1* Rolling. Direct support (DS) maintenance personnel were equally enthusiastic about their ability to keep the *Abrams* rolling. Here are some quotes from members of the DS unit that participated in the test.

"The time to repair an *M-1* compared to time to repair an *M-60* is about the same. Once you find out what is wrong with it, the manuals give step-by-step instructions for making repairs."

"The test equipment we had to work with was a lifesaver as far as we are concerned. The test sets worked beautifully about 95 percent of the time. They identify faults down to the circuit cards."

"Troubleshooting was a bit different at first, but after we had seen the same problems several times we were able to find them and make quick repairs."

"The only thing we had to do different, in so far as shop procedures were concerned, was to use a maintenance stand when we pulled a power pack."

"If a pack goes out, we pull it, put another in, and in less than 2 hours the tank is back in action."

"The tank can be maintained by the average trooper."

"The tanks that came down here got the hell beat out of them, but they stood up to the whole thing — 90-kilometer road marches for a solid week straight for instance — and they kept on 'trucking.' The crews kept them running. As for statistics as to how well they performed, I think that speaks for itself."

"We were really surprised at the end of the test to find that, after firing the number of rounds we did in such a short period of time, we could come back to the zero range and hit within the circle without going through a complete zeroing process."

Durability. The survivability of the *Abrams* in terms of taking enemy hits was not tested at Fort Hood, of course, but an accident described by a company commander gives a good indication of the tank's ruggedness and durability.

"The driver of my tank tell asleep during one of our long road marches and we 'christened' a mountain when we went off the road at about 30 miles per hour. Fortunately, no one was hurt, and we had the tank back in operation in about 1 hour. That was one of the tanks in my company that successfully cmpleted a confirm-zero test at the end of the exercise. If you were to take a shot like that with an *M-60*, you would have to go through a complete synchronization because there is no way than an *M-60* would shoot accurately after an accident like that."

"After listening to the praises of crewmen, tank commanders, platoon sergeants, platoon leaders, and company commanders, there can be no doubt about the Abrams mobility, agility, dependability, and maintainability insofar as the troops are concerned."

The *Abrams'* ruggedness was also demonstrated by a firing exercise at the end of a 6-day FTX. A sampling of four tanks from each company went on the range to confirm zeroes, and all tanks except one completed the test successfully. That one failed only because there was a faulty chip in its computer. And, even that tank confirmed with SABOT, but when the gunner switched to the HEAT reticle it didn't register.

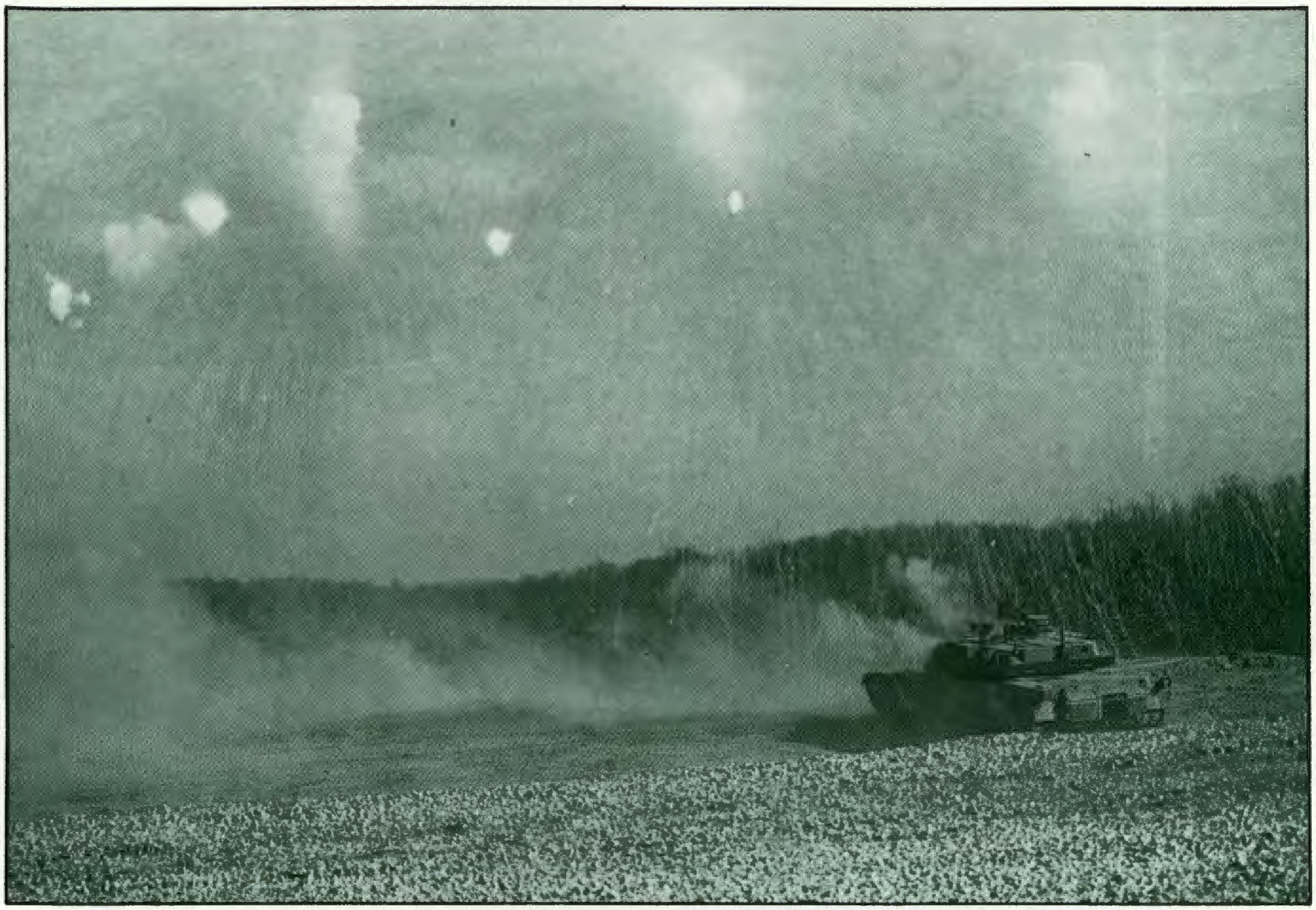
The durability of the fire control system is best summarized by the statement of a company commander.

"We were really surprised at the end of the test to find that, after firing the number of rounds we did in such a short period of time, we could come back to the zero range and hit within the circle without going through a complete zeroing process."

After listening to the praises of crewmen, tank commanders, platoon sergeants, platoon leaders and company commanders, there can be no doubt about the *Abrams'* mobility, agility, dependability, and maintainability, insofar as the troops are concerned.

The *Abrams* and Tactical Doctrine. Now, what about its tactical employment?

This is a company commander's description of the test's final FTX:



"The 'Six-Day War' kicked off with what I think would be a realistic European scenario in which you deploy to your local dispersal area, do your precombat checks, get topped off, and make a long march into your defensive position.

"In this exercise, the initial road march was about 130 kilometers. It started in late afternoon and most of it was done during darkness. Part of the distance was covered with headlights on until we crossed the corps light line. From there, we ran another 40 or 50 kilometers in total blackout at road speeds of 30 to 35 miles per hour and sometimes more — about twice what you can do in a M-60. We closed into our defensive positions and received an attack. Then, we were pulled out of that battle, conducted another long road march, refueled, rearmed, and moved laterally into another sector — into another corps' sector really. We received an attack there, moved back to another assembly area, refueled, rearmed, rested for 4 hours, and then kicked off in yet another attack.

"The 'Six-Day War' was probably one of the most realistic exercises we have ever had here at Fort Hood and we accomplished just about all the ARTEP missions that might come up."

The exercise was designed to exploit the *M-1's* speed to move units laterally and mass a force at the critical point. That is why the scenario included so many long road marches that approximated the movement from one corps boundary to the other.

Logistical Support. This tactical maneuver brought out another aspect of employing the *Abrams* — it put a strain on the logistics system, as can be seen from the company commander's description of the operation.

"If we had not known the scenario — where we were going, and where to have fuel waiting for us — we would have had a problem. We had prepositioned supply points. The support platoon leader knew about where we would be at what time, so his platoon was able to get fuel to us on time. If there was one thing that was unrealistic about the FTX, it was that aspect of it. The fuel *Goers* were not travelling the same distance over the same route of march, at the same speed as the tanks were. However, we used only our battalion support assets. But, in a fast moving combat situation, they would have a problem keeping up, and refueling with helicopters and fuel bladders would probably be the only immediate solution to the problem."

A Battalion Commander Discusses the *Abrams*. This is what the battalion commander had to say about the impact of the *M-1* on tactical operations at battalion level.

"It is going to revolutionize our tactics. Just the ability to go from point A to point B on the battlefield about three times faster than you can with *M-60s* will enable commanders from brigade to corps to make decisions 20 to 30 minutes later than they do now. The *Abrams* gives commanders the capability for massing forces rapidly at the point in place and time that can stem an attack or deliver a decisive counterblow.

"From the logistical side of the house, however, we have some bugs to work out. It uses a lot of fuel, and its cross-country and highway speed stretches our tail a long way.

"Turning to the combined arms aspect of combat operations, we come up with another need. The mechanized infantry's *M-113* armored personnel carriers cannot keep up with the *M-1*. We have to come up with something to get the infantry and cavalry out there. For example, during the long road marches, we used our scout platoon more for traffic control than anything else, and we had to send them out as much as 2 hours ahead of time just to keep the tanks from running over them.

"We know that the armor-protected rearm, resupply, and refuel vehicles are being developed, but the question is, 'When are we going to get them?' As far as I'm concerned, the *UH-1* is going to be our best bet for rearming and refueling if we have to go to war today.

"In the matter of command and control, the S-3 section and the battalion tactical operations center are going to be totally different. The old concept of having *M-577* command vehicles backed up to one another with a tarpaulin in between is pretty much out the window. We have to have something that can be put up and taken down quickly and moved.

"All-in-all, we are going to have to rethink our doctrine. The capability is there, but being able to manage it and orchestrate it with what else is on the battlefield is something that we have to work on. It is going to take some time."

The *M-1* as the Division Commander Sees It. What has been said to this point reflects the opinions of individual tankers, platoon leaders, company and battalion commanders, and support personnel. Their praise, observations, and remarks about the *Abrams* are echoed and reinforced by their division commander.

"The *M-1* tank is going to create a much faster tempo of operations. Until a person has been with the tank in a tactical situation, he cannot visualize how much faster he can do things on the battlefield — the ability to move cross-country, from one flank to another, forward from an assembly area to an attack position, and later on to a line of departure is remarkable. One of the things my troops, particularly my tank commanders, have said repeatedly during major exercises is that they must be continually thinking ahead several kilometers rather than several hundred meters because of the speeds with which an *M-1* formation or column can eat up ground. The tempo on the battlefield is going to be increased tremendously. Therefore, in our planning effort, and in our visualization of the operation, we are going to have to think ahead and plan ahead farther, at lower levels, to optimize the capabilities of the *M-1*.

"***We are going to have to go to some innovative ideas for leapfrogging fuel and resupply vehicles or prepositioning them so that they are up ahead waiting for us.***"

"In terms of resupply, I don't see the resupply problem, for ammunition for example, as being that much more difficult than what we are operating with now in terms of the procedures we use to resupply a tank. The *M-60* has 63 rounds in it and the *M-1* has 55, so, for a full load of ammunition, you are actually loading less rounds for the *M-1* than for the *M-60*. Furthermore, the ease of loading in terms of numbers is considerably less, and the way the ammunition is stowed in the *M-1* will make loading much simpler. When we move to the 120-mm round, we will have fewer rounds yet to load, and I don't think it will be all that much more difficult because there isn't that much difference in the weight of the round. Therefore, I don't see any near-term difficulty in resupplying ammunition.

"As for rearming forward, I believe in the necessity for an armored rearm vehicle now, whether we have to rearm an *M-60* or *M-1* tank. The Army must have an armored rearm vehicle if it is to employ its tank forces with an optimum capability.

"In refueling operations, we employed several *Goer* fuel vehicles positioned in parallel lines, moved the tanks through, and refueled each fuel point on the tank simultaneously. That was a very effective way of quickly refueling, even though it represents a significant hazard because there is a lot of fuel around the tank. But after all, combat is a hazardous business.

"In tactical operations, we determined that, although the *M-1* uses a bit more fuel than the *M-60* we were able to fuel the *M-1* the preceding evening or early in the morning before stand-to and fight all day without refueling. That is no worse than we do with the *M-60*. We were able, under a very intensive European scenario, to refuel at night, fight all day without having to refuel until the following night. I find that tactically acceptable, and it also allows us to position the *Goers* or bring them up under blackout conditions in a relatively safer situation.

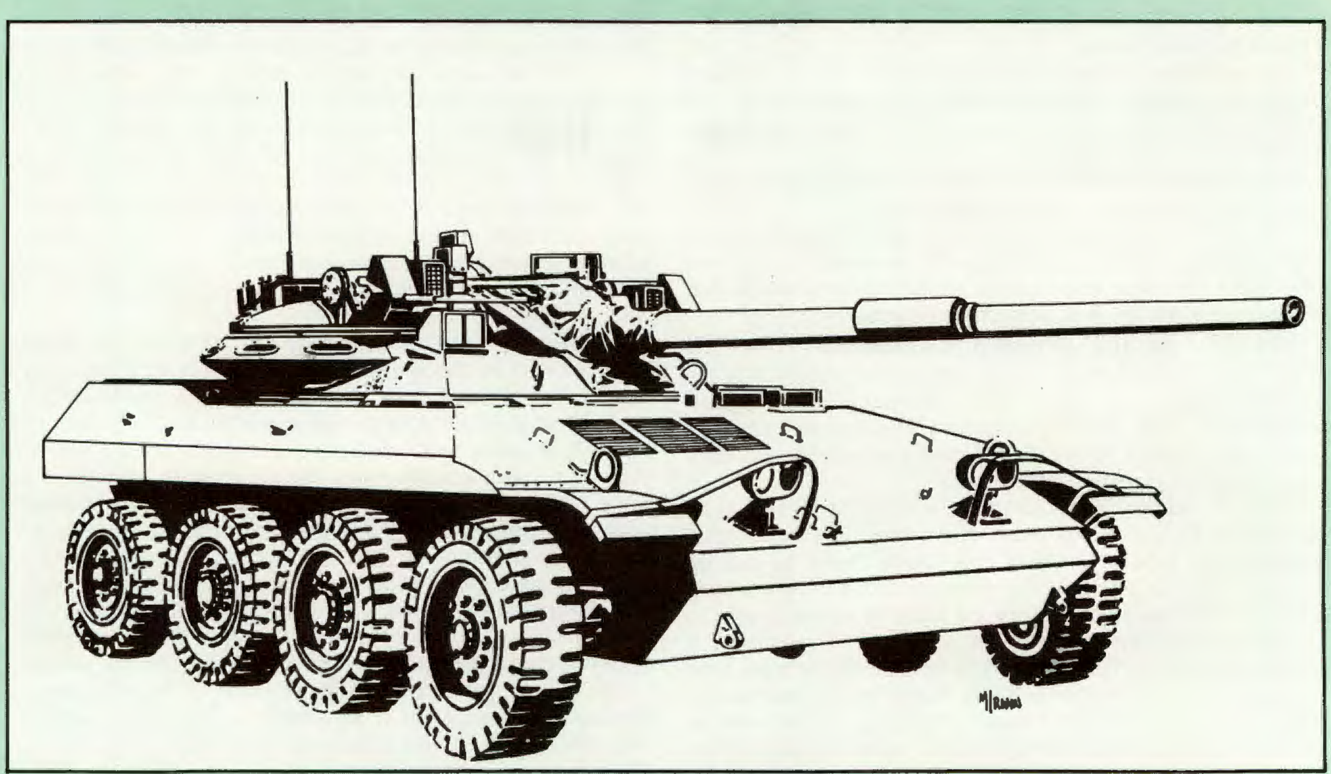
"However, there is one refueling operation that we are going to have to be concerned about, and that is refueling on the march. Battalions will be able to march on good roads in daylight or at night at sustained speeds of 30 to 35 miles per hour. It is going to be difficult for combat service support vehicles to maintain that pace. We are going to have to go to some innovative ideas for leapfrogging fuel and resupply vehicles or prepositioning them, so that we know that they are up ahead waiting for us. That is one problem we are going to have to solve because we are not going to have a vehicle in the near future that will solve it for us. Airlifted fuel bladders are another option, but with bladders you don't have the flexibility in refueling operations once you have them on the ground.

"In addressing the matter of the ability of *M-113* armored personnel carriers (APCs) and artillery vehicles to keep up with the *Abrams*, I don't find that there will be difficulty for short distances — say from the attack position to the objective. In tactical movements where you have a bounding overwatch, with one unit moving while it is being overwatched, or supported by fire by another unit, I don't see the difficulty in *M-113s* keeping up. I don't think that will be so much of a problem on the battlefield proper. The problem you are going to have with *M-113s* will be during long tactical road marches if you are in a pursuit or a rapid retrograde operation. The *M-1* can do so much more cross-country in those situations, that we are going to have to come up with some innovative ideas.

"Again, on long marches, we may have to move the APCs out ahead of time and rendevous at forward assembly areas before we move into the battle proper. We may even have to join forces in the attack position just before we cross the line of departure, if we are using a line of departure. In the pursuit, we may have to accept the fact that APCs cannot maintain speeds that will match *M-1s*, and that we will have to use them on two different axes.

"Turning to maintainability and durability, I would like to point out that, in 1972, we set certain benchmarks for maintainability and durability. Those were, in a sense, educated guesses about what we thought we might be able to achieve in the late seventies and early eighties. I was one of the team members that conceptualized the *M-1*, and I think we overreached in some of those requirements. Apart from that, people are comparing the *Abrams'* key reliability and durability factors with what we have on the *M-60*, which has been in the field for 21 years. In that time, the *M-60* has been modified through three or four major automotive and fire control models, and its growing pains are behind it. Hence, the maintenance ratios and the durability we are getting out of the *M-60* should not be compared to the *M-1*. In fact, the *M-1* today is far ahead in its maintainability and durability factors when compared to the *M-60's* performance in the early sixties. Therefore, when we get more *M-1's* in the field in the next 3 or 4 years, and have a mature system out there, we are going to see maintainability and durability that is far better than it is today, and much better than the *M-60*."

How good is the Abrams? Now, we have the answer. It's the best.



Ground Mobility

by Lieutenant Colonel

The mobility design of armored vehicles can be likened to an art form. It is viewed from many perspectives and means different things to different people; it is a value judgement. The comparison of wheels versus tracks is also a value judgement, although some classify it as an emotional issue. The problem at hand is not to prove which is better but to determine *which, where,* and *why.*

The military interest in light armor vehicle mobility is three fold; acceptable negotiation of terrain to insure mission accomplishment, agile responsiveness to enhance survivability from enemy fire, and air transportability.

In order to understand mobility, let us look at two examples in nature. The rabbit is a four-footed animal that is very fast and agile because it can change directions almost effortlessly. It is at home in the bush and moves with ease, except for traversing 6-foot wide ditches or 2-foot deep streams. A 5-foot high chain link fence will bring the rabbit to a complete halt. The elephant, in turn, is 4-footed, not as fast, and certainly not as agile in its movement as the rabbit. The elephant is also at home in the bush, but his movement is slowed only briefly by 6-foot wide ditches and 2-foot deep streams. A 5-foot chain link fence is not much of an obstacle if the elephant's intent is to get to a watering hole.

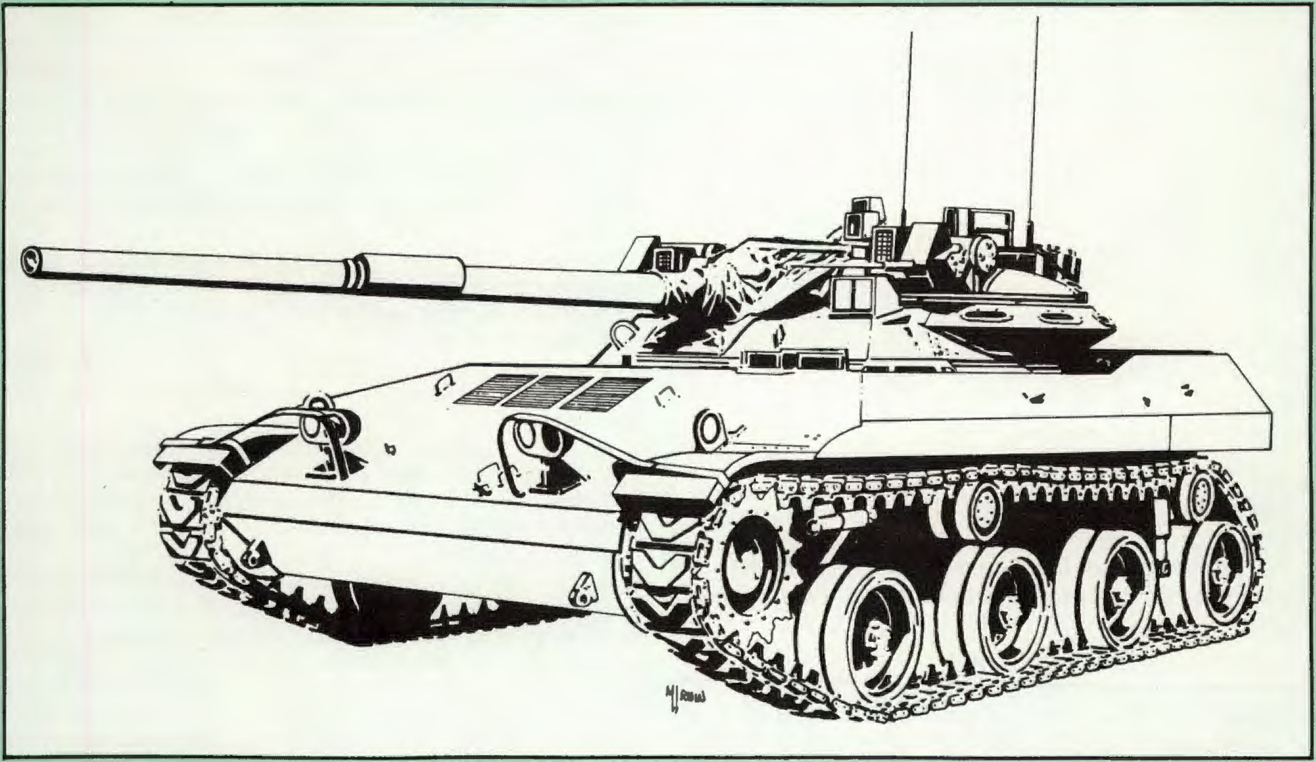
The foregoing analogy illustrates two methods of using mobility and agility. Both animals have different degrees of both. Now, if we use these examples to reflect what we are looking for in a mobility differential for armored vehicles, let's look at them again in view of survivability from a weapon. The rabbit is very small compared to the elephant and we know how responsive it can be in changing speed and direction. The problem for the rabbit is that it takes only a small-caliber rifle to bring him down. The problem for the hunter is that he should shoot at the rabit while it is stationary because when it is on the run, the chance of hitting this fast target is slim, especially if the first shot is a miss. On the other hand, the elephant is not that fast and has to throw his weight in the direction he wants to go. The elephant's problem is that he is big, and an excellent target. The hunter's problem is that he must have a large-caliber rifle and he cannot just hit the elephant anywhere to bring him down. Furthermore, elephants are more aggressive than rabbits, especially when being shot at.

Somewhere between the rabbit and elephant there is a fast, agile animal that can cross ditches and streams with ease, feint the hunter's shots, jump the fence, take a heavy slug or two, and still get to the hunter.

This mobility and agility, with staying power, is what we want in a light, armored vehicle; not a tank, as we know it, and not a scout car, but an armored combat maneuver vehicle with optimum mobility and protection.

Now, how do we get there from here? Does a light mobile chassis have to be tracked or can it be wheeled? How do we demonstrate which is best? It is not easy. There is no definite answer unless we know *what we want the vehicle to do, and where we want it to do it.*

Several Army studies have concluded that the wheeled combat vehicle is more cost effective than a track, based on aspects of design, procurement, maintenance, and training. This should not come as a surprise, since tracked vehicles cost more because they have unique suspensions and powertrains, while



in Perspective

(Ret.) Burton S. Boudinot

wheeled vehicles use more commercially-derived components.

Let's discuss tracked vehicle mobility first. Waterways Experiment Station (WES) tells us that tracked vehicles have a significantly better cross-country ride and shock performance than wheeled vehicles because of a distinct advantage for tracks in rough terrain. How does WES determine this? It uses an Army mobility model and other models to make predictions that are later validated by field tests.

There are important factors involved such as soil strength, weather conditions, horsepower-to-ton ratio, and crew tolerance to the ride. From a technical viewpoint, there are many more factors but the above are critical to the analysis.

A significant advantage of tracks over wheels is that a tracked vehicle can weigh considerably more, and carry a larger payload at a greater speed while negotiating soft soils. This single advantage is of great concern to the tactician.

Dr. M. G. Bekker, author of "Introduction to Terrain Vehicles," and other works on land mobility gives a simple example of the problem. Suppose a vehicle weighing 11,200 lbs requires a 75 percent probability of mission accomplishment in a given soft soil with simple slopes during wet conditions. Dr. Bekker's calculations tell us that the needed track-to-ground pressure for a tracked vehicle in this case is 16.3 psi, and for a wheeled vehicle the allowable load is 1,800 lbs per wheel.

This means that to meet the 75 percent probability of mission accomplishment, a tracked vehicle's ground contact must be at least 41 inches in length with a track width of 8.3 inches. At 1,800 lbs per wheel load the wheeled vehicle will have to have a 100-inch wheelbase with six 40-inch diameter wheels with 11-inch wide tread contact to ground (figure 1).

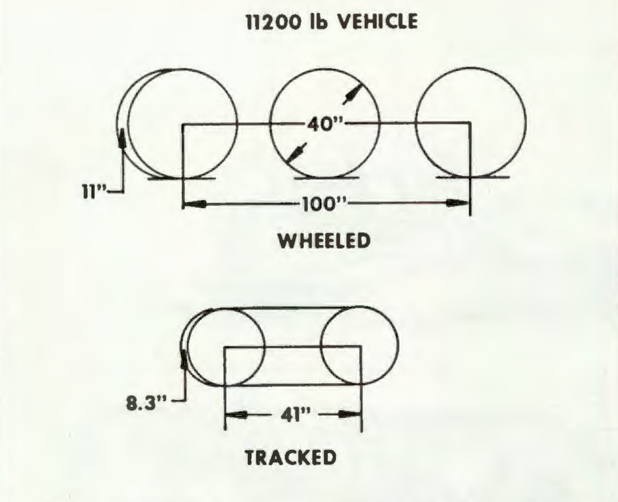
What is depicted is that a wheeled vehicle must generally be larger in volume to negotiate soft soil with the same probability of success as a track. However, there appears to be a practical limit to this arithmetic. WES data indicates that as a wheeled vehicle approaches 30,000 lbs, its mobility degrades rapidly in soft soil. It is a flotation and traction problem that tracks do not have at a lower or higher weight. It is obvious that increasing the horsepower-per-ton in the wheeled vehicle will not compensate for loss of traction.

Another significant constraint is the relatively low capability of wheeled vehicles in crossing linear features such as ditches, wadies, embankments, etc. They simply cannot negotiate these types of terrain features as well, or with the same speed as tracks. Articulated wheeled vehicles with roll, pitch, and yaw have been built and tested that improve on this constraint, but there are many engineering implications that have to be addressed before this can be considered a standard approach.

What has been determined thus far?

- Tracked vehicles have superior rough-terrain ride and shock performance over wheeled vehicles at almost any equal weight.
- Tracked vehicles have superior soft-soil traction. Wheeled vehicles have an upper weight limit on soft soils of about 30,000 lbs when the design envelopes are about the same for both wheels and tracks.
- Wheeled vehicles generally cannot negotiate linear features as well as those with tracks.

This just about does it for which is better — or does it? The real question is, "What do you want the vehicle to do?" The overriding issue is, "What is the mission profile?" Does the



75% PROBABILITY OF MISSION ACCOMPLISHMENT OVER SOFT SOIL WITH SLOPES DURING WET CONDITIONS

Figure 1.

user want the vehicle capable of operating 70 percent off road, 30 percent on road, 50-50 percent on and off road, or 30 percent cross-country, and 70 percent on road and trails. The user is the key, and he must understand the pros and cons of tracked and wheeled vehicle mobility.

We are talking about mobility verus the mission profile that can be explained by another analogy:

Your boss wants to move 50 tons of dirt 5 kilometers. You need a crawler equipped with a frontloader and a 5-ton dump truck. The frontloader can scoop 1 ton of wet dirt at a time and move it to the hardstand to fill the dump truck to its 5-ton limit. This seems to be efficient and cost effective, except you could probably use two or three dump trucks to complete the job sooner. More trucks are not available, and even worse, your boss says you can use only one vehicle for the job — the frontloader or the truck. With only a crawler with a frontloader, you will have to scoop the dirt in the bucket and drive the crawler 5 kilometers down the road to the hardstand, and then back for more dirt.

With only the dump truck, you will need additional men and take the time to shovel the dirt and fill the truckbed. It is obvious that the use of only one earthmoving vehicle is not very efficient and it is unrealistic timewise. But wait, what about a hybird, a wheeled scooploader that can lift 1,000 pounds of dirt over its cab and fill a 2½-ton bed mounted on the rear. It must be the solution. It is better than having only a crawler frontloader or a truck. The problem here is that the wheeled scooploader does not traverse the wet dirt easily with a payload; it cannot handle the volume of dirt the crawler can, it cannot carry the payload the dump truck can, and it must both load and move the dirt 5 kilometers. The hybird vehicle is not an ineffective compromise *per se*, but it is still time inefficient. The boss must understand that this is only one job. He may have to do many jobs to stay in business. For him, it is not a question of a dump truck versus the crawler with frontloader, a dump truck versus a wheeled frontloader, or an inefficient compromise. The job dictates the need for the different mobility potential of the efficient tracked crawler and the cost effective wheeled dump truck.

Having given a tracked vehicle a fair appraisal of its inherent mobility, do wheeled combat vehicles have any real mobility differential over tracks? Yes! Where? At the lower range of terrain roughness, and in dry conditions over meadows and desert, the wheeled vehicle is equal or superior to the track. When it comes to the hard-surface dash, long march, or patrolling on roads or trails, the wheel is superior. Worldwide the wheeled combat vehicle has demonstrated that it is a clear winner when the mission profile is 70 percent road and trails, and 30 percent cross-country. If the user does not envision such a mission profile, and the freedom to select the time and place for his cross-country travel, the choice of vehicles is obvious.

Dr. Bekker's following philosophy throws some light on the remedies for overcoming the present dilemma in the development of new wheeled and tracked vehicles.

- Mobility is not a technology dilemma. It is the users' lack of appreciation of modern day requirements to understand proper field data on the environmental versus the operational concepts.
- Technology can satisfy reasonable requirements for specified mission profiles. (It is surprising how many requests for proposals (RFP) ask for the impossible due to conflicting requirements). This necessitates lots of homework by the user when writing a RFP.
- The answer to the users needs for new ground vehicles is not in all probability a radical departure from what we already know about tracks or the wheel; but it is a track/wheel mobility system that helps accomplish the mission with the postulated probability of success with maximum effectiveness and minimum cost of the equipment mix. The user must abandon unworkable and unrealistic definitions of missions and environment and provide quantitative input compatible with engineering capabilities and modern technology.

In conclusion, WES data tells us that wheeled combat vehicles can perform as well or better than tracked vehicles if the mission profile is such that the vehicle can avoid rough terrain, linear features and soft soils. Dr. Bekker reflects that it is the users careful determination of the mission profile that will provide the proper end product.

Finally, the mobility differential between track and wheel must be seen in perspective. Mobility is a key factor, but only a factor. The consideration of operational and support cost, reliability and maintainability, and life-cycle cost, are very important aspects if availability and probability of mission accomplishment are critical. Only the user can determine what he needs, but this should be done with objective knowledge of the capabilities and limitations of both mobility systems in realistic scenarios.

BURTON S. BOUDINOT retired as a Lieutenant Colonel after 26 years in Armor. He held command positions up to squadron level and served on the Joint Staff in Vietnam. He spent several years in armor combat developments and several as Chief of Armor Testing at the Armor and Engineer Board, Fort Knox, KY. He ended his career as Editor-in-Chief of *ARMOR* Magazine. Once in the Army R&D Specialist program, he is currently working as a Consultant with the System Planning Corporation at Fort Knox.

Defense of the Reich — Two Battles

by Robert Smith

By late 1944, it was obvious that the ultimate defeat of Germany was only a few months away, yet the German Army continued its stubborn, almost fanatical resistance, especially on the Eastern Front—the result of a combination of German misadministration and native Russian cruelty well known to any of the men who fought against the Soviet advance.

The situation was made all the more desperate because large German casualties could only be partly replaced, and the strategic bombing offensive had managed, at last, to slow German war production and partially disrupt rail transport. Some of the replacements that were available had been diverted to the West, where the great Ardennes Offensive—the Battle of the Bulge—was being prepared. The net result was that the Germans had far too few men on the front to cover the lines, so the skeletonized divisions were simply brushed aside or cut off and annihilated by the Soviet advance. By this time, the normal German practice of leaving open flanks was becoming fatal. A few months before, this could be done in safety by counting on the rigidity of Soviet tactics to prevent their being turned. Now the Soviets adroitly exploited every opening to achieve victory.

The Battle of Budapest—Failure

In one area, the Danube Valley of the Balkans, a combination of fanatical resistance on the German side, and overstretched supply lines on the Soviet side, and adverse weather had held the Soviets just short of the Hungarian capitol of Budapest. The check to the Soviet advance was only temporary, and by the end of December, Soviet infantry and armor had managed to seal off several major units of the Hungarian and German Armies in the city. The most prominent of these divisions were the elite 13th *Panzer* Division, the *Feldherrnhalle Panzer* Division, and the *Florian Geyer* and *Maria Theresa Waffen-SS* Cavalry Divisions. Altogether, an estimated 100,000 men were trapped, and the Germans could ill afford the loss of all this trained manpower, especially at a time when 12 to 14-year-old *Hitlerjugend* were fighting Soviet *T-34s*.

Immediate efforts were put in hand to break through to these men and stage some sort of rescue. The *Totenkopf* and *Wiking SS-Panzer* Divisions, along with a scratch infantry force in support, attempted to relieve the city and opened their attack on New Year's Day, 1945. Initially, the attack did very well, and after 11 days of very hard fighting, the lead German units managed to reach the Budapest airport. Victory and rescue appeared to be in the Germans' grasp.

Unfortunately, two other factors intervened to make the German attack useless. The garrison of the city was being contained by the Soviets with heavy casualties on both sides, and could no longer break out of the entrapment on its own; while the terrain, already muddy and badly churned after nearly 2 weeks of combat, slowed the advance even more. Finally, the Germans suffered from poor decisions at middle command levels. When there appeared to be a chance that the *Totenkopf* could wipe out a number of Soviet infantry divisions, half the attack's striking power was siphoned off and diverted into a fruitless effort to gain some tactical advantage. As a result, *Wiking* and most of the supporting infantry were left to batter themselves bloody against a stubborn Soviet defense. Some penetrations were made into the city's outskirts, but as the Soviet supply lines caught up to their advanced units, these attacks were easily thrown back. Soon the rescue force had been forced back almost to their start lines—tacitly, the troops in Budapest were being abandoned to their fate.

By 23 February, the Budapest gar-

rison, having fought to almost the last man and last bullet, attempted to break out of the Soviet encirclement. Of the 100,000 men who had been cut off 7 weeks before, less than 800 managed to break through the almost impenetrable Soviet defense lines. The loss in manpower and material was staggering—an escape rate of less than 0.8 percent could hardly be tolerated for long.

Outside the trap, yet another effort was being mounted to drive the Soviets back, only this time, the goal was the oil fields around Lake Balaton, with relief of Budapest as, at best, a very remote goal. Weather, lack of tactical surprise, and severe manpower and equipment shortages all combined to cause yet another failure for the Germans. Adding extra weight to the tactical problems was a major Soviet defense effort that had constructed vast networks of trenches and other terrain reinforcements.

The Soviet commander wisely allowed the Germans to beat helplessly against the strong defenses, then, with admirable exploitation of the situation, launched a counteroffensive in very poor weather that forced the surviving Germans to scramble to extricate themselves from yet another pocket. Once more, the unlucky German Sixth Army was virtually eliminated by major flanking forces and infantry mop-up units.

As the Battle of Lake Balaton ended, there ceased to be any creditable German resistance between Budapest and the city of Vienna; even the SS Divisions that had been in the battle were making plans for their escape from the area, and when that happened, the end was near.

During the early hours of 7 April, Soviet Naval Infantry used captured river boats to storm the Danube bridges in the heart of Vienna, and prevented their demolition. The balance of the Soviet forces attacked under heavy artillery preparation and forced their way into the city that had sheltered Hitler and encouraged his mad dreams. On 13 April, the battle ended, and the premier divisions of the German *Wehrmacht, SS-Liebstrandarte, Das Reich, Wiking,* and *Totenkopf,* as well as their support units, plus numerous Army formations, had ceased to exist.

The Soviet Army resumed its advance on the day Vienna surrendered against scattered, ineffectual resistance, but it became very casualty conscious and suddenly slowed down. In fact, by 15 April, the Soviets had frozen in place, only a few miles from Graz. The reason was quite clear the next day when a tremendous artillery barrage tore through the early morning darkness, and hundreds of antiaircraft searchlights illuminated the battlefield near the *Seelowe* Heights; the Battle of Berlin had begun.

The Battle of Kustrin—Limited Success

In the closing days of March, one of the last real successes of the German *Panzer* force occurred and it was such an extraordinary battle that it deserves more attention than it has had. Yet, historically, it has been swallowed up in the events that occurred just a few days later.

A German force, traditionally unidentified, made up of a scratch force of about 2 weak infantry battalions, 27 to 37 *Panther* and about 28 *Tiger* tanks of various models, and some light artillery, was deployed on the west bank of the Oder River, on the main highway to Berlin. *(Although certain confirmation is lacking, my research has narrowed the identity of the unit to either the 20th or 25th Panzer Divisions. I believe that it was the 25th. R.C.S.)* The unit was guarding the approaches to the city of Kustrin, which controlled an intact river crossing. However, the Soviets had partially surrounded the city and forced a crossing in the face of considerable resistance. If the defending force could be eliminated, the capture of Kustrin and its bridge would be assured.

The Soviet force probably consisted of a tank corps, which was really a division-sized unit, but which had considerable artillery attached for the assault. At dawn, the artillery began to rake the German infantry positions near the town of Gorgast, and after considerable preparation, the Soviets moved in with tanks and supporting infantry. The artillery concentration, however, had failed to disrupt the German defenders who fought back viciously with machinegun and scattered light artillery fire. The Soviet infantry, riding on tanks, was forced to dismount, and in the muddy conditions, the infantry became permanently separated from the tanks. Nevertheless, the infantry assaulted the town.

In the meantime, the tanks, shorn of their infantry support, blundered into range of the *Panthers* and *Tigers* who could stand off and attack the *T-34/85s* with little danger of effective retaliation. Doggedly, the Soviet tanks struggled forward through the mud, until the German tanks rolled down on them to engage at close range (or the enemy tanks reached an effective range; the accounts differ).

In a swirling cauldron of fire, the German tanks and Soviet tanks slugged it out at close range, where the German long-range accuracy was nearly negated by the conditions. The superior German tank crew training showed its value almost immediately. The battle ended when the Soviets managed to disengage under cover of smoke shells, and the exhausted Germans let them go.

The success was short-lived, however. The infantry on the flank near Gorgast was finally overwhelmed. Meanwhile, the balance of the Soviet force, after regrouping, attacked again, and sealed

off the Kustrin birdgehead. In a matter of hours, the city and its vital crossing were captured, and, by the time the Soviet offensive got under way on 16 April, the Kustrin bridgehead was filled with thousands of Soviet troops, eager to get to Berlin. A few of them may have marveled at the wrecks of 50 to 70 *T-34/85s,* blown apart at close range by the German force, but there were so many more flooding in that the loss of a few tanks wouldn't have any effect on the campaign.

Here we can draw some conclusions. The battles in Hungary were foredoomed. They failed almost totally to take advantage of the qualitative superiority of the German forces. Instead, the troops were committed to a rescue attempt that should never have been necessary; to allow their units to be surrounded was suicidal on the part of the German division commander (in fact, the commander of the *Florian Geyer* killed himself). Far too many German units had been cut off and anhiliated to believe that there was the slightest chance that the situation at Budapest would be different. Further, the Germans committed themselves to an unimaginative series of frontal assaults against men who had mastered the technique of defense against the *Blitzkreig* at Kursk. The very basic sterility of German tactical and strategic thought is quite evident at this point, and is in sharp contrast to the briliant actions of even a few months before.

The contrast at the Kustrin bridgehead couldn't be more startling. The German commander had taken full advantage of the effectiveness of his tank guns at long range to blunt the enemy attack; then, when close-range battle was finally forced on him, the superior training of the crews took over to turn back the first enemy threat. The Germans were initially successful because the Soviets allowed their infantry and armor to become, and stay, separated, and because the Soviets did not have a truly distinct numerical superiority (roughly 2:1 or 3:1); further, the weather worked for the Germans. The battlefield was muddy and hard to traverse, and bogged down the Soviet tactical transport.

The lessons, then, should be clear. While overwhelming enemy superiority can crush even the best divisions, clever use of terrain and the force multipliers inherent in superior equipment and crews can break even determined enemy assaults.

Research into any historical event allows a certain number of errors and problems to creep into the effort. Part of the problem arises from "the fog of war," where both sides, and even units on the same side, don't see the battle or campaign as a whole. Confusion also arises when we start to "count rifles," because the number of men and amount of equipment is sensitive to the actual state of the unit concerned—a classic example is the German Infantry Division of the Second World War, since, depending on the year, the strength could range from 17,734 down to 10,000, according to the TO & E. The problem of faulty memories also arises; an interesting example is the autobiography of a British pilot recently published that swore, in all sincerity, that the Germans used 14,000 transports to attack Crete.

The worst problem, though, is deliberate falsification of history. Most Soviet historians (and I use the term loosely) subscribe to the socialist realism school of history, and, since the Soviet archives are closed, it is relatively easy for the Soviets to lie about facts. The official history of the Red Air Force alleges the "Air Eagles" managed to destroy over 3,500 Axis aircraft during the first 3 months of the war. That is a patent impossibility, since the Axis had around 3,000 aircraft available according to their records, and the number increased during the period. The Soviet author also, wisely, doesn't mention the tremendous number of Soviet aircraft destroyed.

The moral is that, just as you need a mine detector to go through a minefield, you need a lie detector to go through any Soviet history.

The result is that you tend to rely more and more exclusively on the German accounts of the Campaign in the East. This is equally fraught with problems, especially since it creates a one-sided view of history, and forces you to depend on people who have, at best, a vested interest in the creation of a myth of being overwhelmed by superior numbers alone.

Robert C. Smith

ROBERT C. SMITH is a graduate geologist living in Pennsauken, NJ, and has written numerous articles on military history, military science, civil defense, and nuclear warfare for a variety of defense-oriented publications.

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)


①


②


③


④


⑤


⑥

PROFESSIONAL THOUGHTS

Low Visibility Tactical Navigation

There are a variety of tactical problems related to military navigation that suggest the need of an expedient approach to battlefield movement.

First, military compasses simply are too awkward and inefficient for use in mechanized operations. In order to get a true magnetic azimuth, the "navigator" of an armored vehicle formation has to dismount and move away from his vehicle. This not only consumes precious time, but also requires frequent stops to check and correct azimuths; thereby slowing movement.

Another problem directly related to this type of navigation is found in an nuclear, biological, and chemical (NBC) environment. If the crews are sealed inside their vehicles, they will have low visibility and also be forced to move more slowly because terrain association will be particularly difficult.

Darkness presents an even greater problem.

A solution to these problems is available, however, for units that are equipped with armored vehicles that have stabilized armament and an *M-28A2* azimuth indicator. Since the azimuth indicator is not affected by the metal of the vehicle, it can be used in conjunction with the stabilization system to lock the gun tube on a particular azimuth, or heading, as an aid to navigation during low visibility. The technique for using these fire control devices for navigation follows.

First, a magnetic compass or terrain association is used to determine the azimuth on which the tank is facing. Next, the azimuth to the objective is established by determining where grid north is in relation to the hull front dead center, and rotating the gunners aid on the azimuth indicator so that zero is aligned on grid north. The turret is then rotated until the correct travel grid azimuth in mils is displayed on the azimuth indicator. Then the navigator estimates the distance to his objective or intermediate checkpoint and calculates the travel time based on the speed at which the vehicle or formation is to travel. The gunner then energizes the stabilization system and locks onto the objective azimuth, and the tank is oriented so that the main gun is pointing straight ahead over the front slope. During movement, the vehicle commander in the "navigator track" needs only to have the driver keep the gun tube forward and centered and the tank will travel on the prescribed heading. This system is generally reliable for about 5,000 meters due to stabilization drift, but checkpoints at 5,000-meter intervals will provide adequate compensation.

If one straight-line azimuth cannot be used, a series of offset azimuths and checkpoints can be used to reach a given point.

The navigational technique just described enables an armor formation to move over unfamiliar or open, featureless terrain without having to stop for corrections in headings. Moreover, direction changes can be made on the move, thus saving time and reducing the likelihood of detection.

The azimuth indicator-gun stabilization navigational method is tactically significant because it permits armored forces to converge quickly on any point, regardless of terrain-to-map association, to exploit an enemy weakness or counter an enemy penetration. This advantage in tactical movement during periods of poor visibility would be particularly important in a desert environment.

In reality this system is simply a mechanized form of orienteering in which a tank becomes a 52-ton field-expedient compass. This form of land navigation entails no extra cost other than training time and enables mechanized formations to move with speed and accuracy to critical points on the battlefield.

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Maintenance in Korea

Armor and mechanized units in Korea face the never-ending problem of personnel turbulence and little or no continuity. Therefore, maintenance and maintenance procedures must be a perpetual educational process for all new personnel. For the benefit of those who are about to begin a tour of duty in the "Land of the Morning Calm," I offer the following synopsis of my approach to maintenance while serving there as commander 1-72d Armor.

Upon arrival in the unit, mechanics (CMF 63) had received training only to the apprentice level. Therefore emphasis was placed on teaming new mechanics with experienced mechanics, along with weekly classes conducted for all mechanics by the battalion motor officer (BMO) and maintenance technician. Emphasis in these classes oriented on local problems, basic maintenance procedures, and use of appropriate technical manuals (TM).

With the additional assistance of the Maintenance Assistance Instruction Team (MAIT), and the Tank Automotive Command technical representatives, classes on maintenance troubleshooting, use of the operator's manual, and TM 38-750 were presented to officer and NCO classes, and in turn, to first line supervisors.

Maintenance facilities in Korea are quite antiquated and leave a great deal to be desired, particularly for those coming to Korea from CONUS posts that have modern facilities, including hardstand motor parks. A very important facet of good maintenance is the working environment in which day to day maintenance is performed. However, soldiers in Korea adapt themselves quite well, and surprisingly, very little complaining is done about the antiquated facilites.

One particular maintenance management system that was quite successful in the 2d Infantry Division was the "maintenance shootout." The system was implemented by the assistant division commander-support, (ADC-S) and was conducted monthly. In turn, the system was adapted at battalion level on a weekly basis. The "shootout" involved a meeting chaired by the battalion commander with all company commanders, the battalion executive officer, the battalion maintenance officer, (BMO), and the battalion communications officer present. All commanders presented their maintenance status and gave the battalion commander a completed DA Form 2406 of reportable and nonreportable items. Each commander addressed each of his nonoperational vehicles and the status of requisitioned parts or job order status if the item was in direct support (DS) maintenance. If there appeared to be a lag in requisitions, the BMO contacted the DS element and pursued the problem of the lag time. In addition to providing the battalion commander with a current status and requiring the company commanders to stay fully aware of their maintenance posture, the "shootout" also brought to light any other types of maintenance problems. Examples of these problems are maintenance management techniques, qualified maintenance personnel problems, need for publications. training weaknesses in the maintenance area, and the status of the prescribed load list of parts. If there appeared to be a need for controlled substitution within the battalion, the commander retained the authority to authorize substitution, and made his determination on the basis of information provided at these weekly sessions.

These "shootouts" provided the battalion commander and company commanders with a system for identifying problems regarding all equipment, ranging from tanks to radios, to metascopes, to binoculars.

Organizational and operator maintenance has always been the foundation for sound maintenance programs. And, so it was in 1-72d Armor, where a series of lessons encompassing preventive maintenance checks and services (PMCS) were taught two times per week to all echelons from the battalion commander down to the operator. The program emphasized training by the noncommissioned officers and featured an extensive check list of PMCS items that was based on appropriate tables in organizational and operator's maintenance manuals. The program soon paid dividends, especially during the Korean winter months, in improved starting procedures, reduced battery use, conservation of antifreeze, and fewer malfunctions of electrical systems.

Another key to any good maintenance program and combat readiness is a scheduled and well-performed service on all equipment requiring either an "S" or "Q"-type service. "Paper Services" do nothing but degrade the readiness posture. Whenever a "Q" service was scheduled in the 1-72d Armor, it was done by platoon, supported by the technical expertise of the battalion maintenance section's "Q" team. A week was devoted to completing the service. There was often a tendency to request a delay or rescheduling of services because of training requirements or mandatory classes. This was corrected by proper scheduling and long-range planning. This is where the S-3 played an important role. Quarterly training plans were prepared in advance in order to assure that company commanders could accomplish their required training and still have services performed.

It is quite easy to point the finger at other maintenance programs. Each commander has his own insights and ideas concerning maintenance and the techniques for achieving the combat-ready posture required to fight a war. The concepts and thoughts outlined above are those that were found to be productive and useful in achieving the standards required in an area where the threat is real and very close. Commanders must be objective, call it as it is: if there is a problem, find out the cause and correct it. Do not think that ignoring a problem will make it go away. Maintenance is your lifeline. Unless it is emphasized at all levels of the command, you will never get out the gate.

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The Executive Officer as Commander

After 14 months in command of a tank battalion headquarters company and tours on battalion staffs in jobs ranging from adjutant to operations officer, I am convinced that—in combat arms battalions—both command of the Headquarters and Headquarters Company (HHC) and responsibility for the coordination of the battalion staff should be consolidated under one man—the battalion executive officer (XO).

Under the current scheme, the responsibilities of the HHC commander and those of the battalion XO are frequently at odds with each other. The HHC commander's responsibilities include the training of his personnel, the administration of military justice, and controlling and accounting for military property—all areas only casually related to the principal concerns of the XO, whose responsibilities have to do more with the administrative elements of logistical support for the battalion, maintenance of the battalion vehicle fleet, and supervision of most of the battalion staff. Even in the area of maintenance, the XO's concerns are not always coincident with those of the HHC commander. In a tank battalion, for example, the XO is interested primarily in the maintenance of equipment of primary importance in readiness reporting, which currently includes only tanks. The temptation for him to be less concerned with other vehicle types, which make up the bulk of the headquarters company fleet, is great.

The most serious problem with the current structure, however, arises from the destruction of the concept of a clear chain of command. The HHC commander owns the enlisted personnel; the XO supervises and rates the officers. With only a few exceptions, the HHC commander's role in the supervisory chain is that of a powerful outsider. He does not supervise the day-to-day activities of most of his soldiers; he only enforces general military policies having to do with conduct, appearance, common-skills training, and internal company administration. He usually has little or no direct influence on the evaluations prepared on most of his noncommissioned officers. He has, as I used to tell my sergeants, no "flyswatter" to make a point. He cannot do only mild damage by making a minor comment on a soldier's efficiency report. He has only a "sledge hammer," exercised in the form of letters of reprimand and nonjudicial punishment—all of which can do major damage to a soldier's career.

The "Division 86" concept recognizes some of the weaknesses inherent in the present organization and proposes to cure them by making the headquarters company commander a major. That obviously will help the commander, because it will place him on an equal footing (at least in terms of rank) with the executive officer, and it will make him senior to most of the staff. It will not, however, address the more serious issue of a split between the functions of command and the responsibility for subordinate performance. The company commander will still be responsible for soldiers who work for officers not subordinate to him.

The Army's philosophy has generally been that echoed by Captains Bledsoe and Drebus in a recent issue of ***ARMOR:*** ". . . virtually all elements of the HHC are under the operational control of the various staff officers, and thus, the size of the company does not pose a span of control problem."[1] Unfortunately, that observation misses the point. Those officers do not work for the commander, and—even worse—as Lieutenant Colonel Griffin, in a recent issue of *Military Review* points out, "the assignment of subordinate responsibilities defines turf which a subordinate can avoid."[2] In an HHC, the truth of that maxim is too often realized with a vengeance.

The staff officer concerns himself with his specific staff functions, often to the exclusion and detriment of the leadership and individual responsibilities that he sees as the HHC commander's job. At the same time, the HHC commander often presses his leadership concerns to the detriment of the staff functions essential to the operation of the battlaion. The most tragic feature of this all but inevitable conflict is that the noncommissioned officer serves two masters with conflicting concerns, both of whom have the power to destroy or seriously damage his career. It need not be so.

By making the battalion XO the HHC commander as well, one officer would be made responsible for both the company-level concerns crucial to the operation of the company and for the larger battalion staff functions, and a clear chain of command would be established. Staff officers would become platoon or section leaders with real responsibility for all the soldier's activities—on and off duty. The battalion XO would remain responsible for all the logistical support activities in the battalion, but he would control both the staff supervisors and all their assets. His performance would still be measured in terms of how well he met battalion needs, but the conflict between company requirements and battalion needs would then be resolved by one man. Most importantly, the chain of command and the supervisory chain would be the same.

Effecting this change would require no additions of personnel to existing Tables of Organization and Equipment (TO&E). In fact, it would reduce by one the number of field grade officers required in the battalion by the new "Division 86" TO&E. The captain who currently serves as the HHC commander would become the XO of the HHC company (as is now proposed in the "Division 86" organization). It seems wise to suggest, however, that the lieutenant currently listed as the company XO be retained to manage the company's maintenance operation (the new TO&E eliminates him). Under most current TO&E's, the HHC vehicle fleet represents about 40 percent of the total battalion fleet (with most of these vehicle types unique to or highly concentrated in the HHC) while under "Division 86" the fleet comprises 60 percent of the battalion's vehicles. Retaining this lieutenant as a company maintenance officer would greatly enhance the company's ability to support the battalion.

Obviously, if this change is made, several of the field responsibilities traditionally invested in the HHC commander will have to be reassigned in order to free him to handle his new duties. Responsibility for the location and establishment of the battalion's tactical operations center (TOC), for example, will have to be given to someone else—perhaps to the S3 (air) or the battalion signal officer, while the S2 will probably have to take over all the security responsibilities (as he already does in many battalions). The greatest adjustment, however, is one in concept only.

The battalion XO is currently required (and generally used) as the battalion's second-in-command. As the conventional wisdom goes, he must stay fully conversant with developments on the battlefield, so that he can quickly assume command if the commander is lost. In practice, however, his support responsibilities are far too extensive for him to follow the battle as closely as he would need in order to be able to fill in quickly as commander. Consequently, the S3 becomes the real battlefield second-in-command, and—logically—ought to be the officer so recognized. The only change required, then, is one of concept. We need only force our thinking away from stereotypes.

Consolidating the jobs HHC commander and battalion XO in the hands of one man, and providing him with the organizational assets he will need, will simplify coordination of the battalion staff, ease unnecessary friction between the supporters and the supported, and establish a clear and comprehensive chain of both command and responsibility.

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Major, Armor
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Footnotes

[1] Captains Bill Bledsoe and John R. Drebus, "Combat Services Support for Division 86", ***ARMOR,*** January-February, 1981, p. 53.

[2] LTC Donald K. Griffin, "Proponency for War", *Military Review,* January, 1981, p. 38.

MOS Mismanagement

CPT A: Sergeant P, I've had the opportunity to watch you over the past 5 months, and I'm convinced that your knowledge of tanks, particularly of maintenance, gunnery, and tactics, is generally inadequate for what should be expected of your rank. I don't understand. You strike me as being intelligent and having fine potential.

SGT P: "Sir, tanks don't excite me too much anymore. Besides, I haven't worked in tanks for a couple of years.

CPT A: "How can that be? Your last assignment was to an armor battalion in the States.

SGT P: "Yes, sir. But I didn't work as a tanker. You see, sir, I type 35-40 words a minute and, as soon as they found that out, I went to the PAC. My last year, I was the battalion legal clerk, and I did such a good job, the commander gave me a letter of commendation for my work during the AGI."

CPT A: "When is the last time you were on a tank?

SGT P: "AIT, sir.

CPT A: "What?! But you just reenlisted for a bonus before you came to Germany. Why didn't you reenlist for another MOS? You were a first termer.

SGT P: "Well, sir, I needed the money.

CPT A: "I'm afraid I've got no choice but to give you a low EER because of your performance...

SGT P: "But, sir, if I get shot down on my EER, I may not get promoted later. I've got a good career going and I'm a good soldier!" (Excerpted from an EER counseling in a USAREUR tank company.)

Is this scene familiar? Perhaps. Even more likely, you know soldiers like Sergeant P *who should have* received poor EERs but did not. They have not worked in their Primary Military Occupational Specialty (MOS) for years and probably are not working in it now. They have been promoted right along, and they have scraped by or avoided their SQTs through the years. Who has allowed this to happen? You have; I have; we all have.

MOS mismanagement is bad for several reasons. First, the Army has spent a good sum of money training the individual. By working someone out of their MOS, we waste that money, and perhaps spend more, training him or her to do something else.

Second, MOS mismanagement can give higher headquarters a false picture of your unit's training and personnel readiness. Division AG personnel know where your personnel *should be used;* they do not know where your personnel *actually are used,* especially if you slot individuals on the UMR (Unit Manning Report) in authorized places, but employ them somewhere else.

Third, MOS mismanagement hurts your unit, and the Army, by literally untraining personnel. By training or working someone in a job other than their PMOS, we solve a short-range problem and create a long-term one. We have all experienced the chagrin and frustration of interviewing the long-awaited and sorely-needed "widget" mechanic, only to find he's been a supply clerk for the past 3 years and remembers little or nothing about "widgets".

Finally, MOS mismanagement does a serious disservice to the soldier. If he intends to stay and get ahead in the Army, he must be proficient in his PMOS. This means knowing his job, passing SQTs and, as they advance in rank, teaching others. An NCO who does not know his job endangers his chances for promotion and jeopardizes his continued career in the Army. He also loses the confidence and respect of those under him, and most importantly, he is downright dangerous in combat.

How serious is the problem? It varies from unit to unit, depending on the unit's priority of fill and the commander's interest. One thing is certain, while a unit may be affected somewhat by the fill of its high-density MOS slots, most problems are caused by the unit's lack of low-density MOSs. An armor battalion may suffer a bit if it only has 90 percent of its tankers, but it has a major problem if it only has 50 percent of its authorized supply specialists.

This situation is a driving force in MOS mismanagement, especially in combat arms battalions, and using someone in a job outside his/her MOS may become a necessary evil. The key is to prevent this from becoming mismanagement. Although there is no one best solution, I present the following ideas for your consideration:

Setting a quota: A friend and former adjutant told me that his old unit addressed the problem in this fashion. The battalion commander made it policy that at least 95 percent of the unit's soldiers would work in their proper MOS. Not all units may be able to measure their problem that precisely.

Management by exception: Commanders should look at exempting certain critical MOSs from doing anything but their proper job. The 3d Armored Division Commander recently decided that all tank commander slots would be filled by experienced 19E30s, unless none were available. This decision came about when the commander found far too many tanks being commanded by inexperienced sergeants or low-ranking specialists when he knew that staff sergeants were assigned to the division in sufficient quantities.

Rotation: No one should be allowed to work in a non-MOS related job for more than 1 year. Most personnel can and should be rotated back to an MOS-related job after 90 days. Although this may create turbulence, I believe that keeping people trained in their MOS is more important.

Reclassification: This solution cannot occur overnight, but should be considered for those medically or technically unable to perform in their PMOS. Beware of "hip-pocket" profiles and waivers. There are those nonprofessionals who have "secret" profiles that are used to win the holder an easy job, often outside his MOS. Likewise, commanders should be leery of approving waivers stating that an individual can work in his MOS despite a normally disqualifying profile. Many of these waiver cases return, asking that their waiver be invalidated because they have discovered that they cannot do the job. Commanders should not be afraid to recommend reclassification of those who are medically unfit, and should be very select in granting waivers. A man with bad knees, no matter how good his intentions and how strong his love for the infantry, will eventually not be able to do his best job and should be bluntly told so. Do not hesitate. You are doing him and the Army a favor.

Many commanders are slow to reclassify a soldier for inefficiency because it may involve a reduction in grade, thus ruining the career of an NCO with several years of service. It may seem easier to move the incompetent individual to another "less dangerous" job. However, the best interests of the Army should prevail. If you can honestly say you would not trust an NCO with your life, then you should consider reclassifying him. Additionally, soldiers should be advised that it is always their option to request voluntarily reclassification.

Awarding a secondary MOS: If you determine that you must use an individual in a job outside his MOS for any great length of time, you should consider awarding the soldier a secondary MOS. There are many MOSs that can be awarded after only 90 days of on-the-job training. It makes your unit more professional in its personnel management, and it benefits the Army in the long run.

First-term reenlistment: First-termers have a number of choices when it comes time for reenlistment. These include reenlisting for a speciality-producing school, thus changing their PMOS. Commanders and first sergeants should try to identify those good soldiers who are unhappy with their present MOS and encourage them to reenlist for an MOS more to their liking. This is an important point for commanders and reenlistment NCOs to remember while counseling first-term enlistees.

Training: All personnel, regardless of job, have the obligation to remain proficient in their PMOS. Therefore, we must ensure soldiers working outside their PMOS are given the time and opportunity to study the SQT tasks of their PMOS and train in them.

Communication: It is essential that your adjutant and PAC be in constant communication with the division AG. While you may be forced to work someone outside his PMOS in a critical job, this is only a temporary solution until the "right" person arrives. AG personnel must be updated on a regular basis so that they know what your unit's situation is and can try to find those "right" people.

MOS malutilization can not be eliminated completely, because we just will never have the correct person to fill every critical position. But the ideas above can help reduce and minimize an otherwise serious problem. Good personnel management includes a carefully monitored and well-thought-out plan of "malutilization," if necessary, and at the commander's discretion, to fill critical positions and accomplish the mission. "Stuffing" people into slots or making unnecessary unit-level diversions, regardless of MOS and experience, and without careful consideration, is simply mismanagement, which the Army and your soldiers cannot afford.

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Targeting Ranges to Simulate Threat Formations

In any future conflict, NATO crews of both tanks and anti-tank weapon systems will face masses of Warsaw Pact tanks. Outnumbered, Western soldiers will have to rely on superior technology, tactics, and training to defeat their Warsaw Pact opponents. Training must include a great deal of firing with live ammunition as was demonstrated by Israeli tank crew performance in the Yom Kippur War. Israeli tank crews, accustomed to firing live ammunition in practice battles, are supreme experts at juggling their repertoire of weapons.[1] Brigadier-General Avigdor Kahalami of the Israeli Defense Forces (IDF) confirmed the Israeli emphasis on gunnery training, stating, "The most important way to prepare your tankers for combat is to teach your gunners how to shoot."[2] A vital part of training on the firing range is targeting. Tank crews, whether firing from static positions, on a battle run, or as part of a fire and maneuver exercise, must be confronted with masses of targets displayed in accordance with Russian tactical drills.

The Soviet tank battalion or motor rifle battalion group advances in battalion column. At approximately 5,000 meters from known enemy positions, this battalion column breaks into company columns. Exactly how far away this deployment occurs may vary with terrain. About 3,000 meters from the suspected NATO position, the company columns will divide into platoon columns. About 1,000 meters away, the platoon columns deploy into line-abreast for the final assault. Ideally, our targeting should duplicate this deployment, utilizing a battalion's worth of moving targets (about 30). Present target technology would probably make such an ideal layout too expensive, as well as difficult to protect against damage. However, development of such a range of moving targets should be a NATO objective funded by all the member countries in proportion to their tank strengths. Targeting in conformity with Warsaw Pact tank drills *can not* await the development of better moving targets. Utilizing present targets, ranges can be laid out to challenge crews with the problems that they can expect in combat in Central Europe.

Hopefully, NATO soldiers will most likely be engaging from stationary fire positions. Therefore, static firing will duplicate the most probable combat situation if space is left for jockeying.[3] This is fortunate, because the danger template on any but the largest of ranges severely inhibits movement. For example, the danger template of the 120-mm service armor-piercing, discarding-sabot round of the *Chieftain* tank covers the area of a city of over half a million population and therefore must be restricted in use even on Suffield's 1,100 square miles of prairie. Targeting for static firing positions must start with those most likely to be seen first. At about 6,000 meters, single targets representing the head of battalion columns should be sited. These need not be popups, as rear echelon columns will be seen moving up even after the close-in battle has been joined. This is a good location for hard targets, if available, for then the more-difficult, longer-range gunnery will be rewarded with a solid indication that the target has been hit. Long-range targets provide ideal opportunities to practice procedures with sniping tanks, other arms support, or even close air support. The lead tank of a Soviet battalion column may well be a tactical commander of some importance, and thus, training to kill him may result in considerable tactical advantage in real war.[4] Targets in company column should be deployed at 4,000 meters. All the vehicles in each company as well as the battalion headquarters should be represented on the ground, preferably by popup targets. Fire control and target allocation will be added to the difficulties of engaging targets at this range. Special emphasis should be placed on hitting targets identified as company commanders whose vehicles usually lag back at the center of the formation. Killing Soviet company commanders pays dividends.[6] Targets should be popped after the time it would take a tracked vehicle to cover did some Israelis on the Golan Heights in 1973.

elapsed. This caters for the move forward from the first sighting, and might pose an interesting problem if a sniping weapon has been placed forward. Popup targets are a must for the simulation of platoon columns between 2,000 and 3,000 meters from the firing positions. Every vehicle in the Threat battalion must be represented in its appropriate location. These targets should also be popped, after the elapsed time required to move armored fighting vehicles (AFVs) from where the company column targets are located. Line-abreast targets should be popped about 1,000 meters from the firing position. Although in combat we do not expect this line to have 30 vehicles, that many targets should be placed at this range to pose the maximum difficulties of fire control and target priorities. Of course, many tanks or other weapons will probably still be completing engagements at longer ranges. After a properly calculated time interval, about 15 targets should be popped at 400 meters, representing enemy AFVs, not yet destroyed, that are closing with our position. Dismounted assaults can be represented by popup man-sized targets at close range. These targets should be sited at proper tactical distances apart, governed by the terrain of each particular range. Static firing positions should cater to jockeying and must be as natural as possible. Combined arms firing should be encouraged including the integration of fire from all antitank weapons with that of the tank guns.

If the physical limitations of the range prevent the placing of targets at further distances, then battalion and company columns should not be targeted unreasonably close. The sense of distance at which various hostile formations can be expected in that type of terrain and the time before the next formation is seen can only be absorbed if Soviet drills are duplicated, *not* modeled on a different scale. On ranges with limitations, it is better to concentrate on dealing with platoon columns and the line-abreast formation. After all, effectively dealing with these two Soviet tank formations will be a matter of survival in the real-life case. Similarly, if there is space for only a platoon on the firing point, the number of targets displayed can be cut down; although, someday, a platoon may face a battalion, as did some Israelis on the Golan Heights in 1973.

Tanks practicing firing on the move can utilize the target layout for firing at stationary targets. Presumably, the armor force will be used in a counterattack and would attack the Soviet assault in the flank. Therefore, while the same target pits could be used, the direction of fire would be different. This would raise the problem of three dimensional targets, particularly if it was intended for advanced practice to combine fire-on-the-move with the fire of antitank weapons firing from static positions.[7] Practice in dealing with a meeting engagement, with both sides moving, can also be conducted with the standard layout. In all these expanded-usage scenerios, much larger danger templates are involved. Fire and maneuver is with live ammunition much more difficult to target with the appropriate number of targets without stifling initiative of participating commanders by forcing them onto positions where they will *see the target layouts*. However, most engagements will be fought from static positions. All NATO countries have ranges where targets can be sited to duplicate Soviet tactical drills. The Warsaw Pact tank force vastly outnumbers that of NATO. If we are to beat this threat, we must train now to "take on" masses of tanks by properly targeting our antitank ranges.

F. R. THOMAS
Captain
Canadian Forces Europe

Footnotes

[1] Insight Team of the *Sunday Times, Insight on the Middle East War,* London, 1974, p. 146.

[2] In an interview quoted in the *Military Review* of Oct 1979, p. 9.

[3] The author believes that moving to an alternative fire position after each stationary shoot is an integral part of the gunnery drills, and thus, must be practiced each and every time the main armament is fired.

[4] Author, "Let's Attack the Weak Link," *British Army Review,* April 1981.

[5] Author, op cit; *BAR* article.

[7] Three dimensional targets are a suitable subject for an article in their own right. Ideally, a 3-D target should fall when hit either from the front or flank, while presenting a representative figure in all directions. There are mechanical or electrical improvisations possible with existing range target systems that readers can develop on their own. Developments, such as balloon shapes that expand to 3-D size when the target is popped, have also been suggested in studies.

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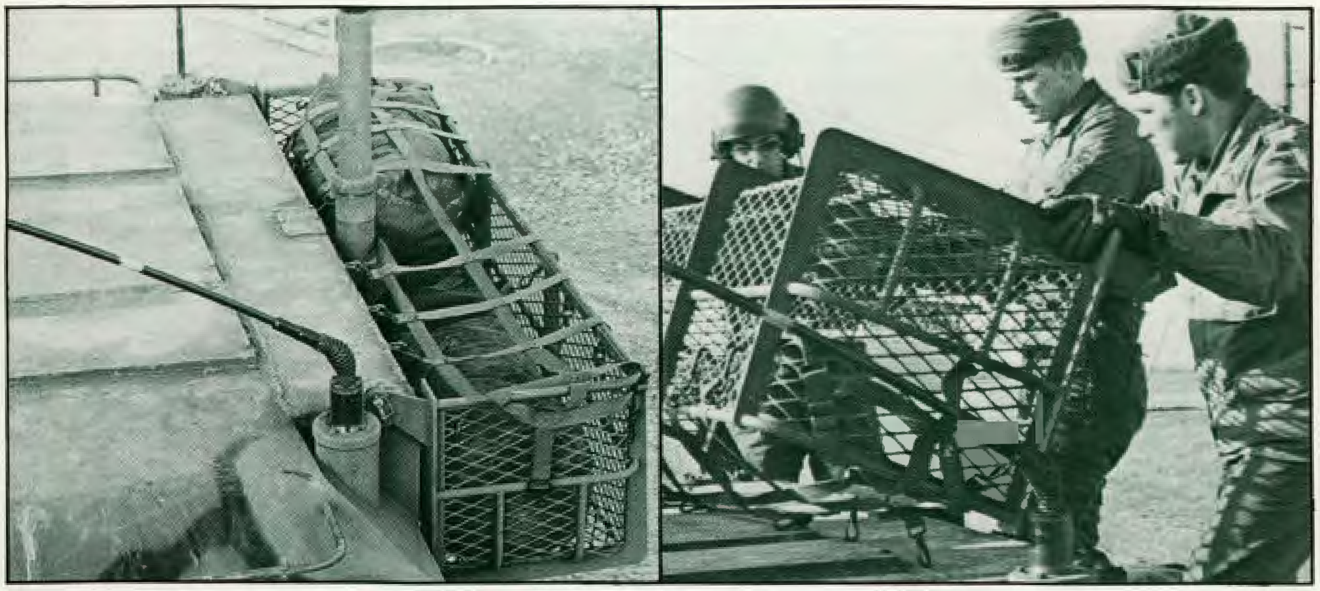


Bustle Rack for M-1

A bustle rack designed by 1st Lieutenant John Baker, Company H, 2-6th Cavalry, Fort Knox, KY may solve the problem of lack of stowage space on the *M-1 Abrams* tank for personal gear, rations, and other equipment that is essential for combat operations.

The problem of inadequate external storage space has been recognized since testing of the *M-1* began. A bustle rack was not added, however, because it was believed that the turret overhang plus a rack would cause problems during operation and in maintenance bays.

The latter concern is overcome in the Baker design by giving the rack a flip-up feature so that it can be tilted up to lie on top of the turret overhang. During operation, the Baker bustle rack can be dismounted if the situation requires it.

A prototype of the Baker bustle rack was fabricated by the U.S. Army Armor and Engineer Board and initial testing by Company H, 2-6th Cavalry indicates that the rack does not restrict the tanks maneuverability, even in wooded areas.

Chrysler Corporation has fabricated additional pivotal rear storage racks, based on the Baker design, for further testing.

Cooling System for Combat Vehicle Crewmen

A microclimate personnel liquid cooling system developed jointly by the Army's Mobility Equipment Research and Development Command and Natick Laboratories is being field tested at Fort Sill, OK.

The system transports cool liquid into a vest worn by the vehicle crewmen under his clothing. The vest provides relief from heat stress for the crewmen even when heavy protective overgarments are worn, such as those required for chemical and biological warfare conditions.

Each vest is connected to supply and return manifolds inside the vehicle with two relatively short, flexible insulated liquid lines. Quick connections are available at several stations within the crew compartment so that the soldier can connect and disconnect if he has to move around or exit the vehicle.

The system is designed to protect crewmen from heat exhaustion even when temperatures inside the vehicle reach as high as 140 degrees Fahrenheit. The system is also capable of circulating warm liquid to protect crewmen from cold temperatures.

The main advantages of the liquid system are its small size and low power requirements.

Soviet Antitank Weapons

The Soviet Army is fielding new antitank (AT) weapons. The *RPG-16* is replacing the *RPG-7* as the squad-level AT rocket launcher. Complementing the *RPG-16* is the *RPG-18*, a weapon similar to the U.S. *M-72* LAW. The *RPG-18* comes from the factory as an expendable combination launcher/carrying case. As a last-ditch AT weapon, the Soviets still issues the *RKG-3* series of hand-thrown grenades.

The penetration capabilities of the *RPG-16* and *18* are unknown, but since the *RPG-7* can penetrate 330-350 mm of armor, the *RPG-16* and *18* should be able to penetrate at least 350 mm of armor. The *RKG-3M* can penetrate 125 mm of armor.

Helicopter Air To Air Combat

An article titled "Helicopter Air to Air Combat Operations—The Concept," US Army Aviation Digest, October 1981 addresses the need to develop doctrine, equipment and training to counter the growing air threat. Comments and suggestions should be addressed to Chief, Concepts and Studies Division, Directorate of Combat Developments, US Army Aviation Center, Fort Rucker, AL 36362.

BOOKS

SHARPE'S EAGLE, by Bernard Cornwell. New York: Viking Press, 1981. $12.95.

Sharpe's Eagle is the first in a projected 10-book series. Within the cycle, the reader will follow the progress of Richard Sharpe from the battle of Talavera in 1809 to Waterloo, 6 years later. The central character is a former enlisted man who has become an officer in the British 95th (Rifles) Regiment. There is much to recommend the book, although it is not an unflawed work. First, let's look at the novel's strongpoints.

Cornwell has done a substantial amount of research. The book is filled with the details that help to realistically anchor events and characters in place and time, including minutiae regarding uniforms, weapons and administrative matters. The author has a good feel for the tactics of the period and describes them quite well.

On the negative side, characters, motives, and issues are oversimplified. You will learn a great deal of the hero and his background, but he is the only character to escape a two-dimensional portrayal. The tendency to oversimplify extends to the historical situation.

The cast of characters contains few, if any, surprises: the chivalrous enemy officer, the loyal and fearless NCO, the incompetent old fool, the swaggering bully, a romantic interest, and even the Duke of Wellington to occasionally intervene in the hero's fortunes. Inevitably, bullies and incompetents get their punishment, and virtue is rewarded.

Cornwell is a good writer and although you will soon guess just how everything will turn out, his lively style will hold you to the end of the book. As an historical account, I have some doubts, but, as good writing and entertaining reading, *Sharpe's Eagle* is highly recommended.

ROBERT STACY
Marlborough, MA

THE WAR BETWEEN THE GENERALS, by David Irving. The Congdon and Lattes Inc., Empire State Building, New York. 1981. $17.95.

One of the most remarkable stories about World War II is startlingly revealed in Irving's *The War Between the Generals*. This book is an unprecedented literary work that deals pointedly with the "small wars" that were fought among the mightiest military chiefs in the world at the time—the Allied generals. Mr. Irving's book is an in-depth exclusive on those "small wars."

The War Between the Generals is overpowering in its uninhibited revelations about the true personalities of men whose decisions determined the lives of thousands of soldiers. Spanning the period from 1943, during the tumultous birth of Operation Overlord, to 1945, the book provides stunning disclosures about the legends of our time: Dwight Eisenhower, Bernard Montgomery, George S. Patton, and Charles de Gaulle. These mighty warlords and others were formidable allies in the eyes of the unsuspecting world. However, beneath their professional relationships lay tremendous antagonism, which caused much bickering among their ranks for power and prestige. As a result, one could only wonder throughout the book as to the real enemy of the Allies—the Germans or the generals themselves!

The War Between the Generals is a must for the military reader. It clearly demonstrates how the personalities of great military leaders and their grudges can tragically affect the course of an entire war and waste the lives of men on the battlefield.

DAVID N. HERNANDEZ
Captain, Armor
New Orleans, LA

THE CROSSING OF THE SUEZ, by LTG Saad El Shazly. American Mideast Research. San Francisco, CA, 1980. 333 pages. $14.00.

The Crossing of the Suez is a rather unique book, not because of its literary style (the prose is, in fact, rather mundane), or its subject matter, but because it provides a critical insider's account of the planning and execution of the Egyptian Army's momentous crossing of the Suez Canal on October 6, 1973.

Of particular interest is Shazly's account of General Arik Sharon's keenly successful penetration of Egyptian lines. As the reader may recall, Sharon's armored penetration led to the isolation of the Egyptian Third Army and thus provided Israel with a strong bargaining card in the disengagement negotiations, held at Kilometer 101 following the war.

Reading Shazly's account, it is easy to infer that the national leadership was concerned lest the political significance of having Egyptian soldiers east of the Suez be lost. Thus, Sadat and others were extremely reluctant to redeploy any forces that had crossed the canal, even if this reluctance denied the ground commanders the wherewithal to counter Sharon.

The Crossing of the Suez should interest military readers, whether their interest is the 1973 war or the decisions that led to it. The text is nicely complemented by maps and figures, and the book is indexed.

AUGUSTUS R. NORTON
Major, USA
U.S. Military Observer Group (Lebanon)

Although the vehicles presented in this Recognition Quiz were manufactured in other countries, all are also in service with the North Korean Army.

1. **BTR-152** — Introduced in 1949, this armored personnel carrier (APC) weighs 8.9 tons and carries 16 passengers in addition to the driver and commander. Armament is a 12.7-mm or a 7.62-mm machinegun. On a hard surface it operates at 65 kmph with a range of 650 km.

2. **K-63** — Introduced in the 1960's, this APC has a four-man crew consisting of a commander, gunner, loader, and driver. It can carry 10 fully equipped infantrymen, and mounts one 12.7-mm machinegun.

3. **PT-76** — Introduced in 1952, this light tank has a three-man crew consisting of a commander/gunner, loader, and driver. Its armament is a 76-mm main gun and a 7.62-mm coaxial machinegun. This vehicle has a road range of 250-km with speeds up to 44 kmph on land and 11 kmph in water.

4. **T-34/85** — This tank has a five-man crew and is armed with an 85-mm main gun, a 7.62-mm coaxial machinegun, and 7.62-mm blow gun. Road range of this tank is 300 km at 55 kmph. Although introduced in 1943 it still is in limited service in many countries.

5. **T-55** — Introduced in 1949 as the T-54, this tank is in service today. It has a four-man crew and mounts a 100-mm main gun, 12.7-mm anti-aircraft machinegun, and a 7.62-mm coaxial machinegun. Main gun ammunition consists of APHE, HEAT and APFSDS.

6. **T-62** — The T-62 was introduced in 1961 in Soviet forces. This tank like the T-54/55 has a four-man crew but is longer and wider and has a 115-mm main gun. Other armament consists of a 12.7-mm anti-aircraft machinegun and a 7.62-mm coaxial machinegun. Ammunition for the main gun includes HE-FRAG, HEAT and APFSDS.

This quiz was prepared by Captain David M. Phipps, Threat Office, Directorate of Combat Developments, USAARMC.

STEEL ON TARGET

Hardly noticed in the rush hour traffic, they congregate at the bus stops in Arlington, carpool down Dixie Highway, or carry their lunchboxes through the plant gates in Warren, Lima, or Anniston. Though little noticed, the impact of this silent majority of the Armor Force is enormous. They are the civilian component of Armor.

Working in the public and private sector, thousands of men and women go to work everyday to ensure that the soldiers of the Armor Force are fully trained, maintained and sustained in order for them to deliver the goods where it's needed—on target.

Many work with their hands. For some, "Forging the Thunderbolt" literally describes their labor. Others toil on the assembly lines, eat dust on the test tracks, drip sweat in the rebuild shops, or move about the stacks in the parts warehouses.

Others work with their minds. They are found in the fluorescent lit cubicles of the Pentagon, in the design departments of private industry, or at computer terminals world-wide.

Their forebearers, the countless men and women who have supported cavalry and armor through the years, have left a rich legacy on which to build. Blacksmiths, gunsmiths, muleskinners, and merchants supported the cavalry. As the tank replaced the horse, the program which was to make American business a partner in the design and construction of armored fighting vehicles made names like Overland, Studebaker, and Ford familiar to the soldiers of Armor.

Today, from motor pool to typing pool, the civilian men and women of Armor play their part. Many have never touched a tank nor heard the beating roar of an attack helicopter. Most will never know the sights, sounds, tastes, and smells of battle—simulated or real. They are denied the thrills of victory and the agonies of defeat. Yet, the part they play is crucial to Armor's success, for without their contribution, the deterrent power of our Force would ring hollow in peacetime and victory would be doubtful in wartime.

But, given their sacrifices and dedication, the timbre of deterrence is loud and clear in peace, and victory will not be in doubt should the Armor Force be tested in war. The civilian sector will provide the support necessary for the soldiers of the Armor Force to fight, survive and win.

ARMOR salutes the men and women of the civilian side of the Armor Force. White collar or blue, you have not let us down. We thank you for your help and should the day come when battle is joined, we will not let you down.

Good shooting!

5th Cavalry

(Black Knights)

Lineage and Honors

Constituted 3 March 1855 in the Regular Army as 2d Cavalry. Organized 28 May 1855 at Louisville, Kentucky. Redesignated 3 August 1861 as 5th Cavalry. Assigned to 15th Cavalry Division December 1917—May 1918. Assigned 18 December 1922 to 1st Cavalry Division.

Dismounted 28 February 1943 and reorganized 4 December 1943 partly under cavalry and partly under infantry tables of organization and equipment. Reorganized wholly as infantry 20 July 1945 but retained cavalry designations. Reorganized 25 March 1949 with troops redesignated as companies. Relieved 15 October 1957 from assignment to 1st Cavalry Division.

Reorganized 15 November 1957 as a parent regiment under the Combat Arms Regimental System.

Campaign Participation Credit

Indian Wars
- Comanches
- Apaches
- Little Big Horn
- Nez Perces
- Bannocks
- Cheyennes
- Utes
- Texas 1856
- Texas 1860
- Oklahoma 1858
- Oklahoma 1859
- Arizona 1872
- Arizona 1874

Civil War
- Bull Run
- Peninsula
- Antietam
- Fredericksburg
- Chancellorsville
- Gettysburg
- Wilderness
- Spotsylvania
- Cold Harbor
- Petersburg
- Shenandoah
- Appomattox
- Virginia 1861
- Virginia 1862
- Virginia 1863
- Virginia 1864
- Maryland 1863

Philippine Insurrection
- Streamer without inscription

Mexican Expedition
- Mexico 1916-1917

World War II
- New Guinea
- Bismarck Archipelago (with arrowhead)
- Leyte (with arrowhead)
- Luzon

Korean War
- UN defensive
- UN offensive
- CCF intervention
- First UN counteroffensive
- CCF spring offensive
- UN summer-fall offensive
- Second Korean winter
- Third Korean winter

Vietnam
- Tet 69/Counteroffensive
- Summer-Fall 1969
- Winter-Spring 1970
- Sanctuary Counteroffensive
- Counteroffensive, Phase VII
- Consolidation I
- Consolidation II
- Cease-Fire
- Defense
- Counteroffensive
- Counteroffensive, Phase II
- Counteroffensive, Phase III
- Tet Counteroffensive
- Counteroffensive, Phase IV
- Counteroffensive, Phase V
- Counteroffensive, Phase VI

Decorations

Presidential Unit Citation (Army), Streamer embroidered *Los Negros Island* (5th Cavalry cited; DA GO 16, 1949)

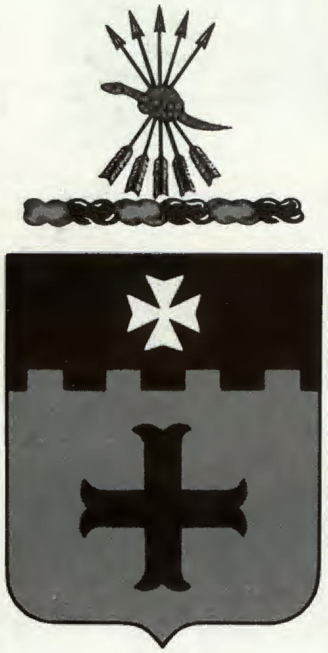
Presidential Unit Citation (Army), Streamer embroidered *Pleiku Province* (1st and 2d Battalions, 5th Cavalry, cited; DA GO 40, 1967)

Philippine Presidential Unit Citation, Streamer embroidered *17 October 1944 to 4 July 1945* (5th Cavalry cited; DA GO 47, 1950)

Republic of Korea Presidential Unit Citation, Streamer embroidered *Waegwan-Taegu* (5th Cavalry cited; DA GO 35, 1951)

Republic of Korea Presidential Unit Citation, Streamer embroidered *Korea* (5th Cavalry cited; DA GO 24, 1954)

Chryssoun Aristion Andrias (Bravery Gold Medal of Greece), Streamer embroidered *Korea* (5th Cavalry cited; DA GO 2, 1956)



Symbolism

The shield is yellow for cavalry. The cross moline symbolizes the charge of the regiment on Longstreet's troops at Gaines Mill in 1862, a charge that saved the Union artillery and that is characterized by the regimental historian as "its most distinguished service." The cross moline represents the iron pieces of a millstone (*moulin*, the French word for mill). The black chief of the shield with the maltese cross is for the Puerto Rican Expedition of 1898. (It symbolizes the original name of the island, San Juan, named for the old knights of St. John who wore a white maltese cross on a black habit.) The partition line is embattled to suggest the castle on the Spanish arms. The crest is for the Indian campaigns. The number of arrows corresponds to the numerical designation of the regiment.

Distinctive Insignia

The distinctive insignia is the shield, crest, and motto of the coat of arms.

ARMOR

The Magazine of Mobile Warfare

March-April 1982

United States Army Armor School

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January-February 1982 Vol XCI, No. 1

FEATURES

DEPARTMENTS

COVER

Armor aviation leads the attack! Armed with multiple weapons, the Cobra is an effective tank killer. On page 26, Captain Trant discusses the new facets of the Army's most mobile of all attack forces.

Letters

Letters to the editor are as welcome as payday. But, ARMOR has been reduced from 64 to 56 pages. So, if our many correspondents keep letters short, succinct, and lively, our editing job will be easier and will insure that maximum space is devoted to major articles and features. Ed.

Bastogne Remembered

Dear Sir:

Your superb article by Doctor (Professor) A. Harding Ganz in the November-December 1981 *ARMOR* pays a great tribute to those of the 4th Armored Division who struggled to reach the defenders of Bastogne in 1944.

The "Breakthrough to Bastogne" was made at a considerable cost in men and machines, yet the redirection of the attack, after a 160-mile march from the Sarre, was carried out with the same tenacious enthusiasm so typical of 4th Armored Division troops.

'Tis little wonder that General Patton favored them with much praise and that in the end—they were the only entire U.S. Armored Division to be awarded the Presidential Unit Citation and the French *Fourragere*.

Please give appropriate credit to Corporal John Yorenchuk, gunner of the B/37 Tank Battalion command tank "Blockbuster" for KO-ing the captured *Sherman* at Flatzboor-Bigonville railroad station.

Thank you, ARMOR and Doctor Ganz, for this high tribute to superb American soldiers.

JAMES H. LEACH
Colonel, USA (Ret)
Arlington, VA

Merkava Update

Another innovation, added to the *Merkava* after an extensive analysis of experiences gathered during the 1973 War, is the tank commander (TC)/driver guidance system. It was found that during a high intensity battle, the tank commander was too busy fighting his tank to devote time to orally direct the driver in placement of the tank. The guidance system is activated by the tank commander applying hard pressure on a pistol grip in the TC's hatch. This activates a directional arrow on a video screen in the driver's compartment. The commander merely has to move the handle in the direction he wants the driver to move the tank and the driver follows the arrow. At the same time, an audio recording is activated and sends directions to the driver's helmet corresponding to the direction the arrow is pointing. The driver continues to follow the arrow and the recorded instructions until the commander releases the pistol grip, which deactivates the guidance system. This action can be accomplished simultaneously as the commander and the gunner continue to fight the tank.

Again, an excellent article by Second Lieutenant Urban.

EDWIN L. KENNEDY. JR.
Captain, Infantry
Ft. Benning, GA

WAYNE J. SABO
Captain, Infantry
Ft. Benning, GA

Use Vietnam Experience

Dear Sir:

First, congratulations on the continuing excellence of *ARMOR* magazine.

Next, I would like to second Major Fairchild's opinion as expressed in his letter that 10 or so hours be devoted to armor and cavalry operations in Vietnam.

General Starry's *Mounted Combat in Vietnam* would indeed make a fine point of departure for such a study.

That, plus the numerous *ARMOR* articles over the past decade dealing with armor and cavalry operations in Vietnam and other relevant extant material, would represent a reasonable curricula...with a seasoning of first-hand report seminars.

Having spent time in combat with Company B, 1-69th Armor before, during, and after, the Tet offensive in 1968, I can assure you there were an abundance of well-executed missions, unique lessons to be learned, combined arms operations in varying terrain, and dedication and heroism.

As Major Fairchild noted, it would be unenlightened for the Army to ignore those sacrifices, lessons, knowledge, and expertise of Vietnam War tankers and cavalrymen.

JOHN B. DWYER
Dayton, OH

Seeks Information for Book

Dear Sir:

I would like to hear from anyone, of any rank or branch of service, who was or thought he was going to be in the World War II invasion of Japan. I'm looking for pictures, diaries, letters, or reminiscences. I promise to return everything sent to me. My book is being written under contract with Random House/Ballantine.

GEORGE MCMILLAN
Coffin Point
Frogmore, SC 29920

Fooling Soviet Reconnaissance

Dear Sir:

I have noted over the past years the Army's reinterest in camouflage. This is a step in the right direction, but is only one step that needs to be taken if the Army is to successfully defend Central Europe.

The Soviet intelligence agencies must know our troop and equipment strengths and roughly where we plan to deploy them. Blessed with this knowledge, Soviet forces will not be blindly attacking an unknown force.

Employing sophisticated, but standard, reconnaissance equipment, the Soviets would search the areas of preplanned U.S. troop concentrations until they locate the battalion and company positions. The armored fighting vehicles (AFV) will surely be the easiest to detect due to their heat, magnetic, and POL radiation signatures. The foreordained results are that it is going to be virtually impossible to draw Soviet forces into a killing ground. Instead, concealed U.S. forces will find themselves at the receiving end of fire from Soviet standoff weapons.

If U.S. armor is to avoid this scenario, two further camouflage steps need to be taken. The first is to reduce the machine readable signature of the AFV's and, secondly, provide an alternate target for the Soviet reconnaissance equipment to lock on. The concealment of the AFV at its battle position is only part of the problem, for if the Soviets know AFVs are in an area they will search until they find them. The solution is thus to conceal the real fighting position and provide a realistic simulated fighting position on which the Soviets can waste their standoff fire power.

Due to the sophistication of today's reconnaissance gear, the simulated position will have to be more than the WWII rubber tank or wooden gun, though even these are better than nothing for they can deceive the eye. To be truly effective, however, these alternative targets will also have to provide those signatures measurable by today's reconnaissance gear.

One must remember that the eye may have trouble finding the needle in the haystack, but there are a number of machines on the market that can detect the needle. The only way to defeat the machine is to salt the haystack with a variety of alternate targets, rendering the detection of the real needle harder.

CHARLES H. BOGART
Office of the Adjutant General
Frankfort, KY

Initiative-Key to Success

Dear Sir:

My thanks to *ARMOR* and A. Harding Ganz for the historical lesson, *Break-*

through to Bastogne. As a junior officer caught in the high-technology explosion, I found this article addressing a critical area I fear we may tend to overlook amidst microwaves and miniaturization. That area being the development of initiative and decision making on the part of the junior leaders. In the next war, on the high-intensity battlefield, it will be the junior leader, commissioned or noncommissioned, who will determine the outcome of the battle.

Lieutenant Colonel Abram's simple and direct approach to issuing orders, as typified in the relief operation at Bastogne, allowed his subordinate leaders to apply their initiative in maneuver and the application of firepower. Lieutenant Colonel Abrams gave them a well defined mission objective and avoided hampering them with unnecessary control measures. This same direct, simplistic, approach may be the missing link in our tactical training today.

Don't over-control! Give the platoon or section leader a loose rein in maneuver training. Let him go! The lessons learned through this approach by error and success alike will have a long-lasting effect. Who but the junior leader has a better knowledge of the strengths and limitations of his men and equipment? Allow him to employ his own thoughts. Remember, training is free in terms of the casualty report. Use this time to develop the entire chain of command to the lowest level. Initiative is one thing the Threat lacks, but we shouldn't.

In the next battle, when the chain of command is violently altered from the outset, the junior leader is the soldier who will either stand in bewilderment, or, through experience and initiative, take charge and win that battle.

OWEN T. EDWARDS, III
First Lieutenant, Armor
A Co 2/77 Armor

Know Your Enemy

Dear Sir:

I just received the November-December 1981 issue and what more can one say than, "another excellent issue."

While at Battelle Laboratories, I had the opportunity to review *ARMOR* magazine from as far back as 1962, and I think it is safe to say that the magazine has come a long way since then.

When I was a second lieutenant assigned to the Permissive Action Link Detachment and had the opportunity to travel all over NATO, I was sadly disappointed that not many units seemed to know much about Soviet equipment or that of our allies. The most notable exception was the Armored Cavalry units on the border.

In recent years, *ARMOR* magazine has done a wonderful job of keeping armor officers informed on both Soviet and NATO tank development. The current color cross section of the T-72 is but another excellent example.

Dr. Volz' letter is an excellent dissertation on the problems the intelligence community faces in making assessments of Soviet tank developments. It is nice, however, to be able to sit comfortably with a large library and volumes of reports and plenty of time to make observations and judgements, but it is still something else for a tank commander under fire to make an accurate report, and for the battalion S2 to process it, etc, and for the S3 to make plans, and the commander to make decisions.

I believe that the National Training Center will help improve matters greatly, but Regional Centers, perhaps using Reserve Component personnel with a limited amount of foreign material, would be ideal.

WILLIAM L. HOWARD
Major, Armor
Spring Lake Heights, NJ

Leaders Should Lead

Dear Sir:

As a practicing tank company commander, I read with interest Captain Snedden's article "Equipment Changes for the Tank Company," in the September-October'81 issue of *ARMOR*. Several points are raised that should be carefully considered before any actual changes of this type are approved.

The author correctly points out that the company commander's tank offers limited communication capabilities. I fully agree and believe that one of the most poorly conceived items of equipment on the vehicle is the *AN/VRC-12* series radio. Any leader who has simultaneously attempted to communicate with his squadron or battalion commander and pass orders knows the frustrations that this equipment can cause. We solved this problem in my company by changing the radio configuration to two AN/VRC-46 radio sets. I usually use hand mikes, and the setup allows me to turn one radio over to my gunner or loader to pass orders or take reports. Backed up by a good executive officer operating out of my *M-577* command post vehicles, I have few problems in getting the word to those with whom I must communicate. Furthermore, in the potential electronic warfare environment we must face, the actual method of communications may revert to the commander riding forward to his platoon leader's vehicle and telling him, by voice or visual signal, to "Go there and defend." I submit that only the main battle tank is capable of transporting the commander under this hostile communications environment.

A second issue raised by Captain Snedden is that the commander is primarily a leader and a manager, not a fighter, and argues that the tank company commander should command his company from an M2 or M3 armored fighting vehicle. A unit commander directing his unit from a vehicle significantly different from those he is commanding would be quickly noticed on the battlefield. Furthermore, he needs the same mobility and protection as the remainder of his command. An M113 or M2 is not, and never will be, a tank.

A third issue that needs to be discussed is the leader/fighter versus manager/director controversy. A commander can sit back and manage or direct a battle as long as it is going well. But when the momentum slows, or the defensive situation is critical, the commander—especially the tank company commander—must be prepared to move himself to the decisive point on the battlefield and dynamically interject all of his experience, knowledge, and energy into the conflict at hand. He must do everything in his power, including target engagements, to insure a successful resolution of the conflict. This action is best performed in the main battle tank.

German and Russian experiences are that commanders, especially company and battalion commanders, lead from the saddle and are prepared to fight their vehicles simultaneously while commanding the unit. During the Syrian onslaught toward the Golan Heights in 1973, Israeli company, battalion, and brigade commanders, were involved in fighting their vehicles while commanding. The appearance of a commander on the scene was often sufficient to stabilize the combat situation. Ask an Israeli armor officer which vehicle he prefers—it will be a tank.

According to our current doctrine, company commanders fight the battle. Tank company commanders should fight the battle—either by directing the actions of their subordinates or, when required, by personally leading the command in the fight. I do not believe we need to take the tank company commander off his tank and, that to do so would be a grave mistake, and an indication of a "laid back" unresponsive officer corps. We are leaders!

STEPHEN A. BOURQUE
Captain, Armor
D Company, 1/2 Armd Cav Regt

The Forgotten Men

Dear Sir:

After reading Major Skipper and Major Kerr's article "The Reserve Component Armor Force, " (ARMOR, Nov-Dec '81, p. 40), I came away with the feeling that the higher headquarters doesn't really understand who makes up the Total Armor Force. The first paragraph of the article states that the reader will be provided with "a brief overview of the Total Armor Force." A glance at the second paragraph and figure 1 (US Map) confirms one's worst fears—higher headquarters does not know where all the troops, battalions and squadrons of armor are located.

Now, to quickly put the problem in perspective, it should be noted that *separate* tank battalions and armor cavalry regiments (ACR) of the Reserve Components (RC) were correctly identified by the authors. However, if they are going to present the Total Armor Force they should have included those separate cavalry troops, the tank battalions and cavalry squadrons of RC mechanized infantry brigades and divisions.

These armor crewmen are just as typical, train just as hard, and represent the Total Armor Force as do their counterparts in the separate tank battalions, ACRs and armored divisions. To ignore them in an article on the Total Armor Force is an injustice to those hard working tankers and scouts, and leaves the reader short on information about the Total Armor Force.

An example of the magnitude of the shortfall can be provided by a look at Army Readiness and Mobilization Region (ARMR) IX in which I am an Armor advisor, which deals with RC armor and mechanized infantry in Washington, Oregon, California, Nevada, and Arizona. The article presents the Total Armor Force in this five state area as two tank battalions. On closer examination however, we find the 81st Mechanized Infantry Brigade, Washington National Guard with a tank battalion (1-303 Armor), and separate cavalry troop (E/303 Cavalry), the Oregon National Guard providing the only ground cavalry troop (E/82 Cavalry) reconnaissance capability (roundout) in the 7th Infantry Division; the 40th Mechanized Infantry Division of the California National Guard with four tank battalions and a divisional cavalry squadron; and the Nevada National Guard's tank battalion, which is organic to the 40th Mechanized Division.

With this information it should be clear that the Total Armor Force in ARMR IX is a total of eight armor battalions, one divisional armored cavalry squadron, one regimental cavalry squadron, and two separate cavalry troops. A significant difference from the two battalions noted in the article. If this is the case in ARMR IX, it must be concluded that other armor and cavalry units have not been included in the Total Armor Force across the country.

One additional point that should be made concerning the Total Armor Force deals with aviation units of Armor. While I'm sure the authors did not mean to overlook this vital asset, it should be noted that both attack helicopter and air cavalry organizations are found in the RC and are an integral part of the Armor Force.

I hope this letter will help give credit to all the tankers, scouts, and aviators who serve in units not shown in figure 1, since their contribution to the Total Armor Force is in no way diminished by such an inexcusable oversight.

MARC A. KING
Major, Armor
Readiness Group, Fort Lewis, WA

The authors were given an opportunity to reply and their comments follow. Ed.

Authors Reply

Dear Sir:

Major King's comments concerning our recent article, "Reserve Component Armor Force," (*ARMOR*, November-December 81) are well received. It was never our intention to confirm his worst fears, however. Our purpose in writing the article was to provide a snapshot of the RC portion of the Armor Force. Obviously, "editorial license" was used in developing the map depicting RC armor units. Major King can put his fears to bed and sleep soundly tonight because higher headquarters is well aware of the identity and location of all the troops, battalions, and squadrons, of Armor, as well as how well they are training.

It would certainly be beneficial if Major King and his armor advisor contemporaries in the other Readiness Regions were to prepare descriptions of and discuss activation of the armor/cavalry units within their regions and share this valuable information with the Armor audience.

We would appreciate it if you could update the data contained in table 3 of the article. Data contained in table 3 has changed considerably since initial submission last year, as follows:

AC/RC Partnership Units

AC Unit	RC Unit
2d Armd Div Ft Hood, TX	49th Armd Div TX ARNG 149th Armd Bde KY ARNG
5th Inf Div (Mech) Ft Polk, LA	31st Armd Bde AL ARNG 155th Armd Bde MS ARNG
24th Inf Div (Mech) Ft Stewart, GA	50th Armd Div NJ,VT ARNG 278th ACR TN ARNG
3d ACR Ft Bliss, TX	116th ACR ID,OR ARNG 163d ACR MT,TX ARNG
194th Armd Bde Ft Knox, KY	30th Armd Bde TN ARNG 107th ACR OH, WV ARNG

We applaud Major King for his keen interest in RC armor and look forward with great anticipation to future articles on RC armor activities in ARMR IX including armor aviation.

DON SKIPPER
Major, Armor
FORSCOM

Wants More Live Firing

Dear Sir:

I would like to add my comments on the excellent article by Captain Thomas of the Canadian Forces in Europe on targeting ranges that will simulate Threat forces. (Jan-Feb '82 *ARMOR*.)

The captain is right! Nothing is as valuable as firing live ammunition (combat loads) if tank gunners are to know what it is really like. The occasional—once-a-year, live firing we now practice is all but useless, in my opinion. I know that the cost of ammunition is high—but so is the cost of survivability.

Modern battle is incredibly noisy, beyond belief, in fact; and if tankers are not accustomed to this outrageous sound level they will not be able to function when the chips are down.

More and more live firing should be instituted in all branches of the service. Then, perhaps, the soldier will learn that the one he hears going by won't hurt him. But the noise level of combat may well unhinge him. Live firing is the training answer. Besides, it is more rewarding to shoot the gun than merely to pretend or to pop off a subcaliber round in lieu of a main gun round. Additionally, there is nothing like live firing to show the soldier just where the rounds would *really* go if and when he ever has to shoot for real.

And while the captain is correct in stating that range areas in Europe are limited, there is no lack of space in either western Canada or the U.S. for live firing ranges. Several million square miles of desert land, in fact. So, while live firing may be restricted in Europe, there doesn't seem to be any reason why it cannot be practiced to the fullest extent in the Western Hemisphere.

JOHN V. CALUMET
Sergeant First Class, Armor

"Bravo, CSM Gillis"

Dear Sir:

I can only extend a hearty "Bravo" to CSM Gillis and his views toward NCO leadership.

CSM Gillis is obviously a realist and a man choosing to deal in absolutes. What do I mean by that? The Army was established and continues to develop on absolutes, a few of which follow.

- Everyone in the Army is trained first and foremost as a soldier.
- We have to have those who will follow and those who will lead.
- If you function without purpose and dedication, you will most certainly die on the next battlefield.
- We are training for the next war, not the last one.

The list goes on and on, but the crux of the matter is that NCOs are charged with great responsibilities; the greatest of which is to effectively train and lead their men.

There is a tendency to dwell on the negative and forget the positive and that can be the cancer that consumes the minds of potentially super soldiers.

Rather than complain about spending an extra week in the field, remember when the CO gave you an extra day off and, for his efforts, surrendered a generous portion of his lower anatomy to his superior. Rather than complain about pay being a couple of days late, remember when Johnny broke his leg at school and Uncle took care of it. So, before you decide to let your efficiency as an NCO dwindle, evaluate honestly the good versus the bad, and you'll find that the scale doesn't balance.

In terms of discipline, if you don't discipline for the sake of friendship or whatever, or if you delegate your disciplinary responsibility, you've lost any respect you may have had from the soldier and reduced your effectiveness as a leader.

I feel that the NCO-officer relationship at company level should be addressed more than it is. As an NCO, your junior officers rely heavily on your judgement and your ability to communicate their wishes to the soldier, and more, they expect you to fulfill your duty as the most important leader in the Army.

Remember that, for the most part, you have had the luxury of knowing and working more closely with the individual soldier than the lieutenant has; and, in light of that fact, you will have the opportunity to head off problems that are sometimes unforeseen by that officer. If you can do that, you'll earn the undying respect of both the troops and your officers.

Remember that the platoon leader is only as good as those he commands, and if you expect him to run a tight ship, *you* must run a tight ship. He expects no more from you than he is willing to give, and the same had better hold true in your expectations of him.

The NCO corps is the heart of leadership in the Army. If you, as an NCO, believe otherwise, you're being naive. If you find yourself caught up in what CSM Gillis refers to as "garrison mentality," you had better stop, regroup, and drive on, rather than to let the situation snowball.

There will always be some internal strife in any business where people are involved, but if, as NCOs, we allow ourselves to be party to it, we can't expect it to get better.

So, if you are concerned about your soldiers; if you discipline your soldiers properly; if you train your soldiers properly; if you reward your soldiers properly, and respect them, you're most certainly on the right track.

In closing I can think of no better phrase than this to sum it up:

Lead—follow—or get the hell out of the way!

DOUG HARMON
Staff Sergeant, MTARNG
Hamilton, MT

Bastogne Vet Recalls

Dear Sir,

Your article "Breakthrough To Bastogne" in the November-December '81 *ARMOR* magazine was recently brought to my attention. I was with C Company, 53d AIB, until 16 December 1944, at which time I was transferred to 53d Bn. Hq., and we proceeded to move through Arlong and up through Cobreville and Remichampagne and Assenois. What vivid memories were conjured up by the reassociation with those dimly remembered place names!

It made no difference at the time as to what platoon or company one normally was assigned to and we *all* were well kissed by the Germans. Incidentally, I ran across the tracks of Jimmy "Arky" Hendrix near Jonesboro, Arkansas in April or May of 1979, but never did get to see him. Lieutenant Colonel George Jacques (also known as 'Jake the Fake'), I remember, but not as well as Major Crosby.

As for having, as Mr. Ganz asserts, "unbounded confidence in their equipment" (tanks), I must take issue with him. Infantrymen, as well as many of the tankers, railed against the 75's and 76's ineffectiveness, in many instances, against the frontal armor of the German tanks. The *Stars and Stripes* (the Army daily newspaper. Ed.) at the time was printing critical letters and articles about American tanks vis-a-vis German armor. But that's water over the dam. It was a very accurate and well-written article.

NORMAN SUE
Accobeck, MD

NCO Disagrees

Dear Sir,

As an NCO dedicated to training tankers, I'm appalled by LT Davis in the Jan-Feb '81 issue of *ARMOR*. His theory plainly will not work. Any real tanker knows that once you've moved the turret to avoid obstacles or to engage targets during "battlefield movement" you will lose the imaginary azimuth.

Let's stop perpetuating rumors and allow the professional tanker NCOs to teach tank subjects.

CHARLES O. HILL, JR
Staff Sergeant, Armor
Fort Knox, KY

A Rose Is A Rose

Dear Sir,

I would like to be the very first to extend a sincere and warm welcome, along with my personal congratulations, to the U.S. Infantry. Welcome! Welcome to the 20th Century, and congratulations on finally realizing the importance of armor on the modern battlefield.

I fully realize a lot of thought has gone into the latest developments of infantry tactics, and that the Infantry Fighting Vehicle (IFV) is now the "in" thing. I only wonder if that thought has been carried to its logical conclusion. I hope that infantry leaders fully understand what they are letting themselves in for. From the newest squad leader all the way up the chain of command, when the infantry is issued their "little tanks," and they become "almost armor," a lot more will be expected of them.

What's that? Did I hear some groans and a little growling from someone saying, "No way will we, the Infantry, 'Queen of Battle,' be associated with the Armor Corps."

Well, let us first go to Mr. Webster for a definition of a tank: "Tank—an armored self-propelled vehicle carrying guns and moving on endless treads.

Alright. Now let us look at the IFV. Armored: Yes. Self-Propelled: Sure is. Carrys guns: I reckon. Moves on endless treads: That's right.

Sounds like a tank, but I will not rest my case with just that.

Richard M. Ogorkiewicz calls a tank a "mobile weapon platform" and says, "various other, more specialized, armored vehicles have been developed to support them."

So you say that the IFV is not a tank, but fits into the category of one of these specialized vehicles, designed to carry an infantry squad of 11 men...Sorry, but that doesn't wash. Because the IFV carries 11 men that does not rule it out as a tank. Those 11 men fight from the vehicle, not just ride to the fight. Ergo, it's a tank.

To further prove my point, let us look at some of the tanks of the past. The Germans designed a tank in 1918 that carried a crew of 30. The Italian Fiat 200 tank had a crew of 10, mounted a 65-mm gun and 7 machineguns. And how about the French Char 2C tank of 1923? It had a crew of 13, mounted a 75-mm gun and had 4 machineguns. Or, again, the German A7V, crew 18, one 75-mm gun, 6 machineguns. I could go on, but I think you understand that the number of men in a crew does not determine what that vehicle is called.

As to the next point that you will bring up,"we dismount to fight,"that really doesn't warrant much discussion. A tanker is also trained to dismount and fight, the only difference being that the tank is usually damaged before the crew gets off and fights on the ground. This, however, is not a hard and fast rule. Many's the time I went on patrol with my M3 light tank of World War II or pulled an LP/OP, or even dismounted to search out a house or village. No, the truth is, that when you get on your armored, track-laying, gun-carrying vehicle and move out on a mission with the intention of fighting from that vehicle, that vehicle is a tank. And a tank by any other name you choose to call it is still a tank.

If Guderian had had your IFV in 1940 instead of the PzKpWs, I am quite sure that things would be a lot different today. But enough of that, just let me say that now is the time to start studying your cavalry tactics. You will be putting them to use, and soon. Two miles per hour no longer makes it.

Again, I would like to extend my welcome to the U.S. Infantry, welcome to the 20th Century and the finest fighting force this world has ever seen—The U.S. Armor Corps!

LEONARD E. WRIGHT
SFC (Ret), Armor
Elizabethtown, KY

Index Available

The Index for the 1981 issues of *ARMOR* Magazine was inadvertently omitted from the November-December issue. Copies of the Index are available from either the Armor Association, P.O. Box O, Ft. Knox, KY, 40121, or USAARMC, Attn: ATZK-MAG, Ft. Knox, KY, 40121.

COMMANDER'S HATCH

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

CMF 19 Training Development

During the last decade the Army has experienced revolutionary changes in the organization and conduct of training. I use the word revolutionary to describe the change because our new approaches to training have completely revised the earlier concepts upon which our training has been based since the 1960's. Our previous approach envisioned three levels of training:

- Institutional training in (basic combat training (BCT) and advanced individual training (AIT) in which individual skills were taught.
- Basic unit training in which crew and platoon level skills were taught.
- Advanced unit training which prepared companies and major units for operational readiness tests.

The training developments pioneered during the decade of the 1970's envision a graduated hierarchy of tasks that are taught in U.S. Army Armor Center (USAARMC) and in the field. These tasks provide the soldier with a comprehensive listing of the skills he must possess to be fully qualified in each of four designated skill levels. The annual Skill Qualification Test (SQT) allows the individual and the commander to make an assessment of the individual's progress in the mastery of his military occupational specialty (MOS).

In addition to the individual skills now identified for each MOS, training developers have retained the crew-served weapons qualification criteria to measure crew skills and have developed the Army Training Evaluation Program (ARTEP) to measure unit proficiency in the collective tasks performed by tactical units in the field. The transition from the old training system to the new has been gradual, although the sum of the changes amounts to a comprehensive change in the way we now conduct training in the Army. These changes have caused us to retrain our trainers to prepare them for their role in using the new training tools.

How is the new training system working? Is it an improvement over the old system? If the new system is working, why?

Instructional Systems Design. I believe that the new training system holds the key to a remarkable improvement in the level of proficiency in Army training. Training developers have relied upon the principles of systems engineering to improve training. The application of systems engineering principles to training development is referred to as the instructional systems design (ISD) process. This process requires a comprehensive review of each MOS to define all tasks that must be mastered by each soldier. Once those tasks have been identified, course design work can begin. Each course of instruction is laid out progressively to insure that each subject to be mastered is taught in an appropriate sequence. Examinations are carefully evaluated to insure that all are mastered.

Once the examinations are approved, individual lesson plans are written specifically to insure that the performance standards required by examinations are achieved. This approach pairs a lesson plan with each task in a performance examination. During training, every task is evaluated independently by the Directorate of Plans and Training, and the Office of Armor Force Management and Standardization to insure that each block of instruction will accurately achieve its objectives.

Long gone are the days of "hurry up and wait," in which boredom and the elements were the soldier's greatest challenge during initial entry training. Today's soldier is challenged to master tough tasks under strictly controlled standards and conditions at each training site in a thoroughly programmed course of instruction. This comprehensive approach to training has great potential for enhancing the combat readiness of the Army.

Perception Problems. Despite the great strides in training made during the past 10 years, we can find evidence in the field of backlash to recent changes. The complaint is often voiced that the teaching burden has been shifted from the training base to the field. Figure 1 shows the comparison between tasks taught in the training base and units in the field for career management field (CMF 19).

This comparison of tasks illustrates the basis for the perception that our tactical units are being called upon to teach individual training subjects that were once taught in the training base. This perception is incorrect and requires a response. Those who have failed to grasp the magnitude of recent training changes need to better appreciate the scope of Army train-

	19E (M-60)	19K (M-1)	19D (Scout)
Basic Training Tasks (IET)	64	64	68
MOS Tasks (IET)	71	69	72
Total Tasks Taught in the Institution	135	133	140
Tasks Taught in the Field (FORSCOM/USAREUR)	70	17	69

Figure 1. CMF 19 Instruction (Skill Level 1)

ing developments and their role in the total soldier training mission.

Our analysis of tasks in CMF 19 has identified many skills required of the soldier that were never formally recognized in the past. As a result of this analysis, we now are aware of the many tasks that our soldiers are required to perform on the job to insure effective troop unit performance. Additionally, it has significantly increased the number of tasks to be taught. An awareness of the total training tasks to be performed permits all trainers to better coordinate and schedule the training of individual soldiers; in the training base and in the field. Moreover, it permits the noncommissioned officer to better prepare himself through self-study programs to perform his duties.

There has been no subtle shift of the individual training mission to the field. In fact, the training base is teaching more today than it has ever taught before. Moreover, the training base is performing its mission in less time than the Army formerly took to teach the soldier under the old system of BCT and AIT as we knew it during the 1960's. BCT and AIT formerly required 16 weeks of instruction with a week to move a soldier between the two phases of training. Our current One Station Unit Training (OSUT) Program requires 14 weeks for the 19E and 19K programs and 13 weeks for the 19D program. Figure 2 shows the increase in numbers of hours of instruction provided to the soldier in training:

It is not my contention that the breakdown of tasks between the U.S. Army Armor Center (USAARMC) and the field is ideal. Personally, I would like to see the institutional training increased; however, with the currently restrained training base it is impossible to provide more training before sending a soldier to his first unit. An increase in institutional training would require not only more personnel and equipment resources, but also more time in the OSUT cycle. I do not see either becoming available in the near future.

	Weeks	Hours
BCT	8	350
AIT	8	350
19E OSUT	14	760
19K OSUT	14	745.5
19D OSUT	13	685.5

Figure 2. Comparison of BCT/AIT and OSUT

The careful design and development of our training programs have greatly improved efficiency in the training base. More important, however, is the fact that the Army has a comprehensive approach, shared by the USAARMC and the field, for increasing the level of proficiency of our soldiers at each skill level. The result is that today's Army better understands its complex training mission. Our determined efforts to use this knowledge for constructive ends will contribute to enhanced combat capability and greater professional growth in the 1980's.

1982 Armor Conference Agenda

Tuesday, 11 May 1982

0900-2400	Registration—Harmon Hall
1730-1900	Garden Party—Quarters 1
1930-2230	Buffet—Heritage House

Wednesday, 12 May 1982

0800-0810	Opening Remarks MG Louis C. Wagner, CG, USAARMC and Fort Knox
0810-0840	Keynote Address General Glenn Otis, CG, USA TRADOC

The Concept Developers

0840-0930	Armor Combat Development
0930-1000	Break—Visit Displays
1000-1045	Organizational and Doctrinal Development
1045-1115	Materiel Development—New Systems from Near to Long Term
1115-1145	Materiel Development—Army Aviation from Near to Long Term
1145-1315	Lunch—Visit Displays

The Testers

1325-1410	Armor Testing
1410-1430	OT III for the M1

The Institutional Trainers

1435-1505	Role of the Institution in Fielding and Training the Armor Force
1505-1535	Break—Visit Exhibits
1535-1605	Initial Entry Training

Armor Association

1605-1700	Armor Association General Membership Meeting—Gaffey Auditorium
1900-2000	Pre-Banquet Cocktails—Main NCO Club (Dress: Coat and Tie)
2000-	Banquet—Main NCO Club Speaker—General Richard E. Cavazos, CG, USA FORSCOM (tentative)

Thursday, 13 May 1982
The Institutional Trainers (continued)

0805-0905	Officer Training
0905-0935	Maintenance Training
0935-1005	Break—Visit Displays
1005-1050	Gunnery Training
1055-1150	The Cutting Edge—Armor in the Field MG Fred K. Mahaffey, CG, 3d Inf Div
1150-1320	Lunch—Visit Displays

The Training Exporters

1325-1355	Armor Training Literature
1355-1415	Training Devices for Gunnery

The Evaluators and Standardizers

1420-1505	Army-Wide Standardization

The Force Maintainers

1505-1530	Personnel Management—The Armor Perspective
1530-1535	Closing Remarks MG Louis C. Wagner, CG, USAARMC and Fort Knox

DRIVER'S SEAT

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

Let the NCO Do His Job

In January 1978, while assigned as the Command Sergeant Major, Division Support Command, 8th Infantry Division, USAREUR, my commander and I had a lengthy conversation concerning the responsibilities of the officer versus those of the noncommissioned officer during the preparation phase of the monthly alerts. The conclusions were that:

- Officer involvement, which included personally supervising the loading of the vehicles, was wrong. When the "balloon went up" the officer corps would be nowhere in sight during this phase because they would have more pressing duties to perform.
- The preparation phase of alerts was a task that NCOs would most certainly be required to perform in the case of an actual alert.
- The noncommissioned officers did not have the detailed knowledge nor the experience required to prepare their units to move as rapidly as would be required.
- We should train the noncommissioned officer corps *now* to accomplish this mission if we really expected to "get out of the gate" as quickly as possible to counter an actual threat.

The DISCOM Commander's decision was to totally eliminate officer involvement during the preparation phase of the monthly alerts. The notification procedures would remain in effect, but all actions between notification and reporting the unit ready to move would be the responsibility of the unit's noncommissioned officers. His plan included the following duties for which the noncommissioned officers would be held responsible.

- Accounting for soldiers whereabouts.
- Inspecting soldiers for proper uniform.
- Insuring that weapons and protective masks were issued.
- Moving the squad/section vehicle from the motor pool to the loading point; supervising the loading of individual, squad or section equipment.
- Moving the vehicle on line when loaded.
- Rendering all reports required up to the point where the first sergeant reported that the unit was formed and ready to move.

The plan also included an inspection by the company and battalion officers, once the first sergeant had reported the unit ready to move, to insure that noncommissioned officers had accomplished all tasks.

Officers were responsible for moving the unit but, upon closing into the local assembly area, the responsibility to unload, set up, organize, camouflage, establish initial security, etc., reverted to the noncommissioned officer. Upon completion, the officers evaluated the NCOs performance.

Surprisingly, when this plan was announced, it met with strong resistance from some commanders and many of the other officers.

The perception that noncommissioned officers would be assuming officer responsibilities, and a lack of confidence in the ability of the noncommissioned officers to accomplish this mission were all causes of this resistance.

There was not much improvement in preparation time during the first alert, and all of the nagging problem areas that continuously occurred under the "old system" recurred. However, the problems were solved by having the battalion command sergeants major and unit first sergeants observe while NCO tasks were being accomplished; by having officers inspect after the tasks were completed; and holding critiques at company and battalion level at the termination of the alert. These critiques, attended by NCOs and officers, identified problems in detail and pinpointed the sergeant responsible for the task in question.

Within a 90- to 120-day period, all battalions were well under the 2-hour standard. All resistance vanished and the system gained full support of the command's leaders. The NCO's eagerly and enthusiastically accomplished what they recongized as their responsibility.

It may appear that what has been described here applies only to TOE units in USAREUR, and therefore is of no use to units in CONUS or elsewhere in the Army. Not true. Any unit, Active Army, or Reserve Component, that has an alert mission of any type, can and should implement the program described above.

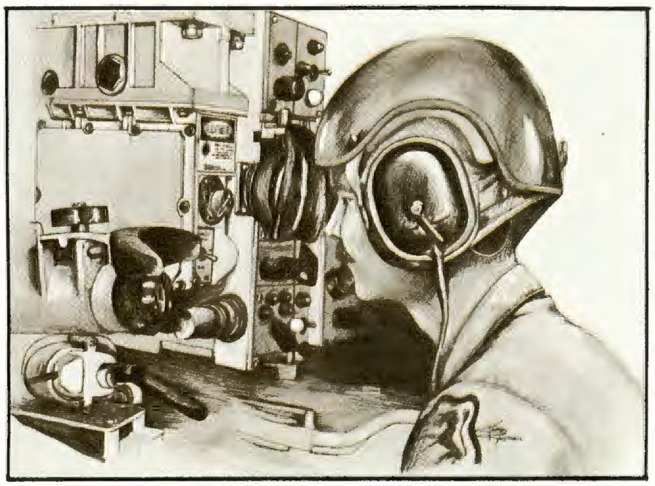
Additionally, there are numerous normal, everyday missions in all units that lend themselves to training the NCO for wartime responsibilities. All it takes is a critical evaluation of what does apply in these "everyday missions" and guts enough to perhaps suffer some mission degradation while training to proficiency.

We train well on how to survive and win on the battlefield of the future. We had better train well on how to get there, or that battlefield will be in our own backyard.

John W. Gillis

MASTER GUNNER'S CORNER

Captain Patrick T. Henry, USMC
Chief, Master Gunner Branch
Weapons Department
U.S. Army Armor School
Fort Knox, KY



Master Gunner's Contact Program

As early as March 1977, the Master Gunner Branch, Weapons Department, U.S. Army Armor School, instituted a point-of contact program designed to provide a continuous link between master gunners in the field and the Armor School. In September 1977, this program was expanded to include liaison with each Army Readiness Region. (See *ARMOR,* January-February 1978, for details.) During the years between the establishment of this program and the present, this vital link has been maintained informally by master gunners and has proven to be an effective method of sharing information and training techniques.

The development of viable tank gunnery training programs must incorporate careful consideration of numerous local conditions such as the current training posture, resource availability, and the short- and long-term objectives of the training programs. As such, the planning and implementation of tank gunnery training precludes the use of a universally applied "school solution." In view of this situation, the master gunner is specifically trained to develop workable, realistic gunnery programs tailored to local conditions. His mission is to assist the Commander in establishing and/or maintaining a continually sound gunnery training program. The Master Gunner Branch remains ready to support the master gunner in the field as he drives towards the accomplishment of this mission.

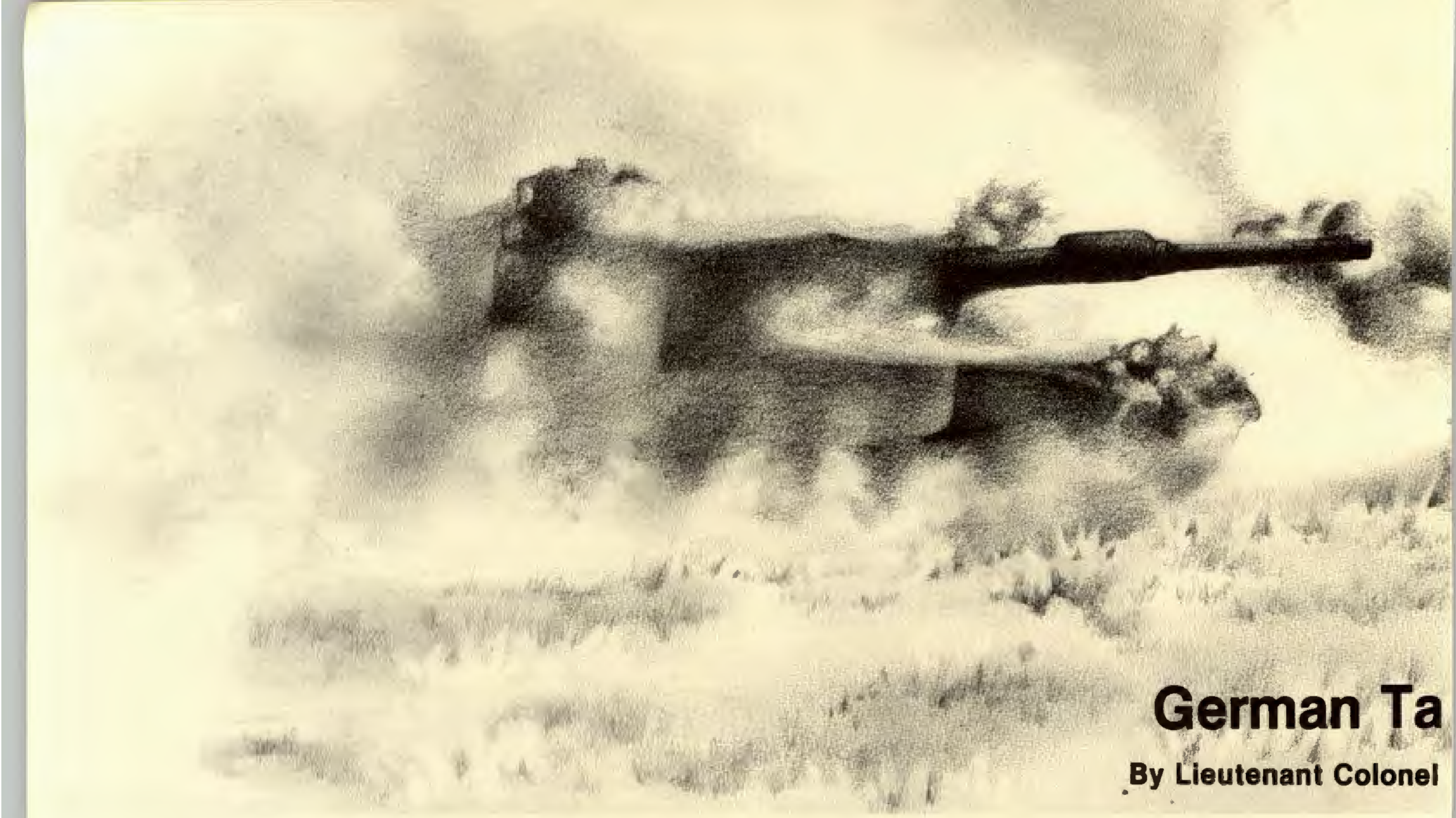
Instructors in the Master Gunner Branch are assigned the responsibility for maintaining communication with, and providing training assistance to units in the field. Table 1, lists the names of the primary and alternate points of contact for each Readiness Region and major unit or post. These individuals can be reached via Autovon 464-8530 or by writing to Headquarters, U.S. Army Armor School (ATTN: ATZK-WP-MG) Fort Knox, KY 40121.

Table I. Points of Contact

USA			**Readiness Regions**		
Location	**Primary**	**Alternate**	**Region**	**Primary**	**Alternate**
Ft. Knox	SFC Huff	SFC Conway	I	SFC Harnish	SFC Barnes
Ft. Hood	SFC Pruitt	SFC Perl	II	SSG Berthel	SFC Strickland
Ft. Bliss	SFC Pruitt	SFC Harmon	III	SFC Strickland	SFC Huff
Ft. Riley	SFC Cason	SFC Strickland	IV	SFC Huff	SFC Perl
Ft. Lewis	SFC Perl	SFC Huff	V	SFC Strickland	SSG Berthel
Ft. Bragg	SFC Strickland	SFC Harmon	VI	SFC Huff	SFC Conway
Ft. Carson	SFC Cason	SFC Perl	VII	SFC Pruitt	SFC Perl
Ft. Polk	SFC Pruitt	SFC Harmon	VIII	SFC Cason	SFC Strickland
Ft. Benning	SFC Huff	SFC Conway	IX	SFC Perl	SFC Huff
Ft. Sill	SFC Pruitt	SFC Harmon			
Ft. Stewart	SFC Huff	SFC Harmon			
Hawaii	SFC Conway	SFC Harnish			
U.S.M.C.	SSGT Wilson				

Overseas

Unit	**Primary**	**Alternate**	**Unit**	**Primary**	**Alternate**
8th ID	SFC Harmon	SFC Conway	11th ACR	SFC Harmon	SFC Cason
3d AD	SFC Perl	SFC Barnes	BERLIN	SFC Huff	SFC Perl
1st AD	SFC Pruitt	SFC Strickland	1st ID (FWD)	SFC Conway	SFC Harmon
3d ID	SFC Harnish	SFC Harmon	7th ATC	SFC Cason	SFC Barnes
2d ACR	SFC Strickland	SFC Barnes	2d ID	SFC Blair	SFC Cason



German Ta

By Lieutenant Colonel

*This article is in response to Lieutenant Colonel J.A. Thomas's letter in **ARMOR**, November-December 1981. The article describes German tank gunnery training and explains why German tank crews participated so successfully in the Canadian Army Trophy competition in 1981. Briefly stated, German tank gunnery training is a matter of logical and sequential methods, but this explanation will not satisfy the professional reader; therefore, I want to explain these matters in more detail.*

GSB.

Tank units are the *schwerpunktwaffe* (arm of decision) of all military commanders. Main battle tanks (MBT) are the *core* of our antitank defense, and their first priority targets are enemy tank formations. Armor units fight in all types of combat, and always employ fire and maneuver to achieve *Beweglichkeit* (high mobility and flexibility) at all levels of command. Under these conditions, even superior enemy forces will be worn down.

While platoon leaders always take an active part in their platoon's firefight, company commanders do so only as long as their command and control function is not impaired.

The evaluation of these given principles results in the logical statement that tank gunnery is, and always must be, an *integrated* part of all tactical and training exercises. It is neither an end in itself, nor is it restricted to the gunnery range. Therefore, the methods and sequences of tank gunnery training must accomodate these conditions.

There is another factor of great significance and that is that the German Army is made up of draftees and volunteers, with approximately 60 percent of its armor soldiers being draftees. Men are eligible for compulsory military service at age 19. If drafted, a man must perform 15 months of basic military service, while volunteers serve a minimum of 2 years. Since the term of military service is relatively short, it is necessary to channel the training into specialized areas.

Selection and Basic Training of Armor Crewman. Before enlistment, all draftees and volunteers are given a thorough physical examination and a series of aptitude tests are administered by induction offices. Based on the results of these tests, the men receive certain designations that indicate that they are qualified for armor and are assigned to armor basic training units as needed. Their qualifications are reexamined by the training unit, and if changes in their classification are necessary, they are made within the first 2 weeks of basic training.

There is no central training organization in the German Army. To minimize expense, and for personnel reasons, basic training is carried out in designated field units. This also provides the opportunity to rotate the instructors within the respective command areas after a certain period.

Basic training prepares the *individual* soldier for the follow-on complementary training conducted by the combat units. Despite the fact that, from an organizational point of view, there are two separate phases, troop training constitutes an entity since *both phases are coordinated.* For example, loaders and gunners are trained in a manner similar to that of earlier U.S. One-Station Unit Training programs, and their training lasts 3 months.

Specialized training consists of 98 hours in tank gunnery, 95 hours in weapons and equipment and 10 hours in communications for a total of 203 hours. The aim of this training is *to prepare the soldier for his future principal assignment;* i.e., the objective of basic training is to produce a soldier who can:

- Use his basic knowledge of gunnery, including fundamental firing techniques and stationary firing.
- Operate the tank weapons and the devices of the fighting compartment.
- Use the tank's intercommunication system.
- Carry out organizational preventive tank maintenance (excluding the driver's station) in accordance with operating instructions and/or service schedules.

Tank gunnery training can be initiated only after thorough training in the use of weapons and equipment has been completed. To achieve this, recruits are given individual instruction in basic knowledge of gunnery and ammunition, and approximately 85 hours of *hands-on* training. The latter includes operation of the turret, target acquisition, fast and

nk Gunnery

Georg K. Schulze-Buettger

accurate gun laying and tracking, consistent and accurate ranging to exposed targets within 10 seconds, and the use of auxilliary sighting devices. Since the *Leopard* 1A1 through A4 tanks are equipped with a gunner-operated optical rangefinder and hit probability is decisively dependent on ranging accuracy, about *60 hours* are devoted to training in that skill.

The *main training aids* that are used to support this intensive training program and insure its success are tanks, turret trainers, and "needle devices." These aids are used on both full and scaled ranges.

In contrast to U.S. armor basic training, there is *no* live firing using main gun training or service ammunition because service practice requires more intensive and extensive preparatory training, even for the lowest level, and during all firing practice, it is not the individual crewman, but rather the *entire crew* working smoothly as *team* that promotes success. There are, however, three firing tables of *preparatory* gunnery that must be completed. At the end of basic training, the recruits must pass a written and performance examination to be awarded an MOS in armor and the soldiers who meet the qualification standards are awarded a *temporary* MOS of *gunner*.

Complementary Training. The 12-month complementary training also includes *collective training* that enables the armor soldiers to perform their tasks in mutual *cooperation* within their subunit and units as well as within larger formations. During this training phase, the *crew* must learn to operate the tank in *all* combat situations. In unit training, the crew performs as a team and learns mainly *crew and platoon* as well as company operations. During this complementary training, *specialized training* takes up at least 36 percent of the available time and additional time can be set aside, if necessary, to emphasize certain subjects. The *three major specialized training areas* are: armor combat, weapons and equipment, and tank gunnery training. *Tank gunnery* is a continuation of previous gunnery training and includes preparatory gunnery, service practice, and battle runs. The objective of all gunnery training is *rapid engagements* and *rapid hits.* While using the various tank weapons and ammunition, each crew, as part of the platoon, is to achieve as many hits as possible from stationary positions or on the move, during the day and at night, as quickly as possible, and use as few rounds as possible.

To attain these objectives within the 12-month training period, 290 hours of training, 17 range-firing days, and 90 rounds of main gun ammunition per tank are prescribed by regulations.

Preparatory Gunnery Training. During this phase, the provisions prescribed for participation in both service practice and battle runs are developed. *Hands-on training* consists of *12 training exercises* during which laying and tracking techniques are improved and the capability of quick and accurate ranging, as well as ranging under adverse conditions, is acquired. Crews also are instructed in their fire fight activities by day and night *both from static positions and on the move,* and battle runs are practiced. The exercises are conducted in sequence and divided into several proficiency levels with varying degrees of difficulty (figure 1). The preparatory gunnery training must conform to the following fundamental principles:

- The training of crews in firing techniques must be accomplished *in the form of drills,* and
- The crew must *always* work as a *team.*
- The engagement, from target acquisition to actual firing, must be *one continuous action.*
- All training is progressive and must be evaluated at each stage. Crews cannot proceed to the next level until they have achieved the required standard for the previous level.

As mentioned above, tank crews engage in service practice and battle runs only after having met all performance requirements of the preparatory gunnery training.

Preparatory gunnery training is conducted mainly on *full-scale ranges* and during *dry battle runs,* utilizing the following *devices and aids:* needle device, *Schiessarm* (similar to U.S. *Brewster* device) with G3 rifle and 5.6mm, subcaliber ammunition; 14.5mm subcaliber training device, tactical light

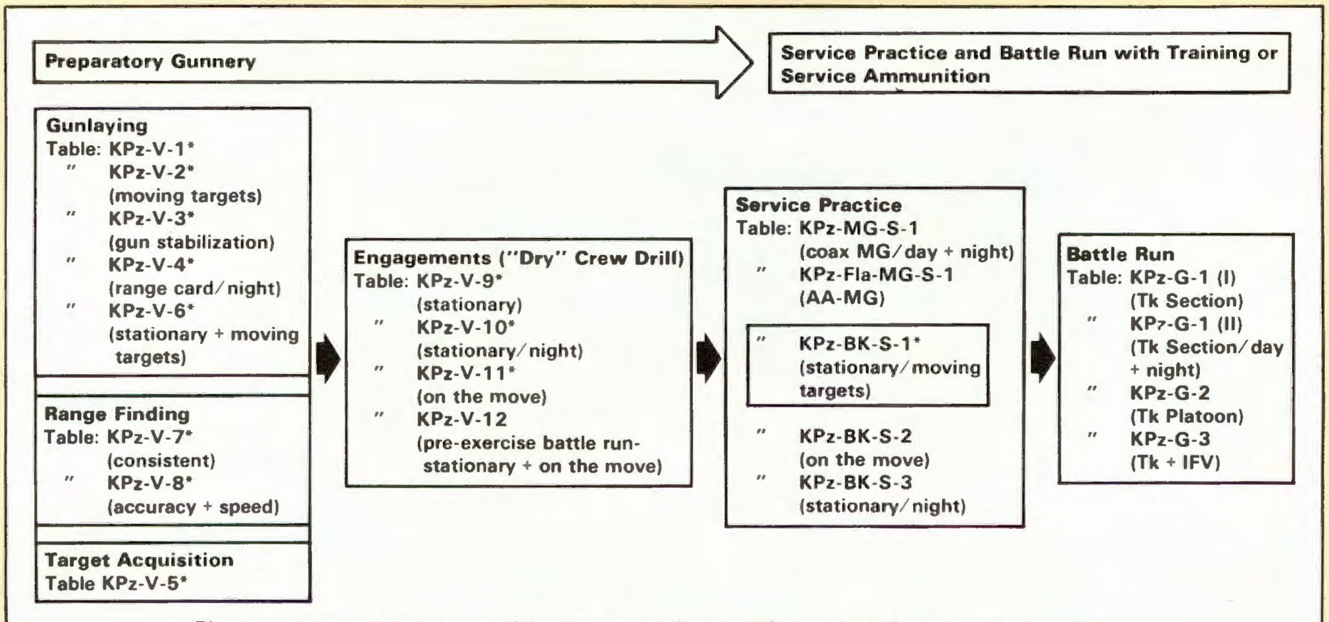


Figure 1. Prerequisites for participation at stationary firing and battle run gunnery tables.

shot simulator (Talissi) — a training hit indicator, Honeywell tank turret simulator and, sand table instruction where gunnery and fire-fight technques are practiced and where service practice and battle runs are prepared. (At present, there is only 1 simulator for the *Leopard* 1A4, available. Troop testing was successfully completed in 1980. To satisfy the needs of armor, more of these important training systems are necessary).

Service Practice. This phase of gunnery training is accomplished from static positions and on the move, by *day and night* (figure 1). Here, *for the first time* the crew employs gunnery techniques, using training and service ammunition, and acquires the ability to sense and make appropriate adjustments. The training objective is to acquire the ability to perform the functions required in the various engagement phases. The training is conducted in controlled situations with the controller giving instructions and intervening when necessary to make corrections. Tactical aspects are not paramount. Service practice starts with one gunnery table using the coaxial machinegun, followed by a second table for the antiaircraft machinegun.

Following this phase, the first gunnery table for the *main gun* is fired during the daytime to engage stationary and moving targets, using all types of ammunition. There are 3 levels of proficiency to be reached, each with increasing degrees of difficulty. Three rounds are allowed for each main gun target. This condition applies to all service practice, as well as battle runs. Time keeping commences as soon as the target appears and the hostile fire simulators have been initiated. This is one of the *key* tables for the armor soldier. As already described, the basic training graduate receives only a *temporary* gunner MOS. Upon *successful* qualification in the first main gun table, skill level III, (figure 2), *temporary* gunners now are awarded the *permanent* MOS. There are two more service practice gunnery tables, which must be passed before entering the battle run phase. Each of them has a different objective and one is to be fired at night (figure 1).

During service practice, the following principles must be observed:

- Only those tank crews who have successfully completed the exercises of the preparatory gunnery program may participate in service practice.
- The controller (who is also the instructor) trains the crew in sensing and gunnery techniques, confirms hits, and intervenes if the crew indicates that it intends, because of erroneous sensing or a lack of sensing, to carry out erroneous firing adjustments which would definitely preclude a hit.
- The requirements must always be met by the entire crew; i.e., they are met if each main gun target has been hit once within the time allowed, using no more than 3 rounds per engagement. No bonus credit is awarded for successful engagements in less time, nor are points awarded for first, second, or third round hits. (i.e. go/or no go)
- The targets must be set up throughout the entire range to provide the same degree of difficulty for each engagement.
- To obtain measurable firing results, and to ensure realistic and effective training, the controllers are *not* permitted to give any indications as to the target array or to make any information available on sensing or adjustments.
- When crews fulfill the requirements of service practice, they are qualified to participate in battle runs.

Battle Runs. The highlights of all armor hands-on training are represented by the battle runs — *they combine gunnery with combat training.* Their *objective* is to develop the crews' ability to

Target	Ammunition	Distance	Standard
Tank Turret* Antitank Gun** Tank Front (Mov)	up to 3 HVAP-DS up to 3 HEP up to 3 HVAP-DS	1,100-1,600 m 1,000-1,500 m 1,000-1,400 m	Hit on each target within 30 seconds

Weapon: 105-mm gun
*pop-up targets
**HEAT can be used, instead of HVAP-DS, if necessary.

Figure 2. Gunnery table "KPz-BK-S-1" (skill level III).

successfully conduct fire fights by day and night in all types of combat. During battle runs crews operating under simulated combat conditions must prove their skills in target acquisition, gunnery techniques, and combat operations.

There are three categories of battle runs (figure 1). One is for two tanks, another for the tank platoon, and the final one is for *combined arms,* with tanks and infantry fighting vehicles (or reconnaissance vehicles) participating.

The controller, (usually the company commander) must develop the scenario containing the situation; mission; envisaged sequence, including target presentation and ammunition to be used; safety regulations, and special training instructions. He must ensure that the tasks are not known by the crews beforehand to guarantee that the requirements to be satisfied are alike for all crews and that those crews who have not fired do not see the target/exercise area.

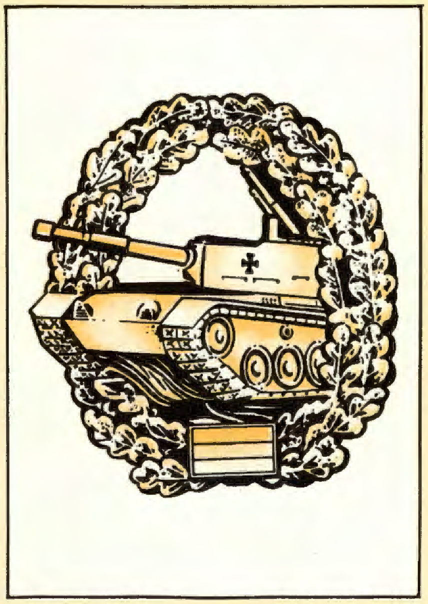
Immediately after the exercise there must be a comprehensive, detailed, *critique* of all actions — both tactical and gunnery.

The *purpose* of the battle run for two tanks is to practice *single* and *joint* firing while moving within the scope of a platoon operation. The crews must *independently* select their targets and then engage the targets with selected weapons and ammunition in order of degree of threat. The *focal point* of this training exercise is the *independent* fire fight conducted by each crew. However, any crew that has successfully engaged its target, may render fire support to the other tank or, *as an exception,* support it by sensing. Tank crews are scored *individually.* The training requirement is met if 60 percent of the main gun targets have been hit within the time allotted and two bursts on target are achieved for each area target. Three rounds are allowed for each main gun target and up to 150 rounds for each machinegun target.

In addition to the *hits* achieved, *time* and *ammunition* used are also graded. Each hit within the allotted time earns 50 points, and up to 300 points can be awarded for the unused time left per target. A bonus of 50 points per round for unused ammunition is allowed if *all* main gun targets have been hit. The length of time for the entire run is not scored. The crews who have successfully completed the battle run for two tanks are now qualified to take part in the platoon battle run.

In this exercise, the platoon leader conducts the fire fight from both stationary positions and on the move using *fire* and *maneuver.* The platoon leader, as the commander of his tank, fully participates in the fight.

The tanks independently open and conduct the fire fight on the basis of independent target selection, and according to the target presentation. The tanks closely cooperate within the platoon — the platoon leader *directs* the platoon fire, only *if* it is to be concentrated or directed against dangerous targets. After engagement begins, he coordinates subsequent firing activity, and the interaction of the tanks.



The number of targets to be engaged simultaneously may vary, but must *at least* equal the number of friendly tanks. When determining time, additional engagement time is allowed *only* when targets outnumber the engaging tanks (e.g. 5 tanks, 5 targets = 30 seconds (base allowance) or (5 tanks, 8 targets = base allowance + 30 seconds).

The scoring criteria are the same as those applicable in the case of battle runs for the two-tank scenario. What has to be rated is the total number of targets hit within the allotted time, and the ammunition expended to hit them.

The combined battle runs with tanks and infantry fighting, or armored reconnaissance vehicles (figure 1) are not conducted within the scope of the established training requirements. They are ordered separately within joint activities of the branches, depending on the training status and the amount of available ammunition.

These battle runs can be performed in any order of magnitude, such as comprising one tank and one infantry fighting vehicle, one reinforced tank platoon or a reinforced reconnaissance squad. The purpose of this training exercise is to conduct joint fire fights from stationary positions or while on the move and include practicing *cooperation* between the leaders, practicing *command and fire control, independent firing,* and *dismounted* fire fights thereby employing antitank weapons and small arms.

In connection with *combined battle runs,* the Germany Army Training Establishment in Shilo, Canada must be mentioned. Since 1974, from springtime until fall, German armor and mechanized infantry units rotate through 3-week training cycles on the Canadian prairie. The main training *objective* is tank gunnery with the *emphasis* on *battle runs.*

Under the excellent conditions provided at the Shilo facility, tank battle runs from section to company level are executed. The majority are run in cooperation with mechanized infantry. The highlights, however, are the battle runs for *reinforced* tank battalions, and they represent the culmination of each training period. These battle runs are often supported by Canadian artillery, which provides a unique opportunity to practice combined arms team operations under live fire. The training in Shilo *is the responsibility of the battalion commanders* with guidance provided by the German General Army Office (comparable to the U.S. Army Training and Doctrine Command), and by the commanding officer of the Training Establishment.

Leadership Training. While enlisted armor crewmen are trained by operational units in the field, the training of their leaders is provided by the *German Army Armor School, where training* is the most important mission and includes *basic and advanced* instruction, the *introduction* of new equipment, organization, and doctrine. This training is given to all officers and NCOs of armored combat troops.

Although the purpose of this article is focused on tank gunnery training, the following brief, but *essential,* remarks should be made regarding leadership training to underline the importance that the German Army dedicates to this area. In relation to tank gunnery (peacetime, wartime, *and* training), the tank commanders and platoon leaders are the most important figures. The Tank Commander's Course (NCO Basic Course) has the main *objective* to qualify the NCO as a *tank commander* in combat and as a tank crew *instructor* in basic as well as complementary training. During the armor-specific training, the main effort is directed at hands-on training and practical aspects of future leader and instructor roles. The Tank Commander's Course is a *career course,* and awards the tank commander MOS. *Before* attending the course, the NCO candidate must have the gunner MOS. No excep-

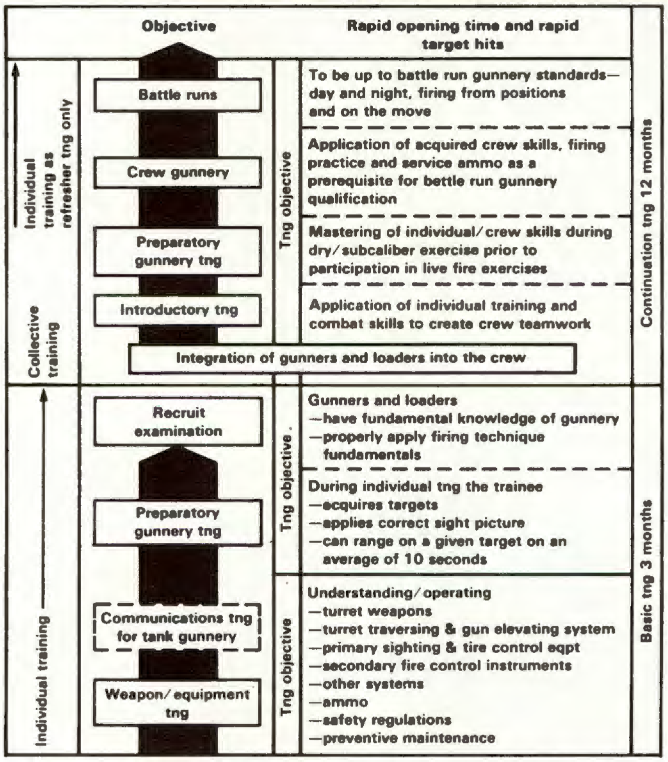


Figure 3. Tank gunnery training sequence.

tions are allowed. Both the *Platoon Leader's Course* for young armor officers and the *Armor Advanced NCO Course* include *master gunner,* or *gunnery instructor, training.* This guarantees that there is at least one master gunner within each German tank platoon. Therefore, all tank crews can be trained effectively within the sphere of responsibility of their direct leaders.

Within the *Pre-Command Courses* for company and battalion commanders, the main emphasis on gunnery training is directed toward the *organization and execution* of *training.* The *Armor School Tank Gunnery Adviser Group* is another important training asset that has proved itself over many years. The group consists of experienced officer and NCO master gunners. Its primary mission is to visit armor battalions and companies while they conduct their live firing programs, and to *support* the commanding officers and company commanders by giving *advice* and assistance. In the event of changes in tank gunnery policies, the advisers provide, in addition to other means of introduction, a fast update for field units.

Conclusion and Outlook. As previously mentioned, current German tank gunnery training is a logical, step-by-step procedure (figure 3). It is a combination of the experiences of World War II participants and expertise that has been gained and applied by the *Bundeswehr* during the past 25 years. Special emphasis has been given to a careful analysis of the Canadian Army Trophy competitions, and the results of these evaluations have had a strong impact on German tank gunnery.

The best training philosophy and methods, however, will not work, if the leaders and instructors do not understand them and are not prepared to put them into practice.

The modern sophisticated battle tank needs to be handled by a crewman who is mentally and physically qualified to use his weapon system most effectively. This is the decisive prerequisite for fighting successfully, even though outnumbered.

There are, however, two other important factors that must be mentioned, and they are *proper handling* and *preventive maintenance.* Only the well-maintained battle tank will succeed! In many situations even small technical failures at the decisive moment cannot be overcome by the best trained and highly qualified tank crews.

Tank gunnery training, as presented in this article, is based on the requirements for the *Leopard* 1A1 through A4 and the *M-48A2/G2.* However, these *principles* are also valid and applicable to any other modern battle tank, such as *Leopard* 2. But certain adjustments are necessary to fully utilize the increased potential of the more advanced weapon system.

To this end, the importance of modern *training simulators* should also be mentioned. They help to further rationalize and intensify the training thereby permitting a shift of the limited training ammunition available from service practice to the battle runs, where the ammunition today is urgently needed — especially at the *platoon level.*

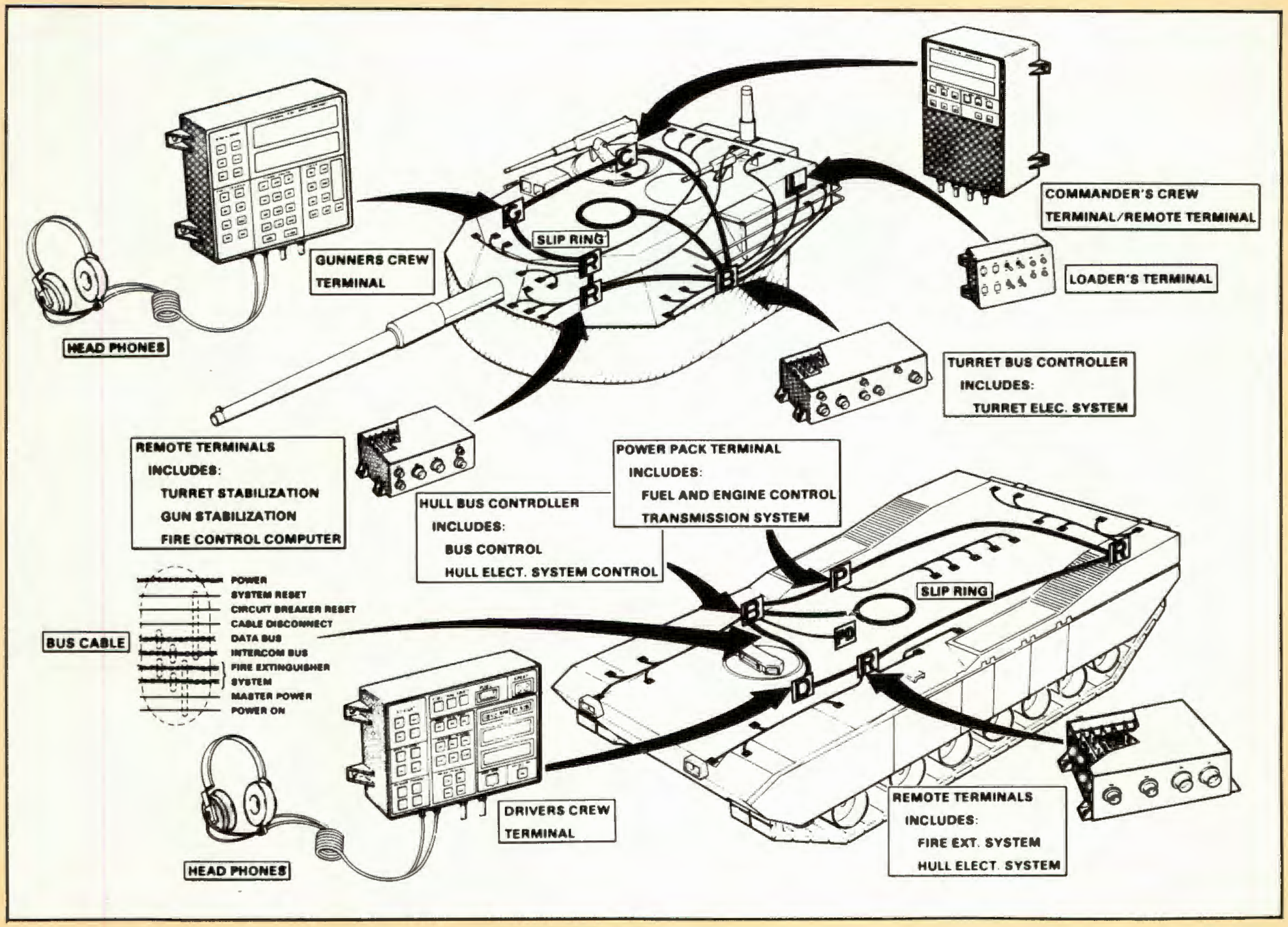
Solid and demanding training, as well as placing the right man in the right position, not only builds the soldier's *confidence* in his weapon, it also develops his *motivation* and *competitive drive — the key elements for tank gunnery success. And, there may be a situation where even the best trained and most highly motivated soldier also needs a little bit of luck!*

References

[1] *Anweisung fur Fuhrung und Einsatz 226/620 Panzer-Schiessen.*

[2] *Anweisung fur die Truppenausbildung. Nr 1 Die Grundausbildung im Heer (GAP 05019).*
Nr 2 Die Vollausbildung im Heer (GAP 05410).

LIEUTENANT COLONEL GEORG K. SCHULZE-BUETTGER enlisted in the German Federal Armed Forces in 1957 and was commissioned in Armor from Officer Training in 1958. He then served 8 years with Tank Battalion 83 as a tank platoon leader, adjutant, S2, and company commander. He has also served as an instructor in the German Army Armor and Officer Schools. He was a deputy commander of Tank Battalion 143 and commander of Tank Battalion 213, and Armor Instruction Battalion 93, which has the mission for combat training, troop testing, evaluations, and demonstrations. Lieutenant Colonel Schulze-Buettger is a graduate of the German Armed Forces Command and General Staff College and since 1978 has been the German Army Liaison Officer and Chief of the German Army Liaison Staff USAARMC and Fort Knox.



The Future Of Diagnostics

By Donald S. Sarna

Although the repair of tank automotive products is still mechanical in nature, even for electrical or electronic repairs, the diagnostic job is becoming a far more sophisticated process. And there is a growing discrepancy between the skill level required to diagnose modern weapon systems and that which is available.

Army combat vehicles are increasing in versatility and capability as an outgrowth of the rapid expansion in low-cost micro-electronic technology that occurred in the 1970's. This has brought about weapon systems that would have been characterized as "science fiction" in past generations. These systems are designed to be simple in operation to optimize vehicle crew effectiveness, but are very sophisticated and, therefore, complex from a diagnostic standpoint.

The future battlefield will be rich in sophisticated weapon systems providing high lethality, high mobility, and an expanded kill zone. The fluidity of the battlefield, in effect, reduces the time available to make a repair. To make matters worse, the needed repair is not likely to be obvious and must be determined before a decision can be made whether to "fix forward" or evacuate the equipment.

However, present trends in vehicle sophistication, erosion of the mechanic skill levels, and battlefield fluidity all run counter to the need to "fix forward."

These trends will not change in the foreseeable future; therefore, certain needs are evident to offset their effects and to bring the system into better balance. The mechanic needs help in diagnosing malfunctions in vehicle systems, especially those that involve electrical or electronic elements. This generates a need for some form of improved test equipment or automatic test equipment (ATE). The test equipment alone, however, addresses only one half of the problem. The other half involves interfacing the test equipment to the vehicle; therefore, another need of equal importance arises — built-in testability provisions on the vehicle.

As the versatility and capability of the vehicle have expanded, so has the complexity of the electrical/electronic system. This complexity is due, in part, to traditional combat vehicle design practices. Many high technology subsystems are developed independently by a variety of agencies and contractors (i.e., radios, range finders, thermal sights, weapon systems, engine controls, etc). Additionally, new combat vehicle requirements generally use some subsystems that were developed previously for other applications. The prime vehicle contractor then, in effect, patches together many subsystems that are available from different sources. This process results in pseudo system integration, with wiring harnesses tying the systems together by "brute force," rather than an efficient, totally integrated system that is capable of accomodating a variety of subsystems.

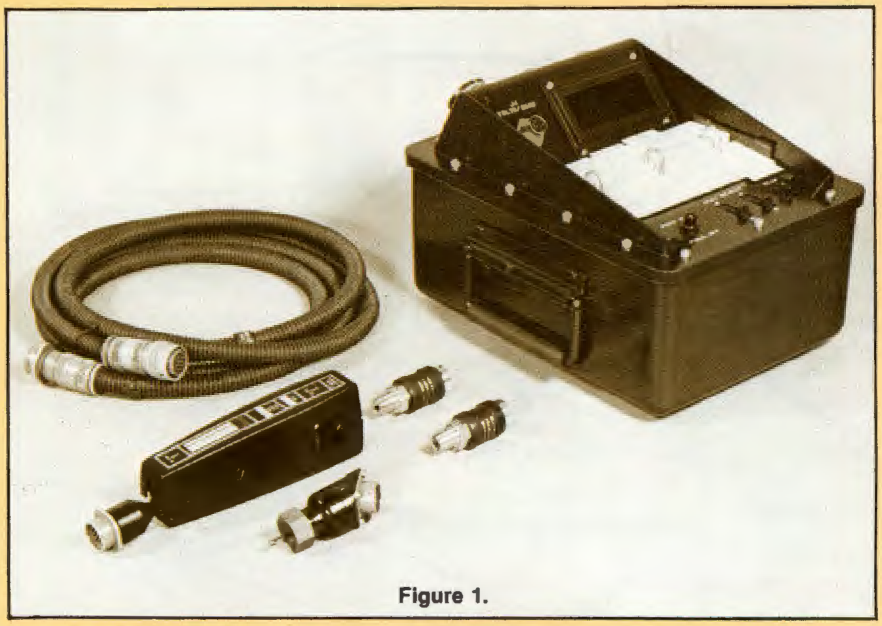


Figure 1.

Such an integrated system would have the potential for modular replacement and technological upgrading.

As the number of subsystems increases, it is clear that a more efficient form of integration is required. The optimum design includes a multiplexed bus system for power and data distribution and control that would be capable of integrating all systems with a significant reduction in complex wiring.

Since an on-board multiplexed power distribution and control system would in fact be a "smart" system using microprocessors, a natural outgrowth would be the addition of on-board diagnostics and prognostics. On the battlefield, the on-board diagnostic/prognostic capability would go a long way toward providing an immediate diagnostic assessment of malfunctions upon which to base a decision to "fix forward" or evacuate.

Test System Evolution. The diagnostic problem has grown slowly in magnitude as systems have become more complex and, during the past 10 years, it has become acute.

To fill the requirement for improved test equipment at the organizational maintenance level, simplified test equipment for internal combustion engines (STE-ICE) was developed during the early and midseventies. The STE-ICE not only performs all the tests that can be done with the older conventional test equipment, but also has far greater range capability to enable it to replace many vehicle peculiar special testers.

The STE-ICE can also perform a series of new and unique tests, including engine power, compression balance, and a series of dynamic battery/starter circuit tests that significantly increase the diagnostic capability of the system.

The vehicle test meter (VTM) of the STE-ICE operates in two modes; either through a diagnostic connector assembly (DCA) that is incorporated into a vehicle at time of manufacture, or with a transducer kit (TK) that is included in the STE-ICE set (figure 1). Various cables, adapters and plumbing fittings (not shown) are also included in the TK to assure its adaptability to the entire fleet of military vehicles.

The *M-1 Abrams* tank represents the latest in electronics technology applications but when the *M-1's* development was initiated, there was no standard test system available to meet its need; therefore *M-1* peculiar test equipment was developed in the traditional fashion.

There was no time, however, to develop the needed standard test set from scratch with the flexibility needed to become the single test set for all combat vehicles. As an interim solution, the basic STE-ICE was expanded by the addition of a controllable interface box (CIB) that added multiplexing, stimuli, and computer memory to the system to provide automatic testing, cable testing, and interface with a multiplicity of test points required for turret testing. A set communicator (SET-COM) was also added, providing an expanded two-way communication link between the operator and the set.

The set is called STE—M-1, but it is designed to include sufficient memory capacity for further expansion so the same test set can cover the *M-2/M-3* Fighting Vechicle Systems (FVS).

The STE—M-1/FVS system, however, represents only an interim solution to total combat vehicle support. It is not reconfigurable and is dedicated to the two vehicles. A multibox design that uses software contained on internal printed circuit boards (PCB) is a severe limitation to expansion, flexibility, and software configuration control changes. The STE—M-1/FVS or STE transition system (STE-T) is an interim step in the evolution of the simplified test system. The second generation system is called simplified test equipment-expandable (STE-X).

The STE-X will combine the capability of all its predecessors as a baseline for a new test set with much greater expansion flexibility. This will allow standardization of a single test set for all present and future combat vehicles. One of the key features of STE-X will be external plug-in modules (figure 2). STE-X development, initiated in 1981, is anticipated to be fielded about 1985.

The STE—M-1 core hardware is con-

Figure 2.

tained in two carrying cases. An additional five cases of sensors, adapters, and cables are required to interface with the *M-1* tank in spite of the fact that it was designed with a multiplicity of built-in test connectors to "simplify" the interface (figure 3).

Vehicle Testability. The effectiveness of the test set will be greatly influenced by the ease with which it can be connected to the vehicle. In many instances, testing cannot be performed unless test points have been built-in.

The STE—M-1 illustrates the relationship between the test set interfacing hardware and vehicle testability features. The *M-1* is the first tank to provide extensive testability features, and the first vehicle to make use of ATE. By examining the resulting STE—M-1 interfacing hardware, much can be learned about vehicle testability and standardization requirements. This hardware includes transducers/fittings, stimuli, standard test interface cables, T-cables, and cable connector adapters.

Each item is analyzed below to establish why it is needed and how it can be optimized. There will probably always be some transducers that are part of the test set. These sensors will not be built-in because they are too expensive, not reliable enough, the requirement measurement frequency will not justify the cost, or the test areas are easily accessible. The fittings on the other hand, can be eliminated by standardizing the thread interface on the vehicle with the transducer thread. In general, test points should be provided at accessible locations where built-in transducers cannot be justified. Plugged T-fittings or quick disconnects should be incorporated to improve hookup time, where appropriate. When a built-in sensor is not warranted and the test point location is inaccessible, consideration should be given to plumbing the test point to an easily accessible test point panel.

The remaining three interface items relate to diagnostic connectors and vehicle electrical cables. A diagnostic connector (DC) is a single termination of various electrical and transducer test points at a convenient location, and is the interface between the test set and vehicle.

Tests performed by a rapid hookup to a diagnostic connector are called level 1 tests. Figure 4 shows a simple example of a junction box containing a diagnostic connector and one of its circuit legs. The replaceable modules in this example are the junction box, control panel, and interconnecting cable.

Unfortunately, the replaceable module cannot always be diagnosed through the level 1 diagnostic connector.

Figure 3.

The information available at a diagnostic connector generally enables verification of proper system operation. In other words, if the signal leaving the junction box and the corresponding return signal are measured to be correct, the particular circuit involved can be called good. If the proper signal leaves the junction box and the return signal is there, but does not have the right level or waveform, more than likely the failure is in the control panel. However, if the proper signal leaves the junction box and no signal is returned, the failure could be the control panel, the cable, or the junction box itself at the connector.

In order to positively locate the failure, it is necessary to break into the interconnecting cable at the commander's panel (figure 5). This is called a level 2 test and requires a T-cable to break into the line and make the measurement while the system is operating. The T-cable used in a level 2 test must have the same connector as the cable being measured. Therefore a standard T-cable, for all vehicle cables that has adapters to convert the T-cable connectors to a specific vehicle connector, is needed.

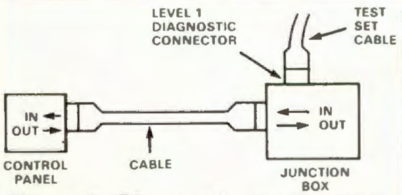


Figure 4. Diagnostic test process - level 1 test.

Many of the cables involved in a combat vehicle are branched, as opposed to point-to-point. Consequently, some of the cable connectors contain up to 61 pins and the other end of a particular circuit may show up in one of several branches of the cable. It is unrealistic to expect a mechanic to "wring out" these cables with a multimeter while the cable is installed in the vehicle because it would be a difficult job even for a technician working at a bench. Therefore, it is necessary for the test set to be able to do an automated test of these cables through a hookup as shown in figure 6.

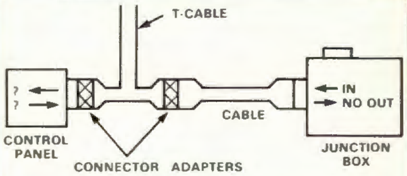


Figure 5. Diagnostic test process - level 2 test.

It is significant that, even if vehicle testability provisions are optimized, there is still a need, though significantly reduced, for a complement of adapters, stimuli, and cables. It is becoming evident that to effectively "fix forward," under a wartime scenario, a built-in diagnostic capability for at least first-order-of-fault isolation is required. Furthermore, the trend toward the increasing complexity and bulk of the combat vehicle electrical system must be reversed if the combat availability of Army vehicles is to be maintained. This points toward a multiplexing concept as the ultimate solution to many of the problems described above.

Multiplexing. This is not a new technology. Multiplexing has been used in aircraft since the early 1960's, and more advanced systems are found in spacecraft and on Navy ships.

As the wiring or data transfer requirements of a vehicle system increase, multiplexing becomes cost-effective even though there is a cost associated with getting on and off the multiplex bus. However, current electronical technology improvements have reduced multiplexing costs while vehicle trends have driven data transfer requirements upward to the point where multiplexing can be cost competitive compared to conventional wiring.

A multiplexing concept for application to combat vehicles is presently in advanced development. The system is called advanced techniques for electrical power management, control, and distribution systems (ATEPS). A unique feature of this system is that it controls power distribution in addition to data transfer. An installation sketch of the ATEPS using an *M-1* tank as a test bed is shown on page 15.

Crew input to the bus is provided by crew terminals which integrate all control functions in a single panel and contain the needed electronics to enter the bus. The vehicle wiring is simplified because the bus loop, in effect, cleans out the multiplicity of wire harnesses in the center of the vehicle, where it is very difficult to gain access, and replaces them with a bus loop. The harnessing from the remote terminals to the components is conventional, but shorter, simpler, and more accessible.

Perhaps, the most significant benefit that comes with the multiplexing system is its ability to diagnose itself. Since the system is "smart," it can, in effect, determine most of its own malfunctions. Although the multiplex system may not always be able to identify the exact failure, it will at least provide a malfunction warning and indicate the general area of failure.

The ATEPS has the potential to provide total integration of all tank subsystems as shown on page 15. The payoffs anticipated relative to the conventional electrical system are decreases in the number of control and display panels, maintenance actions, interconnecting wiring, and an increase in reliability. ATEPS prototype hardware being installed in an *M-1* hull for demonstration and initial concept test is expected to be operational in early 1982.

Future Projections. Remove-and-replace repairs to the vehicle can be effectively accomplished "by the numbers" without knowledge of how the system works. However, this is not completely true for vehicle troubleshooting.

Experience has shown that the diagnostic process is extremely complex due to the extensive number of interrelationships that can occur in a malfunctioning system. The ATEPS can probably routinely diagnose 90 percent of the faults that occur. However, location of the remaining 10 percent will require system knowledge and deductive logic aided by some probed test points. It appears that, in the future, the addition of a technically trained diagnostician is needed to support the mechanic. This concept is supported by experience with aircraft systems that have been highly sophisticated since the 1950's.

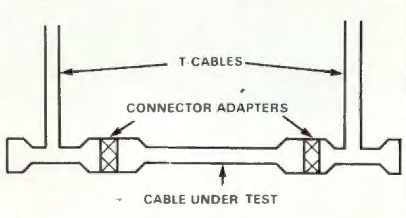


Figure 6. Cable test.

The increased wiring density in the combat vehicle is in conflict with the volume available to contain the wiring and connectors. In many cases, the physical space requirements for connections to electronic boxes are a constraint to the minimum packaging size. More significantly, the diagnostic problems created by sheer wire quantity and accessibility will drive future combat vehicle design toward a multiplex power distribution and control system. The battlefield need for an immediate assessment of vehicle condition and extent or location of failures will also drive the system toward the multiplex concept to provide an on-board diagnostic capability for at least first-order-of-fault isolation.

Prognostic Capability. Diagnostics applies to locating faults in a failed system after the fact. The real objective, however, is to prevent the failure from occurring in the first place, which is especially critical during a combat mission. In many cases, an early minor adjustment or repair could prevent a costly catastrophic failure later.

The multiplex system readily lends itself toward incorporation of prognostics that can be used to predict when failures will occur. Techniques for developing progostics involve measuring trends over time or measuring the system's aging process based on the cumulative damage resulting from a broad range of stresses such as time, activity, inactivity, transients, vibration, physical abuse, etc.

The first priority for prognostics would be vehicle functions that are combat essential; i.e., those systems which will cause a mission failure. Second priority would be the high-cost or maintenance-intense systems.

Trends toward increased vehicle versatility and capability are increasing vehicle sophistication and complexity of the electrical system. On the other hand, limitations in personnel resources and training time have generated a task-oriented, self-paced training program void of theory of system operation.

Highly-mobile, agile weapon systems have resulted in greater battlefield fluidity. As a result, damged or failed combat vehicles must be rapidly assessed to determine if the repair can be accomplished forward, or if the vehicle must be evacuated.

In order to maintain the desired vehicle availability on the future battlefield, a balance must be achieved between the design of the combat vehicle, test support equipment, and the mechanic and his training.

The combat vehicle of the future must incorporate a multiplexed power distribution and control system that provides an instantaneous readiness assessment, demand-maintenance indicators, and first-level, on-board, fault isolation to enable decisions to be made quickly as to on-the-spot repair or evacuation under combat conditions.

Vehicle design must provide a standardized rapid interface to an external combat vehicle ATE (STE-X) for further diagnosis, when required.

A higher skill level diagnostician may be required for vehicle failures that defy routine diagnosis.

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Continuous Operations

By Captain George R. Frank

> *"My men had been moving and fighting for 39 hours since leaving Ein-Hotsev. Before we could enter the perimeter, the dropped battalion had to lift mines and roadblocks. These jokers had posted a sign over the entrance: "International Boundary, Show Your Passports." I noticed that no one with me laughed and I took it as a sign that we were wearing fine. Some of my officers had gone 3 nights without sleep—I hadn't closed my eyes in 70 hours.*
>
> *"At 2300 hours, after getting a full report on the local situation, I called all commanders together to issue orders for the organization of the expanded camp and for completing the capture of Mitla Pass. I still felt fairly good—maybe that was because I had ridden near the front of the column where the dust, and consequently, the fatique had been less. What I planned to do was tell them that we would again carry on at about 0400. That would get us to the Pass by first light, and I figured that 5 hours sleep would be enough.*
>
> *"But I didn't get the words out. As I started speaking, I looked at the men facing me. Every man was sleeping. At that, my words blurred and I toppled over. Nature simply took over. I slept for 4 hours and 15 minutes. I could have used more, but an air drop came in and one 600-pound bundle landed 3 feet from my head. That wakened me and reconvened the conference."*
>
> *Decision in Sinai,* by Lieutenant Colonel Moshe Rose as told to Brigadier General S. L. A. Marshall.

While advanced technology has developed weapons systems that are able to operate with little "down time," man, on the other hand, remains the same fragile organism he has been since the beginning of time. Man then is the "weak link,"—the most vulnerable, but also the most vital component of any of our weapons systems.

When discussing the factors that degrade crew performance it is desirable, for the sake of simplicity, to categorize these factors into two broad areas; physiological and psychological.

Physiological Performance Degraders

Fatigue is probably the foremost degrader of performance. It can be easily understood that in a modern battlefield environment, with the capabilities of advanced weapons systems, man will be the only part of the system unable to sustain long periods of operation. Very little research has been done in this area and nearly all the studies that have been done are based primarily on noncombat situations, usually involving aircraft or naval crews performing technical tasks. There are however, several recent studies on which the recommendations of this article are based.

A recent experiment in England (Exercise Early Call) tested the effects of fatigue due to sleep-loss.[1] In this study, three platoons of infantrymen were tested. One platoon was given 3 hours sleep per night. A second platoon was given 1½ hours of sleep each night, and the last platoon was deprived of all sleep.[2] Over a period of 9 days the platoons were required to develop and improve several battle positions, go on ambush and reconnaissance patrols, and defend their battle positions. The platoon that received 3 hours of sleep each night remained an effective combat force throughout the entire 9-day exercise with only unrelated medical problems causing the loss of personnel.[3]

The platoon that had received only 1½ hours of sleep each night progressively lost energy, personal initiative, group coherance, and organization, until after 4 days they were able to rally only to immediate challenges. On the fifth day, they lost 50 percent of their personnel due to extreme fatigue and exposure.

No one from the third platoon, which was deprived of all sleep, completed the test. From the end of the fourth day until the middle of the fifth (after a period of 90 to 104 hours of continuous wakefulness) the entire platoon was gradually withdrawn from the test because of extreme fatigue and the inability to stay awake. Even after three days, or 72 straight hours of wakefulness, most of the platoon had ceased to be an effective combat force.[4]

Another significant result of the test showed that about 9 percent of the "sleep-deprived" and "1½ hour-sleep" groups reported unusual visual experiences or hallucinations after 3 days, they were unable to communicate verbally, their sight was restricted, and their auditory senses virtually unstimulated.

Studies indicate that performance and efficiency begin to deteriorate after 14 to 18 hours of continuous work and reach a low point after 22 to 24 hours. Performance improves somewhat during the next 8 to 10 hours but begins to decrease again thereafter.[5] After 24 hours of continuous duty at a new or a monotonous task, degradation of performance becomes evident. Most tasks involving cognitive or perceptual skills, such as planning or interpreting complex data, begin to show a performance degradation after 36 to 48 hours of continuous wakefulness. Seventy-two hours of wakefulness is about the limit of endurance, after which personnel cease to be effective.

Schedules of sleep/work are also important factors in determining the amount of sleep loss that will impair performance.

Twenty-four hours of wakefulness will impair performance if it is imposed on a crew that has completed a week on a

4-hour work—2-hour rest schedule.[6] The same 24-hour period of wakefulness will cause impairment to performance of crew on a 4-hour work—4 hour rest schedule, after 2 weeks on the schedule.[7] This indicates that crews on a "4-off-4-on" schedule are less affected by sleep loss than those on a 4-on—2-off schedule.

The jobs that sleep loss affects most seem to be jobs that require monotonous tasks, jobs requiring continuous attention, tasks performed on a time-shared basis with other tasks that are relatively unlearned.[8]

In order to minimize the effects of sleep loss, the commander must be able to recognize the signs of sleep loss on performance. These effects are noticeable as: slower reaction time; increased time to perform a known task; short-term memory decrement; impairment in learning speed, reasoning, and complex decision chain; errors of omission; lapses of attention; irritability; depression, and erratic performance.[9]

It has been demonstrated that the diurnal cycle (day/night cycle) has a significant effect on performance.[10] When personnel become used to a set pattern of work/rest periods, where rest periods occur at the same time each day, they become adapted to this schedule. Any deviation to this schedule that changes the rest period will result in performance decrements. Biological adaptation to work/rest schedules may take from 20 to 30 days.[11]

To employ a work/rest schedule during the heat of battle is out of the question; however, a strictly-enforced sleep plan is vital when possible, for example when occupying and preparing a battle position before enemy contact or during assembly area operations. A work/rest schedule of 4 hours work and 2 hours rest will not degrade performance over a period of a few days but will be less effective than a 4-hour work and 4-hour rest schedule in the long run.[12]

A recommended sleep plan would furnish each soldier with a minimum of 4 hours rest each 24 hour period. This would not, in all probability, be as effective over long periods of time as a sleep plan where personnel would receive 6 or more hours. Four hours rest for each 24-hour period would probably sustain personnel for several weeks if they did not have jobs that require complex decision making, but they would probably begin to show signs of exhaustion after 2 weeks. For periods of 1 to 2 weeks, a unit could possibly maintain combat effectiveness on 3 hours of sleep per 24-hours. This appears to be about the limit, however.

For personnel in highly-technical jobs that require constant monitoring or vigilance, a rest plan of 4 hours on and 4 hours off would be best. Anything less than 4 hours would result in a decrease in vigilance and perceptive abilities.

Another aspect of sleep loss that must be considered is the time required for recovery from the effects of sleep loss. If a commander knows his unit will be undertaking a long period of combat or prolonged work, it is recommended he give his personnel 12 hours of sleep or rest before the operation and awaken them no more than 2 hours before the operation begins.

After an operation of 36 to 48 hours of continuous wakefulness, 12 hours of sleep or rest is required to return personnel to normal functioning: however, subjective fatigue may linger for 3 days.[13] If a high level of activity, such as combat, is undertaken during this period, personnel may need two 12-hour rest periods to attain complete recover.[14] After 72 or more hours of continuous wakefulness, personnel may need as much as 2 or 3 days of rest for recovery of normal performance.

To minimize the effects of sleep loss, the commander has several options. Possibly the best solution for staff personnel is periodic breaks and mild exercise. Some of the exercises recommended are "Range of Motion" and "Strength and Stamina" exercises involving stretching and tensing muscles without requiring a lot of space.[16] Examples of these can be found in, *Biotonics, Stamina Through Six-Second Exercises That Really Work*. Among combat crews, the commander may rotate tasks if the crews are cross-trained. It must be noted, however, that varying tasks through job rotation works only if the jobs include tasks with different human requirements, (gunner to loader or driver).[17] Job rotation also requires a highly-trained crew if the jobs are complex. Prior to combat, effective training and experience will reduce the effects of fatigue.[18]

The two categories of personnel who can be expected to show signs of fatigue first are: the young immature soldier who is unsure of himself and the seasoned old soldier upon whom others have relied and who has sustained them at the cost of his own fatigue.[19] Commanders (leaders) often regard themselves as being the least vulnerable to fatigue, but in fact, tasks requiring the quick reaction, complex reasoning, and detailed planning, that they perform, make leaders the most vulnerable to sleep deprivation.[20] "The display of sleep self-denial as an example of self-control by leaders is extremely counterproductive."[21]

Once the battle has started and there is contact with the enemy, sleep plans, job rotation, and rest periods may become impossible. However, under the "Division '86" concept with four maneuver companies in each battalion, the commander may be able to rotate companies out of contact, enabling them to get at least a temporary break in which rest will be equally as important as maintenance and resupply. Currently, this could possibly be done at brigade level, pulling battalions out of contact for rest, rearming, and reconstitution. Care needs to be taken not to rely exclusively on the performance of certain individuals, teams, or units so that each are rested in turn.

Medicines provide another means for increasing performance during periods of fatigue, but the use of medicines to improve performance has largely been condemned in our society. It also must be realized, that no performance improving drug is without side effects and that frequent repetition can lead to serious consequences.

Caffeine from coffee, theophylline from tea, and theobromine from cocoa are purine derivatives. These substances, especially caffeine, excite the central nervous system. "Consciousness is brightened, thought association takes place faster and clearer, reaction time is shortened, motor actions are increased and feelings of tiredness and sleepiness disappear."[23] Muscular performance capability is increased most by caffeine and least by theobromine. "In cases where requirements exist for intensified performance capability for *short-term* operations several large mocca cups of coffee, direct caffeine, caffeine drinks, or cola preparations can achieve the desired goal although not without limitation. In cases where longer endurance periods are required, they show no improved results."[24]

Temperature is another performance degrader that has a profound physiological effect and a somewhat lesser psychological effect on soldiers during continuous operations.

Even though the human body is less adaptable to cold than to heat, cold has less of an impact when considering an armored vehicle crew's performance. Exposed infantrymen are more susceptable to cold injuries than tank crews because body heat and equipment-generated heat within the vehicle raise the ambient temperatures. Exposure to cold for 2 to 3 hours reduces hand strength 20 to 30 percent. If gloves are worn, manual dexterity is diminished, and the combat effectiveness of the armored vehicle is reduced. For leaders, continuous operations in cold weather require extensive logistical planning. Soldiers will need to be resupplied with additional clothing, fuel, and food, and, in extreme cold, they may require special equipment such as arctic parkas and mittens. For well-protected, well-fed soldiers, cold is probably more of a psychological stressor than a physiological hazard.[25]

Heat, however, is of much more concern than cold, and personnel in tanks or other armored vehicles suffer most from intense heat. As a general rule, any temperature above 90° F will degrade crew performance, and a wet-bulb-globe temperature (WBGT) of 85° is the maximum for effective crew performance. A WBGT of 81.3° is considered ideal, 85° is the maximum acceptable temperature for working conditions, and 90° to 95° will cause casualties.

Surface temperatures of areas with which the crew may come in contact can cause extreme discomfort or even blister the skin. For instance, during tests in the Yuma desert, surface temperatures reached as high as 155°, while WBGT measured 106°.[28]

When anticipating operations in hot climates, commanders and staff should plan for a 3- to 12-day period for troops to become acclimated.[29] Acclimation is faster if soldiers perform work or mild exercise rather than rest during the acclimation period. Physically fit troops acclimatize at a dramatically quicker rate than the unfit.

When a unit must operate "buttoned up" in mission-oriented, protective posture (MOPP) the problems of heat casualties are multiplied. Infantrymen are able to operate efficiently for only about 20 minutes in temperatures of 75° to 90°F where high energy expenditure levels are required.[30] This creates an even greater problem for armor crewmen, operating in an environment where engine, radios, and weapons are producing heat.

During a test of the *M-1* at Yuma Proving Ground, Arizona in September 1980, crewmen were exposed to an inside WBGT of 89°F and an outside (dry-bulb) temperature of 102°F.[31] They were clothed in full MOPP IV ensemble (protective mask with hood, chemical protective overgarments, gloves and boots) and conducted crew duties with blowers off and hatches closed. The crew simulated firing the main gun by loading and unloading a "dummy" round and traversing and elevating the turret. After 1 hour the crew lost effectiveness, and 20 minutes later the test was terminated for safety considerations. The test demonstrated that a tank crew, fighting "buttoned up" in a full MOPP ensemble, on a 100°F day will begin to show heat stress in less than 1 hour and experience heat casualties in less than 2 hours.[32]

To lessen the effects of heat stress, leaders should closely monitor NBC hazards and impose high MOPP levels only when necessary. In some situations it might be appropriate to wear NBC protective clothing over underwear, remove hoods, open hatches and turn on blower motors.

Dehydration creates the most ugrent problem in operating in a hot climate. At daily mean temperatures of 90°F, soldiers resting in the shade need 6 quarts of water per day.[33] Moderate work at this temperature raises the requirement to 8 quarts per day, while soldiers doing heavy work for 8 hours at this temperature need 12 quarts of water per day. At a daily mean temperature of 120°F, personnel resting in the shade need 17 quarts of water per day, while personnel working moderately hard will need 20 quarts, and soldiers working hard in the sun will need at least 25 quarts of water per day.[34]

The Israeli system of overdrinking is successful in combating dehydration. Each leader constantly insures that his personnel drink water. Water is consumed once an hour for temperatures below 100°F and twice an hour for temperatures above 100°F.[35] To insure proper water consumption a urine color check is made. Dark urine color indicates a water deficiency.[36] Soldiers should not be allowed to consume cold beverages that could reduce sweating and cause overheating. Alcohol consumption should be strictly forbidden as it requires extra water for the body to process.[37] Water loss can be reduced by the conserving sweat. This is done by wearing the complete uniform with the sleeves rolled down and the head covered. Clothing helps ration sweat by absorbing it and through

evaporation cools the body. Salt is also lost in sweat, but salt should be given only when recommended by medical personnel.

When operating in hot climates, soldiers require a minimum of 6 hours rest per day and 15 to 20 minutes of rest per hour when performing hard work.[38] It may be necessary to schedule periods of heavy physical activities during the night or early morning hours when temperatures are lowest.

Other factors that physically degrade crew performance during continuous operations are noise and overpressure. These factors are significant degraders of performance. There is little that commanders can do to lessen the effects of either of these factors, however it is important to know the causes and effects of each.

Noise is an occupational hazard that especially affects armor crewmen. Not only is noise an annoyance but it interferes with communication, and if the noise is experienced for long periods it may cause temporary hearing loss.[39] Therefore, commanders should enforce the wearing of protective devices even though these devices restrict and inhibit communication.

Overpressure caused by large explosions nearby is similar to noise and results from the pressure waves in the atmosphere. Overpressure may cause lung hemorrhage, eardrum rupture, and air bubbles in the blood stream.[40] Personnel in armored vehicles are somewhat protected. In foxholes personnel may receive greater overpressure than in the open due to the reduction in square area at the bottom as compared with the opening, creating a funnel effect. Nuclear bursts will likely cause large numbers of casualties by overpressure. Conventional munitions create mainly an annoyance but may burst eardrums.

Psychological Performance Degraders

Psychological Stress is an important area of discussion when considering factors which degrade performance. What causes stress? Simply put, stress is caused by a situation in which adjustment is difficult or impossible to overcome but the motivation to overcome the situation is strong.[41]

The primary stress of the battlefield is the fear of disfigurement, mutilation, intense pain, death, or even fear of loosing face within a peer group. Fear is universal in combat and it is accepted that everyone will experience fear. It becomes a problem, however, when it seriously degrades performance or leads to bizarre behavior.

In the next war commanders must be prepared to deal with large numbers of psychological casualties within the first few hours, due to the vast destructive potential of modern weapons systems and the extreme violence and speed of the modern battlefield.

There seems to be a close association between neuropsychiatric casualties and "wounding rates." Studies have also indicated that the intensity of the conflict as well as the time spent in combat are big factors. Lastly, the relative activity or inactivity of the soldier is closely related to neuropsychiatric casualty rates.[42] Stalemate, inability to retaliate, and idleness cause a marked increase in the number of neuropsychiatric cases.

A. J. Glass has stated that fear and exhaustion during intense combat will surface eventually and almost everyone has a breaking point.[43] A breakdown of pyschological defenses against fear is evident in over 50 percent of nonbattle casualties. He divides these casualties into five groups.

In *Group I* individuals report to the aid station with minor organic disease or injury that would result in little if any incapacitation. Their medical condition thinly disguises a pyschological breakdown.[44]

In *Group II* individuals have subjective complaints but negative findings—backache, headache, diarrhea, or weakness. Such symptoms represent an unconscious attempt to withdraw from an intolerable situation.[45]

In *Group III* individuals appear with self-inflicted wounds or other nonbattle injuries that could have been avoided, indicating either a conscious or unconscious attempt to flee the battlefield.[46]

Group IV contains the soldiers who have lost or broken eyeglasses or dentures, which will keep the men out of combat only temporarily.[47]

Group V soldiers are those suffering complete psychiatric breakdowns, who have lost their ability to cope with the situation of combat.[48] This group of casualties is completely ineffective.

Israeli experiences during the 1973 war have shown that elite units have fewer neuropsychiatric casualties.[49] This would seem to indicate the importance of unit cohesiveness, interpersonal relationships and esprit-de-corps.

There are many ways in which positive leadership may also play an important part in reducing the number of neuropsychiatric casualties. The spirit of the offense is a practical technique to reduce the impact of fatigue and fear. Purposeful, aggressive action brings relief from combat tension.[50]

Furthermore, a soldier's attitude and performance in training is related to his performance in combat. Realism in training improves a soldier's ability to withstand combat stress. Training should emphasize the sights and sounds of the battlefield. It should produce fear provoking situations that develop the soldier's knowledge of himself, his enemy, and his weapons.

Confinement is a potential stressor that may affect the behavior of the crew members when "buttoned up" for long periods of time.

Confinement may cause "status leveling." Because of the lack of privacy and the inability to maintain social distance between superiors and subordinates, authority may be undermined.[51] Anger, scorn, and ridicule may be directed at superiors. "Status leveling" reduces authority and the leader becomes only another member of the crew. Confinement may also foster territorial behavior, with possessive feelings toward certain locations or items within the vehicle.[52] The tank commander should allocate space with very explicit rules and use of resources.

Confinement in a "buttoned up" tank also causes problems of crew performance due not only to psychological stress but also to the physical limitations imposed on vision. Crowding causes stress through a disruption of individual "personal space."[53] In a hostile or stressful environment such as combat, the need for interpersonal distance between individuals increases. During daylight, target detection is degraded from 8 to 25 percent during closed hatch operation.[54] Navigation is degraded 8 to 26 percent and takes 11 to 40 percent more time,[55] while obstacle neogtiation takes from 21 to 99 percent more time.[56]

At night target detection is degraded 8 to 46 percent.[57] Navigation is degraded 14 to 39 percent and takes 19 to 54 percent more time.[58]

MOPP also increases the effects of confinement. A "buttoned-up" *M-60A1* allows only two crew members to don protective clothing at a time, one at the commanders station, one at the loaders station, and it requires 16 minutes even with practice.[59] The *M-1* Abrams has a smaller crew compartment, and thus, will require even more time, suggesting that crew members should wear protective clothing if there is a possibility of chemical warfare.

Infantrymen are also affected by long confinement in armored personnel carriers and fighting vehicles by temperatures, vibration, blast effects, acceleration and deceleration, high noise level, air pollution, sleep deprivation, and body restriction.[60] The effects of body restriction impairs movement for only short intervals after dismounting.

It is essential that we begin training to combat physiological and psychological stressors by realistic, stressful training. Leaders at every level of command must realize that a viable work/rest plan that includes commanders and staff must be implemented. Additionally, simulated neuropyschiatric battle casualties should be incorporated into every field training exercise and ARTEP to adequately train our personnel for continuous operations.

Whenever planning is being done by commanders and staff, emphasis must be placed on the human factor of every weapons system. Although training, proper planning, and other techniques may extend the amount of time a crew may remain combat effective, the human being is still the most vulnerable and valuable asset in the Army inventory.

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The Three D's of Reconnaissance

By Second Lieutenant Geoffrey C. Davis

Photo by John Arpin

The U.S. Army is weak in its ability to conduct battlefield reconnaissance operations because the Divisional reconnaissance squadrons are not operationally independent or fully organized for their true mission. Therefore, they lack the ability to gather timely data for the direction of combat operations on a highly fluid battlefield. Admittedly, reconnaissance is the duty of all troops, but *battlefield reconnaissance* is a highly specialized skill that requires audacity, courage, and clear thinking.

The purpose of this article is to approach battlefield reconnaissance from an armored cavalryman's viewpoint, and assess the mission of reconnaissance troops in a force that is becoming evermore committed to the timeless concept currently called *maneuver warfare*.

The mission of a battlefield reconnaissance force is to assist in the deployment and employment of supported tactical units based on the reconnaissance forces' ability to *detect* the enemy's disposition, *determine* the enemy's weakpoints, and *deceive* the enemy as to the supported unit's objectives and scheme of maneuver. These three considerations are interrelated and, when effectively accomplished, greatly increase the ability of a small mechanized force to disorient and disrupt a much stronger opponent.

Two points need to be made, though, before proceeding:

First, the following approach to combat accepts that engagements will be fluid, and rarely, if ever, setpiece. Enemy and friendly units will be mixed and meshed so that no clear delineation of lines and sectors will be possible in most low-level tactical situations. Rather, battle will be conducted in wide zones, while battlefield reconnaissance will be conducted in even wider tones (possibly to the extent of being out of radio communications range with the main body of friendly forces).

Second, this article does not pretend that cavalry or reconnaissance units are "fire brigades." Their mission is not to be frittered away in needless combat. Their goal is not to directly destroy the enemy, but to guide the concentrated firepower of the supported unit to that point from which it can take the enemy unit out of play. Hence, cavalry, unless it posesses vast superiority over an enemy, should not become locked in decisive combat.

On those assumptions, one can approach cavalry and reconnaissance operations from a challenging operational viewpoint. This viewpoint is based on the missions of reconnaissance elements: *detection, determination,* and *deception.*

Detection. According to FM 17-95, *Cavalry,* the mission of any reconnaissance force is to "gather information on which commanders may base plans, decisions, and orders. . .including surveillance; that is, systematic observation by any means." FM 17-95 has taken an incomplete approach to reconnaissance. The definition alludes to the *detection* aspect potential of such a cavalry force. Essentially, *detection* is the employment of these tactical techniques that enable a scouting force to find the enemy and discern his particular disposition. From a conventional standpoint, detection is accomplished through "systematic observation" of enemy activities, but it is done while minimizing contact with enemy forces.

The less a force is in contact the greater is its ability to move freely in and about enemy's rear and main battle area. Thus, the cavalry units are employed as heavily armed infiltration units that apply techniques similar to those of long-range reconnaissance patrols. They move into the enemy's zone of control and assess his intentions, strength, and posture, while avoiding unnecessary contact with his main battle forces. The mobility and firepower of an armored cavalry unit give it the ability to engage weak or "soft" targets of opportunity while disrupting enemy maneuver forces. The presence of a force in an enemy's rear will make the enemy more cautious and weaken his confidence in his ability to conduct coordinated operations. These factors will be especially evident in areas where the maneuver space is ample and units can move in "pocket-type" formations, whether in the offense or defense.

Gathering information and feeling, but not holding on to, the enemy force then is *detection*.

Detection operations also cause the enemy to become disoriented and ultimately enable the reconnaissance element to find a weak point, zone, or an aspect of the enemy's disposition that can be exploited by attack or counterattack techniques.

Determination. The ultimate goal of reconnaissance troops on a fluid battlefield is to "pull" the force they support along, rather than serving as a clearing party for a preconceived axis-of-advance. That is, cavalry units should *determine* the course of offensive operations, because the cavalry must find a weakness somewhere across the broad expanse of the enemy front for the supported force to exploit. As Moltke the Elder observed, operations should be planned in detail only up to the point of first contact with enemy forces. After that, the situation must dictate the focus of the fighting force's effort. Thus, reconnaissance units or cavalry have a mission of "guiding" the attack or counterattack by finding the enemy's weak points or gaps in his positions or formations "pulling" the attacking or counterattacking force to that point to strike into the enemy's rear at his lines of communications and his command centers. This indirect approach creates a decisive role for cavalry. Cavalry units must insure the success of exploitations by locating enemy's operational centers of gravity that, if destroyed, would cause his entire force to collapse or be taken out of play. These centers usually comprise command centers or lines of communication, but may be any of a number of things depending on a particular situation.

A short discussion of the "Focus of Main Effort" (FME) (the German concept of *"schwerpunkt"*) is most appropriate to the *determination* aspect of battlefield reconnaissance, because it is the basis for bringing forces to a particular area on the battlefield. The FME is that area or unit on the battlefield which is most likely to exploit the enemy situation, and it is *the unit* to which *all* secondary efforts provide support. The task of determining the FME falls to the cavalry because they must find the *schwerpunkt's* area at the start of operations and continue to determine changes in enemy weakpoints as the situation develops. The FME is not oriented on a physical objective, but on that weak point where an attack is most likely to take the enemy unit out of play by breaching a gap in his line and breaking into his rear. The purpose of *schwerpunkt* is to focus all efforts on the enemy force via his weakpoints and center of gravity, as opposed to concentrating on purely physical objectives, or conducting a battle of attrition against his concentrated combat power.

Throughout all of their operations cavalry forces must perform a third, vital, function that is directly linked to *determination* and *detection.*

Deception. During the course of offensive and defensive reconnaissance operations, cavalry and scout units also have the opportunity to conduct deception operations by executing screening operations that can add to the enemy's confusion and disorientation on a fluid battlefield.

Cavalry or reconnaissance unit screens provide a buffer against enemy operations and a mask for friendly operations, thus greatly improving the ability of the supported friendly force to manuever freely.

An enemy facing a well-executed screen, will most likely be forced to show his intentions in a particular area and lose the element of surprise maneuvering against friendly forces. Moreover, a screening force, covering a fairly deep zone, and even intermingled with enemy units, will invariably make the enemy more cautious, or at least force him to make a decisive committment to a particular operation without having complete grasp of the friendly situation.

An effective screening force also can provide a "wall" between friendly and enemy forces, thus preventing many probing operations from becoming sizable penetrations. An enemy reconnaissance unit contending with an effective screening force would no doubt shape much of its reported data from contact or observation of that force. Such a screen would add to the operational flexibilty of a supported unit, because screening troops would buy time and gain valuable information for the supported commander in both offensive and defensive operations.

A third, more active, mission for a screening force is reconnaissance-in-force (RIF). Heavy cavalry screening forces can be concentrated in particular areas to engage an enemy force and gauge the enemy's reaction. A RIF operation can be performed in two ways. The RIF element can break into the enemy rear and conduct an exploitation by destroying operational centers of gravity, or it can serve as bait to focus enemy attention or committment, to provide friendly forces an opportunity to counterattack or mass their efforts in another area.

The "three D's" of battlefield reconnaissance afford the maneuver units of the Army more than just the opportunity to find the enemy. Rather, they can sow the seeds for his defeat during an attack or counterattack. Battlefield reconnaissance provides a means for the cavalry to search out an enemy's weak points and lay the foundation for massed force to disrupt or destroy his operational centers of gravity, thereby defeating him.

Detection, determination and *deception* provide a different approach to cavalry operations, and audacious leadership and thoughtful tactics will mold these concepts to fit each particular situation. Battlefield reconnaissance is not a formula for success, but a tactical concept meant to complement the capabilities of mechanized forces fighting on a fluid, ill-defined battlefield.

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Armor

By Captain

Armor Aviation today is an integral part of the combined arms team. But most company grade officers have little knowledge of the capabilities and limitations of these assets, and battalion and brigade commanders still use them as they were used in Vietnam. It is time we stop looking back and start looking ahead at the role armor aviation plays in the combined arms team.

Today, 61 percent of all Army aviation units are air cavalry troops and attack helicopter companies, and 51 percent of all Army aircraft are in these units.

As maneuver elements, air cavalry and attack helicopter units enhance ground force capabilities by complementing the ground tactical plan. The attack helicopter company is the swiftest and deadliest maneuver unit on the modern battlefield, while the air cavalry troop is highly flexible and provides the ground commander with unique reconnaissance and security capabilities.

Armor combat aviation has long provided high-speed, extremely maneuverable, firepower that is readily available to, brigade, task force, and company team commanders. However, these commanders have misused and, more importantly, failed to use this combat resource to its full advantage.

To clear up the misconceptions ground commanders express about armor aviation, the following points are emphasized:

- The employment of air cavalry is very similar to armored cavalry employment; the employment of attack helicopter companies is very similar to the employment of tank companies.
- Although all *AH-1 Cobras* have basically the same airframe, and to the layman look alike, each version of the aircraft has different weapons systems and capabilities.
- Most armor aviation units are normally assigned to division and corps because of their high maneuverability and attendant logistical requirements.

The missions of the air cavalry troop and attack helicopter company can be compared to those of the armored cavalry troop and the tank company.

The Air Cavalry Troop (figure 1), performs the same mission as the armored cavalry troop — reconnaissance, security and economy of force, — but extends those capabilities over larger areas using their scout and attack helicopters. As the tank protects the armored cavalry scout in the *M-113* armored personnel carrier, the *AH-1 Cobra* gunship protects the air cavalry scout in an *OH-58* scout helicopter. While the air and armored cavalry units have an antiarmor capability, that is not their primary role.

Antiarmor is the primary mission, however, of the attack helicopter company (figure 2). In many ways it is similar to the tank company as it maneuvers and employs massive fires against enemy armor. But, the attack helicopter company can extend these capabilities over a larger area much faster than a tank company can.

Although the attack helicopter company like the air cavalry troop employs the aerial scout, his mission differs from that of the air cavalry scout.

While the air cavalry scout finds the enemy, the attack scout formulates the plan to annihilate him. The attack scout recons routes, holding areas and firing positions then takes control of the engagement by observing the threat area, providing target data to the gunships and directing the employment of their firepower.

The Cobra. The *AH-1G Cobra* is the original model of the series and all subsequent versions have improved on its capabilities. It saw extensive service in Vietnam combat and initial improvements were first based on lessons learned there. It does not mount the TOW system.

The *AH-1Q* model, is an *AH-1G* model equipped with a TOW missile capability and an infrared suppression system to

Aviation

Thomas H. Trant

protect against heat-seaking ground-to-air missles. The Q model was developed specifically for employment in Europe and was an interim solution until the *AH-1S* was developed.

The *AH-1S Cobra* is the newest model with four variants: the *Modified-S, Production-S, Enhanced Cobra Armament System (ECAS),* and *Modernized,* each of which incorporates modifications that enhance its mission capabilities over its predecessors.

Basically, the *Modified-S* is an *AH-1Q* model with flat plate canopy, infrared absorbent paint and suppression system, more powerful engine and drive train, and improved avionics and weapon systems. The *Modified-S* was created by adding conversion kits to existing airframes.

The *Production-S* is an *AH-1G* completely rebuilt with upgraded versions of all S-model subsystems plus a night vision goggle (NVG) system.

The ECAS variant is a *Production-S* model armed with either a three-barreled 20-mm cannon or a 30-mm Chain Gun® mounted in the nose turret.

The *Modernized* version has all of the features of the ECAS plus an improved rocket targeting system that greatly improves the accuracy of 2.75-inch rockets. The *Modernized Cobra* also has a heads-up display that enables the pilot to view the gunsights and critical flight instruments while maintaining his field of vision outside the cockpit.

The key point is that all *AH-1S* model *Cobras* have antitank and antipersonnel capabilities and the four variants may be found in air cavalry and attack helicopter units alike. Plans exist, however, to eventually convert all *Cobras* to the *Modernized* version.

Logistical Considerations. Air cavalry troops and attack helicopter companies consume huge amounts of fuel and ammunition. An air cavalry troop or attack helicopter company can easily burn 10,000 to 15,000 gallons of JP-4 aviation fuel in less than a day if not properly managed. The planning figures for fuel consumption for the *AH-1* is about 112 gallons per hour, while the *OH-58* burns about 30 gallons per hour. Put into perspective, one air cavalry troop requires about 5,400 gallons to refuel all of its aircraft after one full 2-hour flight. An attack helicopter company requires a little more than 5,800 gallons for the same flight time. Supplying those quantities of fuel is beyond a brigade's capabilities, especially considering how many flights aviation units can make in one day. Consequently, armor aviation assets depend on division and corps for class III resupply. The same holds true for class V.

The basic loads of air cavalry troops and attack companies contain TOW missiles as well as many different varities of 2.75-inch folding-fin aerial rockets (FFAR) and gun ammunition. (See figure 3 for the various ordnance loads that can be carried by the *AH-1* series.)

An air cavalry troop or an attack helicopter company in heavy contact can expend its basic load in a matter of hours. In fact, an air cavalry troop in heavy contact requires 47 tons and an attack helicopter company requires 63 tons of class V resupply per day — the latter amount of ordnance being equivalent to the bomb load of a flight of 20 World War II *B-17* bombers.

Tactical Employment. Both air cavalry troops and attack helicopter companies are usually division or corps assets. An air cavalry troop is normally part of a division cavalry squadron. An attack helicopter company is usually part of a divisional combat aviation battalion, or an attack helicopter battalion within that division.

An air cavalry troop is normally employed at division level. However, in some rapid deployment force (RDF) units that have an air cavalry squadron, the troops will be placed under operational control (OPCON) of a brigade to become part of the force package. Once the remainder of the division's assets arrive at the deployment area, the squadron will revert back under division control. In a movement to contact, an air cavalry troop will employ its reconnaissance assets as far forward as necessary to afford the division the maximum reaction time. A distance of 60 kilometers ahead of the main body is possible in the reconnaissance role.

An attack helicopter company, on the other hand, is normally placed under OPCON of a brigade, but it can be held in division reserve. It is not uncommon for an attack helicopter company to attack targets 40-60 kilometers from the forward line of troops. Its responsiveness to the battle, maneuverability, and tremendous fire power make the attack helicopter company the most devastating antiarmor asset on the battlefield.

Flight Modes. Current Army combat aviation flight modes are designed to afford air cavalry and attack helicopter units maximum security and fuel economy for increased time on station. There are several combat aviation flight modes — low-level, contour, and nap-of-the-earth (NOE). The choice of the flight mode to be used is dictated by the type and density of the enemy's air defense on a particular segment of the battlefield and the factors of METT

Low-level flight is defined as having a constant speed and altitude, and is employed usually 25 or more kilometers behind the forward line of troops (FLOT). Low-level flights usually are made at a maximum altitude of 200 feet above the terrain, and offer the best fuel economy while affording the least security. Low-level flying is used in division and corps rear areas because speed is more important than security.

Contour flight is defined as having a constant airspeed and variable altitude, and is used from 20 to 8 kilometers behind the FLOT. Contour flight follows the contours of the terrain at a minimum altitude of 50 feet. This type of flight increases security but decreases fuel economy. It is used from the forward area rearm, refuel point (FARRP) to within 8 kilometers of the FLOT where speed and security are equally important.

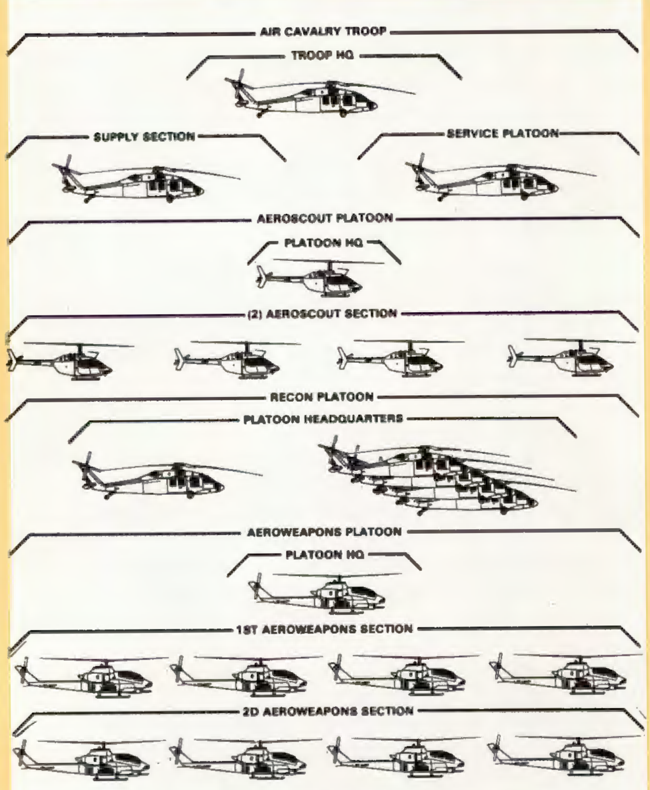


Figure 1. Air cavalry troop.

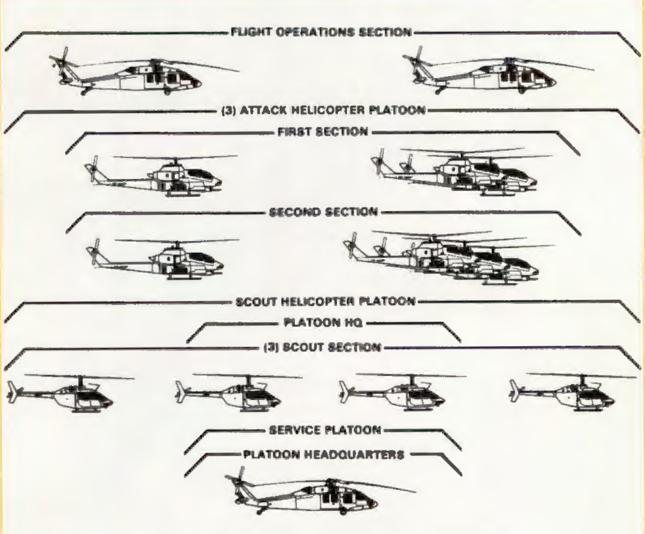


Figure 2. Attack helicopter company.

NOE flight is normally at treetop to ground level, with a latitude in airspeed of from 0 to the maximum attainable. NOE is the most secure flight mode, but fuel economy is severely degraded. The rule of thumb for NOE flying is, "The lower you go, the slower you go." NOE is used where security is more important than speed near the FLOT. Consequently, combat aviation units complementing the ground tactical maneuver plan will employ NOE flight and overwatch techniques very similar to that of ground units when contact is established or likely.

Weapons Systems. Although the TOW missile is the primary antiarmor weapon system on board the *Cobra,* the 2.75-inch rocket system, and the turret-mounted gun systems are devastating weapons.

The 2.75-inch rockets can be employed directly or indirectly as an area-fire system. Since most direct-fire rocket engagements are made from the hover, 2.75-inch rocket fire is more suited for area rather than point targets because the slower the foward airspeed, the less accurate the rocket fire. The air cavalry employs the rocket system to cover the scouts because the rockets can be fired quickly and, from 500 to 1,500 meters, are fairly accurate.

When it is used for indirect fire, the 2.75-inch rocket adds to the capabilities of the armed helicopter. The rocket's maximum range is about 9 kilometers, though its most effective range is about 5 kilometers or less. Rockets can be delivered quickly in response to request for fire from air or ground elements using essential elements of an artillery call-for-fire. The maneuverability of the attack helicopter makes it relatively safe from counterbattery fire. For example, a *Cobra* can fire a mission, move a kilometer from that firing point, and fire again in less than a minute.

Normally, an *AH-1S* carries 38 rockets as wing stores in two inboard pods, but if the TOW missile launchers are dropped, two more rocket pods holding 38 rockets can be added as outboard stores providing a total load of 76 rockets. The 2.75-inch rockets can be fired in one, two, or four pairs, or in salvo. Salvoing 76 rockets at one time is possible but not very economical.

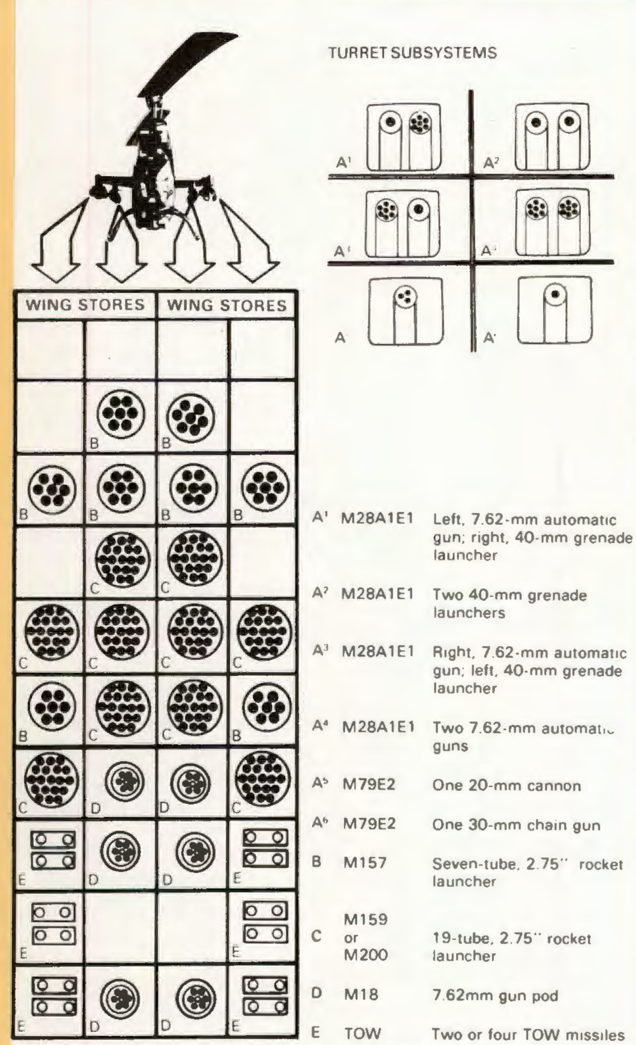
The turret weapons in the *Modified-S* and *Production-S Cobra* mount the 7.62-mm minigun, 40-mm grenade launcher, or a combination of both. Both the minigun and 40-mm grenade launcher are area fire weapons, and are employed against troops in the open and thin-skinned vehicles. The rate of fire of the minigun is 2,000 or 4,000 rounds per minute. The

40-mm grenade launcher fires at 400 rounds per minute. When fired alternately, the minigun and grenade launcher are absolutely devastating.

Only the 20-mm cannon and 30-mm Chain Gun® are mounted in the turrets of the ECAS and *Modernized Cobras* respectively. Both are point-fire weapons and both are very accurate and destructive against lightly-armored and wheeled vehicles, and materiel.The rate of fire of the 20-mm cannon is 750 rounds per minute and from 100 to 475 rounds per minute for the Chain Gun® . The ranges of these weapons, in meters, are: 20-mm cannon — 2,000; 30-mm Chain Gun® — 3,000; 7.62-mm minigun — about 1,100, and 40-mm grenades — about 1,200.

Capabilities and Limitations. Until 4 or 5 years ago, all Army aviation units were considered ineffective at night and in bad weather. However, procedures for tactical instrument flying and requirements for all Army aviators to maintain a current instrument qualification have helped to expand the overall capability of aviation units. Also, emphasis on night flight training and NVG training is paving the way for a 24-hour, all-weather capability. Army aviation is not there yet, but new technology and equipment will eventually make it possible.

Meanwhile, aviation, and especially armor aviation units, are using all available assets for operating at night or during poor visibility. For example, NVG can be used to maneuver aircraft into position to begin an attack, set out observation posts (OP), and to airlift entire units into and out of the battle area at night. But the main problem of night operations centers on the inability to conduct reconnaissance and engage targets, using only NVG. This problem can be solved by air or ground launched flares, or with white or infrared light, provided by ground units.



A^1	M28A1E1	Left, 7.62-mm automatic gun; right, 40-mm grenade launcher
A^2	M28A1E1	Two 40-mm grenade launchers
A^3	M28A1E1	Right, 7.62-mm automatic gun; left, 40-mm grenade launcher
A^4	M28A1E1	Two 7.62-mm automatic guns
A^5	M79E2	One 20-mm cannon
A^6	M79E2	One 30-mm chain gun
B	M157	Seven-tube, 2.75" rocket launcher
C	M159 or M200	19-tube, 2.75" rocket launcher
D	M18	7.62mm gun pod
E	TOW	Two or four TOW missiles

Additional configurations are possible for AH-1S and AH-1G. However, they will use the same basic weapons systems.

Figure 3. Wing Store configurations and turret subsystems.

Unless the ceiling and visibility are zero, armor aviation can conduct limited missions such as delivering direct or indirect 2.75-inch rocket fire and turret weapon's fire against personnel and light vehicles, or inserting OPs and airlifting personnel in periods of inclement weather.

Armor aviation has a new sense of direction with the increased emphasis on the flexibility of air cavalry and the combat power of attack helicopter units, and these aviation assets can provide tremendous advantage to the maneuver capability of ground units.

Besides the antiarmor capabilities, the combat power of armor aviation is the key to unleashing the maneuver capability of the ground forces, especially when used jointly with close air support (CAS) aircraft. Air cavalry units can seek out enemy headquarters elements, antiaircraft artillery, electronic warfare (EW) systems, and rocket and tube artillery. Attack helicopter units can attack those targets, disrupting command and control, dissipating the EW and artillery capability, and puncturing the antiaircraft umbrella to enable CAS aircraft to add their firepower to the land battle.

But the limitations as well as the capabilities of combat aviation must be understood by ground unit commanders at all levels. Valuable time is wasted every time aviation liaison officers have to explain the difference between air cavalry troops and attack helicopter companies to battalion and brigade staffs. It seems almost shameful that personnel in ground combat units have a thorough knowledge of threat units, equipment, capabilities, and tactics, but lack the equivalent knowledge of their own combat aviation elements.

The situation must be corrected through training that integrates Army combat aviation with all other maneuver elements on the battlefield.

Armor aviation units are anxious to train with ground units. Instead of assuming the capabilities and limitations are the same as 15 years ago, ask the air cavalry troop or attack helicopter company commander to brief your unit on exactly what his capabilities and limitations are. He can provide the answers. Hopefully, this article will give you enough insight to ask the right questions.

CAPTAIN THOMAS H. TRANT was commissioned in Armor from the University of Richmond, VA in 1975. He served as tank platoon leader and as XO in the 3-77th Armor, Ft. Polk, LA before attending flight school. He served as aeroscout section leader, platoon commander and assistant S-3 (air movements officer) with 1-17th Air Cavalry, Ft. Bragg, NC. Currently he is attending the AOAC at Ft. Knox, KY.

The Army's Black Tank Battalions

by First Lieutenant Dale E. Wilson

In the early 1940s, a debate raged in the Office of the Chief, Army Ground Forces as to whether black soldiers should be included in the Armored Force being created at Fort Knox, KY.

The Armored Force argued against the idea of forming separate black tank units on the ground that it was not, technically, a separate branch, but a combination of arms and services already taking proportions of Negroes. In turn, Armored Force headquarters proposed using blacks in service detachments at Fort Knox. The blacks assigned to these units would work as chauffeurs, janitors, firemen, cooks, duty soldiers and bandsmen.[1]

On May 8, 1941, the unit to which the black tankers were assigned, the recently organized 78th Tank Battalion (Light), was redesignated as the 758th Tank Battalion (Light). While the 758th was the Army's first "Negro" tank battalion, not all of its members were black. (This was true of all of the black units formed during the war). The initial cadre of officers and noncommissioned officers (NCOs) were white — although the NCO positions were gradually turned over to black soldiers as more experienced troopes transferred in from the 9th and 10th Cavalry Regiments and newer soldiers earned more stripes.

The officer ranks were also integrated as the Armored Force Officer Candidate School turned out a number of black second lieutenants.

During this period, the battalion provided a cadre of officers and NCOs to form the nucleus of the 761st Tank Battalion (Light), which was activated April 1, 1942, at Camp Clairborne, LA.

Although there had been talk of forming an all-Negro armored division, that idea was shelved. Instead, the 758th and 761st were assigned to the 5th Tank Group, the last of five three-battalion tank groups organized during the war. It picked up its third black tank battalion when the 784th was activated in April 1943.

In September 1943, the 761st shipped out to Fort Hood, TX, where it dropped the "light" designation and picked up *M-4 Sherman* tanks for the three line companies and added a Company D equipped with *M-5A1* light tanks.

The 761st Tank Battalion. On June 9, 1944, 3 days after the invasion of Normandy, the 761st was alerted for overseas movement. The advance party sailed from New York Harbor on August 7, followed by the rest of the battalion 3 weeks later. After arriving in England, the battalion spent 3 weeks drawing new tanks and preparing equipment and men for transport to France.

During the remainder of October and the first week of November, the 761st moved across France to where the Third Army was stalled in front of Metz.

On November 2, General George S. Patton, standing atop a half-track, told the men of the 761st:

"You're the first Negro tankers to ever fight in the American Army. I would never have asked for you if you weren't good. I have nothing but the best in my Army. I don't care what color you are, so long as you go up there and kill those Kraut sonsabitches. Everyone has their eyes on you and is expecting great things from you. Most of all, your race is looking forward to you. Don't let them down, and, damn you, don't let me down."[2]

Within a week the black tankers were involved in what was, for them, some of the most vicious fighting of the war. On November 8, spearheading a major push by the 26th Infantry Division south of Metz, the 761st smashed into the German lines. Between November the 8th and 11th, the battalion forced the numerically superior enemy force to withdraw, but lost numerous tanks and 18 soldiers killed in action during the bitter battle.

The day before the battalion's first fight, its commander was shot and seriously wounded.

The loss of its commander before the unit even reached the front might have been enough to unnerve the men of the 761st, but this was followed by an even more unusual event. The first five tankers to die in the 761st were all members of the same crew. Their vehicle was found untouched, their bodies sitting upright at their crew positions marred by nothing more than surprised looks on their faces.[3]

The battalion kept up the pressure on the Nazis for 183 consecutive days. The black tankers fought as both a separate tank battalion and in company-sized task forces with the 26th, 71st, 79th, 87th, 95th and 103rd Infantry Divisions, and the 17th Airborne Division. They participated in major engagements in France, Belgium, Holland, Luxembourg, Germany, and Austria.

According to the Presidential Unit Citation presented to the battalion in April, 1978,[4] the black tankers distinguished themselves in a 5-day battle with the 15th SS *Panzer* Division near Tillet, Belgium, in January 1945, and again in March, when, acting as an armored spearhead, they broke through the Siegfried Line, paving the way for the 14th Armored Division's thrust to the Rhine River.

The citation credits the 761st with inflicting thousands of enemy casualties, and with "capturing, destroying, or aiding in the liberation of more than 30 major towns, 4 airfields, 3 ammunition supply dumps, 461 wheeled vehicles, 34 tanks, 113 large guns, 1 radio station, and numerous individual and crew-served weapons."

In accomplishing all that, the unit endured a 50 percent casualty rate — including 34 dead — and lost 71 tanks. Its men earned 11 Silver Stars, 69 Bronze Stars (almost all for valor) and 296 Purple Hearts.

As the war drew to a close, the 761st was the easternmost American unit in Austria, and linked up with Soviet forces at the Enns River near Steyr on May 6, 1945.[5]

The 758th Tank Battalion. While the soldiers of the 761st were linking up with the 26th Infantry Division in France, the 758th Tank Battalion moved to Camp Patrick Henry, VA, for transportation to Italy. They left on October 21 and spent 28 days at sea. In Italy, the battalion was attached to the 92nd Infantry Division and saw action in the North Appennines and Po Valley campaigns.

Unlike the 761st, the 758th was broken up and cross-attached as separate companies throughout its combat tour, and never fought as a battalion. The problem of fragmentation was so great for the 758th that the unit's wartime supply officer never saw or heard from the Mortar Platoon from Thanksgiving 1944 until after the war ended in Italy in mid-1945. This fragmentation posed a special problem to the historian because published source materials (including after-action reports) were practically nonexistant.[6]

The heaviest fighting the tankers of the 758th encountered occured during February 1945, when the 92nd Infantry Division battled across the Cinquale Canal.

An after-action report from the 760th Tank Battalion, to which most of the 758th had been attached, stated that during 70 hours of bitter fighting spanning the 7th through 9th of February, 20 tanks were lost — 16 from the 760th and 4 from the 758th.

Because of the rugged terrain, the 758th's light tanks were used almost exclusively in an indirect fire role in support of attacking infantry.

The war ended for the members of the 758th on May 5, 1945, although the unit stayed together in Italy until it was deactivated in September.

The 784th Tank Battalion. In late December, 1944, the 784th Tank Battalion entered combat attached to the 104th Infantry Division near Eschweiler, Germany. During early 1945, the 784th operated primarily in an indirect fire role or in division reserve, where the black tankers helped infantrymen learn tank-infantry tactics.

The battalion's after-action reports indicate that it encountered its heaviest fighting in March 1945, while attached to the 35th Infantry Division, which was pushing toward the Rhine from the Roer River. While supporting the 137th Infantry Regiment, elements of the 784th encountered stiff German resistance and the battalion lost 17 tanks and 24 men either missing or killed in action.

By war's end, the soldiers of the 784th had earned eight Silver Stars, 30 Bronze Stars, and 14 Purple Hearts. The unit losses were 22 tanks, 25 soldiers killed in action and four missing in action.

Postwar. After the war, the 761st was briefly reactivated as a training battalion at Fort Knox during the late 1940's. But it was up to the 758th to carry on, providing black soldiers the opportunity to serve in an active tank battalion.

Following 9 months of postwar training at Fort Knox, the 758th dropped its light tanks and became the 758th Heavy Tank Battalion. In June 1948, the unit was transferred to Fort Bragg, NC, and assigned to the 82d Airborne Division — the first tank outfit to be assigned as an organic element of an infantry division. Later, when the 2d Armored Division was reorganized at Fort Hood, the battalion became a part of that organization.

While all this was taking place, the unit underwent another name change, this time becoming the 64th Tank Battalion. The 64th Tank Battalion went into combat in Korea in 1950 — as part of the 3rd Infantry Division.

During those dark days, the black trooper's exploits shone as they helped extricate embattled Marines from the Cho-sin Reservoir, then held a perimeter defense as U.S. forces loaded out at Hungnam. As the last ships pulled out, engineers blew up the remaining port facilities on Christmas Eve, 1950.

Later, members of the 64th fought back in the north, earning praise from the infantrymen they supported. At one point, the 24th Infantry Division commander in a letter to the 3rd Infantry Division commander, said that the black tankers had done things with their tanks he hadn't thought possible.

By late fall of 1951, the rotation system was at work and the 64th was ordered to integrate, bringing it in step with the rest of the Army. Thus ended a period of 5½ years of post-World War II camaraderie for the Army's black tankers that spanned every imaginable condition in training and combat.

Today, the heritage of the Army's black tankers remains alive through the Combat Arms Regimental System in the form of the 64th Armor, units of which are now a part of the 3rd Infantry Division in Germany. They still wear the crest sported by members of the old 758th Tank Battalion — an elephant head above the words "We Pierce."

FIRST LIEUTENANT DALE E. WILSON enlisted in the Army in 1969. He served as an infantryman and combat correspondent in Vietnam and as an instructor at the Defense Information School. He was commissioned from OCS in 1978 and served as an armored cavalry platoon leader in the 194th Armored Brigade and as command information officer, Fort Knox, KY. He is currently assigned to 2-72 Armor, 2ID, Korea.

Footnotes

[1] Lee, Ulysses, *United States Army In World War II: The Employment of Negro Troops;* Office of the Chief of Military History, U.S. Army, Washington, D.C., 1966.

[2] Anderson, Trezzant W., *Come Out Fighting: The Epic Tale of the 761st Tank Battalion, 1942-1945;* Germany, Salzburger Druckerei and Verlag, 1945.

[3] Lee, *op. cit.*

[4] Members of the 761st battled for nearly 33 years after the war to have their exploits officially recognized. Finally, in 1977, a letter from a member of the 761st Veterans' Association to then-Army Secretary Clifford L. Alexander resulted in a 7-month search that uncovered historical records verifying the unit was, indeed, deserving of special recognition.

[5] From the text of the unit's Presidential Unit Citation.

[6] Most of the information about the 758th Tank Battalion appearing in this article comes from personal interviews conducted by the author, and from after-action reports of the 760th Tank Battalion, to which many of the 758th's companies were attached at various times during the war. Copies are available at the Armor School library at Fort Knox.

[7] Copies available at the Armor School Library.

British Army Introduces the Challenger

By Richard M. Ogorkiewicz

The British Army has recently began trials of a new battle tank called the *Challenger*. This new tank is to enter service with the Royal Armoured Corps in the middle 1980's and it's production is, in fact, already under way. These facts alone make the *Challenger* of considerable interest and importance and it is also of interest on account of its unusual characteristics.

To understand properly the characteristics of the *Challenger*, and the speed with which it is to be fielded, it is necessary to know the background to its development. This stems from a broad-based research and development program which the British Army initiated in the late 1960's with the aim of finding a successor to its current battle tank, the *Chieftain*. Responsibility for the program rested with the Military Vehicles and Engineering Establishment (MVEE) which, broadly speaking, is the British equivalent of the US Army Tank-Automotive Command (TACOM).

As part of this program, MVEE constructed in 1968 the prototype of the first tank ever to be built with an externally mounted gun. It also sponsored the development by Rolls-Royce of a novel rotary diesel as well as that of more conventional engines and of other tank components. However, all of this was overshadowed by the contemporary development at MVEE of a new type of armor that offered a dramatic improvement in the protection of tanks against shaped-charge projectiles and missiles.

Chobham Armor. The new armor was called Chobham after the location of MVEE and by 1971 its development had advanced to the state of it being incorporated in an experimental tank called *FV 4211*. (In effect, *FV 4211* was a *Chieftain* redesigned to incorporate Chobham armor. Nevertheless, it was the first tank in the world to incorporate special armor and it became the forerunner of a new generation of battle tanks with greatly increased protection.

The construction of *FV 4211* in 1971 led directly to the adoption of Chobham armor for the US *M1* tank, which was then being designed. But it did not lead immediately to the development of a new, Chobham-armored, tank for the British Army. This surprising failure by the British Army to exploit the technological breakthrough represented by

Chobham armor was mainly due to a decision taken in 1972 by the governments of the United Kingdom and the Federal Republic of Germany to develop a single battle tank for the armies of the two countries. The decision to embark on the joint UK-FRG battle tank program was taken for political and financial reasons, and it delayed the development of a new tank for the British Army by the time taken to explore the wide range of options proposed in the two countries.

The British contributions to the UK-FRG program included the designs of a tank with an externally-mounted gun and of a turretless tank with a semi-fixed gun mounting as well as a more conventional design of a turreted tank. However, the UK and the FRG failed to agree to adopt any one of the British and German designs. In consequence the joint program was terminated in 1976, when almost all it had done was to waste a lot of time and money, like several other attempts at international standardization.

MBT-80. In spite of the collapse of the joint program, the British and German Armies had agreed about one thing, namely that the conventional designs still represented the best option. Thus, both continued to develop battle tanks with a conventional turreted configuration. In the case of the FRG this meant the *Leopard 2* and in the case of the UK a new tank called *MBT-80.*

Design of the *MBT-80* started in 1977. In essence it represented a development of the *FV 4211,* which was built 6 years earlier. But instead of incorporating *Chieftain* components, it was based on completely new automotive and other components that had emerged out of the R&D program initiated in the 1960s. In 1980, however, it became clear that the time required to develop it meant that the *MBT-80* could not be made available to the British forces deployed in the defense of Central Europe until the 1990's. Moreover, the cost of it would be considerable. At the same time the growing threat posed by the deployment of new Soviet tanks made the production of a new tank for the British Army more urgent. As a result, development of the *MBT-80* was discontinued and in its place the British Army decided to develop another tank that could be fielded much more quickly. This tank became the *Challenger*.

FV 4030 Prototypes. The reason why the *Challenger* could be produced much more quickly than the *MBT-80* is that it was based on yet another tank, several prototypes of which had fortunately been built by 1979 and production of which had already been planned. This was all due to a requirement that had been made earlier by what was then the Imperial Iranian Army for a new tank to follow the several hundred *Chieftains* ordered from Britian in 1971.

The Iranian requirement led MVEE to develop not one but two new tanks, in addition to the designs it was developing at the time for the ill-fated UK-FRG tank program. The first of the two tanks for Iran was *FV 4030/2,* or *Shir 1.* In essence, this was a *Chieftain* redesigned to accept a completely new power pack, which made it much more mobile. The second tank was the *FV 4030/3,* or *Shir 2,* which was similar to *FV 4030/2* but had a new hull and turret-with Chobham armor.

Both tanks were ordered by Iran in 1974 but none had been delivered to it when the government of Shah was overthrown in 1979 and the order was cancelled. However, since then, *FV 4030/2* has been developed further, into the *Khalid* tank ordered by Jordan. In fact, some *Khalid* tanks have already been delivered to the Jordanian Army. On the other hand, *FV*

Loading a 120-mm APDS round into the *Challenger's* main gun. the combustible cartridge case, approximately twice as long as the shot, follows. Loading a self-contained round would be all but impossible in the restricted turret space.

4030/3 prototypes were taken over by the British Army to become the basis of the Challenger.

Evolutionary Design. All this makes it clear that the *Challenger* represents an evolutionary design that started with the *Chieftain,* from which it inherits its general configuration. This has been combined with Chobham armor, which initially resulted in *FV 4211,* and then with new automotive components, which were first installed in *FV 4030/2.* These two separate developments were then brought together in *FV 4030/3.* The latter was designed to an Iranian requirement but it was in the mainstream of British tank development and in many respects it was not very different from what the *MBT-80* would have been if it had been built. It was logical, therefore, as well as expedient, that the *FV 4030/3* should be followed by another step in the same sequence of developments and lead directly to the *Challenger.*

One of the consequences of its design being evolved from the *Chieftain* is that the *Challenger* has the same supine driving position. In consequence its hull, is shallow and this leads to a relatively low silhouette.

120-mm Rifled Gun. The turret of the *Challenger* is manned in the usual way by three men and mounts to a 120-mm *L11A5* gun as well as a 7.62-mm coaxial machinegun. The gun is the same as that, which for many years, made the *Chieftain* the most powerfully armed battle tank in the world. But in the future it is likely to be replaced by a technologically more-advanced and even more-powerful 120-mm rifled gun, which is being developed by the Royal Armament Research and Development Establishment (RARDE). In the meantime the well-tried *L11A5* gun is to be provided with armor piercing fin stabilized discarding sobat (APFSDS) ammunition which will make it capable of defeating considerably heavier armor than the existing APDS ammunition. In addition to kinetic energy (KE) rounds, the *Challenger* also carries high explosive squash head (HESH) or, high explosive plastic (HEP) rounds, which the British Army has always regarded as a more effective complement to KE rounds than high explosive antitank (HEAT) projectiles.

All the ammunition used with the 120-mm gun is of the separated type, which makes it easier to handle. In fact, when handling KE rounds the loader does not have to lift more than about 22 pounds at any time, in contrast to the 41 pounds of the one-piece rounds fired from the 120-mm gun of the *Leopard 2* and of the *M1E1.* Moreover, the cartridge cases are combustible, so that there is no "brass" or even stub cases to dispose of. The combustible cases are also less of a risk from the point of view of ammunition explosions. To reduce the risk still further the *Challenger* has the same stowage system as the *Chieftain,* which involves surrounding the propellent charges with jackets filled with water under pressure. The stowage provides for 42 charges if they are for KE projectiles or more if there is a mix of KE and HESH, and all the charges are stowed below the turret ring, where there is less risk of them being hit. It is worth noting, in view of the unhappy experience of the US Army with the combustible cases of the 152-mm gun/launcher ammunition, that the combustible cartridge cases developed by RARDE for the 120-mm guns of the *Chieftain* and *Challenger* have not created any similar problems.

Fire and Control Systems. To achieve a high hit probability, the *Challenger* is fitted with improved fire control system (IFCS) which, like other contemporary systems, incorporates an electronic computer and a number of sensors. The fire control system includes a periscopic gunner's sight with a laser rangefinder that is slaved to the gun and there is also an auxiliary or emergency sight. The latter is unusual in being of the periscopic type, so that it does not require a hole in the frontal turret armor, and it is usually stowed retracted out of harm's way under the turret roof.

The commander is provided with a counter-rotating cupola so that, having acquired a target, he can traverse the turret and the gun on to it without losing sight of it. No details have been released of the night sights but they are likely to be of the thermal-imaging type and not the image intensifying sights that were fitted in *FV 4030/3.*

The British Army has adhered to all-electric systems because they are free of the fire hazards and several other problems associated with hydraulic fluids used in the alternative, electrohydraulic systems.

Like all British tanks built since World War II, the *Challenger* has a stabilized all-electric gun control system that enables it to fire on the move. The British Army has adhered to all-electric systems because they are free of the fire hazards and several other problems associated with the hydraulic fluids used in the alternative, electrohydraulic systems. However, the *Challenger* needs a more powerful system than those used in earlier tanks because of the greater inertia of its Chobham-armored turret and its greater mobility and agility.

Rolls-Royce Diesel. The automotive mobility of the *Challenger* comes primarily from its Rolls-Royce V-12 *Condor* diesel. This engine was developed at about the same time as the rotary diesel, which was mentioned earlier but the development of which was very sensibly discontinued in 1971. During the course of the *MBT-80* program the British Army has also seriously considered using the Avco-Lycoming *AGT-1500* gas turbine. But, once again, it wisely decided that a conventional piston-type diesel was more suitable for tanks and opted for the Rolls-Royce *Condor.*

In the *MBT-80,* the *Condor* was intended to develop 1,500 hp but as originally installed in *FV 4030/2,* and now in the *Challenger,* it has been rated at 1,200 hp. This results in a power-to-weight ratio of 20 hp per metric ton, which is lower than the 27 hp per ton of the *M1* and *Leopard 2.* However, 20 hp per ton is more than adequate for most practical purposes and is about the same as the power-to-weight ratio of the latest Soviet *T-72* tank, which is 19 hp per metric ton.

In spite of its excellent automotive characteristics, the mobility of the **Challenger** *may be questioned on account of its weight, which amounts to no less than 60 metric tons, or 132,000 pounds, when combat loaded.*

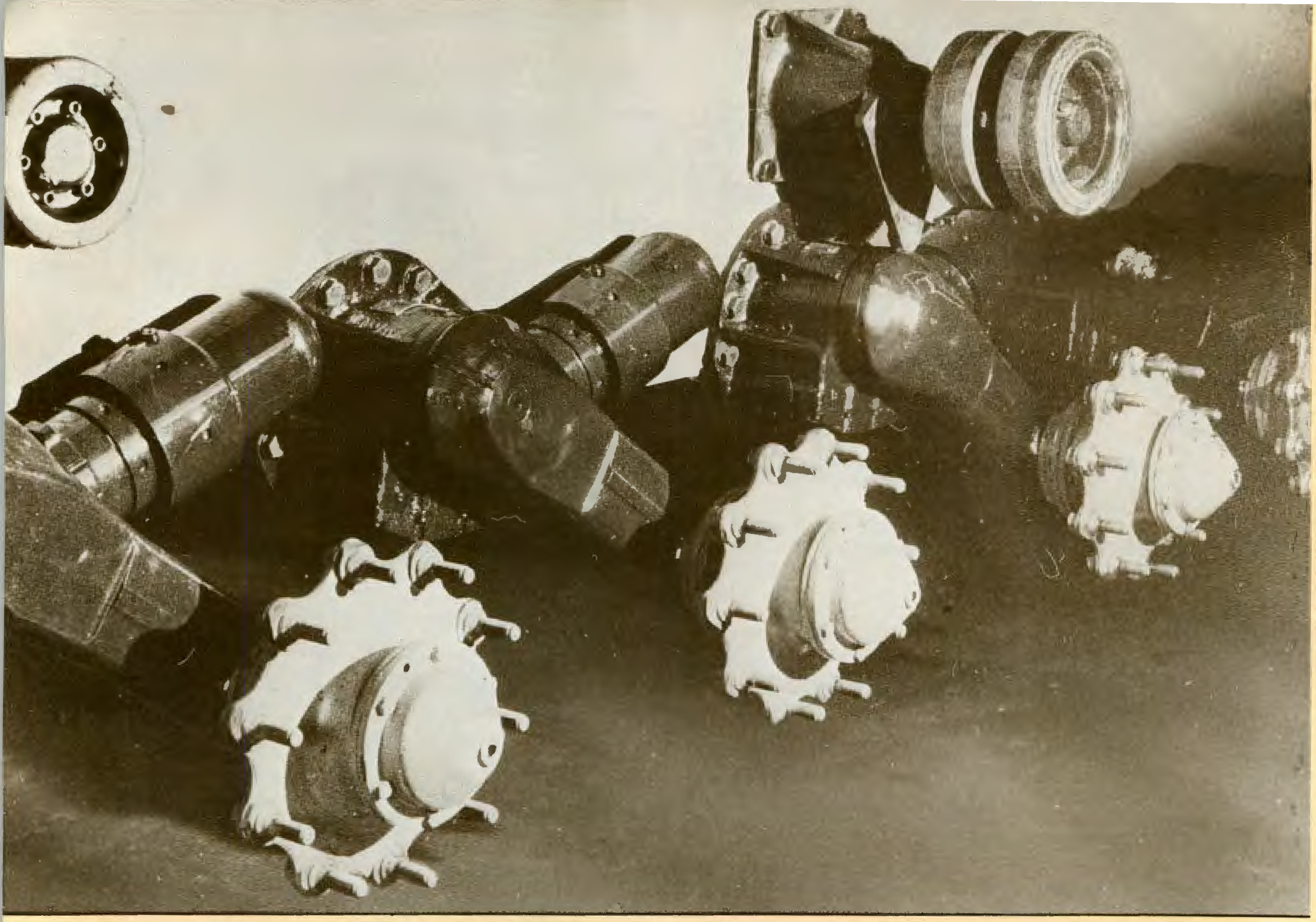
To make effective use of its power the *Condor* engine is coupled to a new *TN 37* transmission. In principle the *TN 37* is very similar to the latest US tank transmission, the Allison *X-1000* used in the *M1.* Thus, like the latter, it includes a torque converter with a lock-up clutch, and automotive gearbox with four forward speeds and a double-differential steering system with an infinitely variable hydrostatic drive. All these features not only make the *TN 37* transmission highly effective, but also make the *Challenger* easy to drive.

Hydropneumatic Suspension. In addition to the new engine and transmission, the *Challenger* is fitted with a completely new hydropneumatic or, as the British keep calling it, "hydro-gas" suspension. It is, in fact, the first British battle tank to have such a suspension and will be only the third tank in the world to go into servie with it — the other two being the Swedish *S-tank* and the Japanese *Type 74.*

A complete separated-type 120-mm round used in the *Challenger* main gun and weighing approximately 41 pounds is held by a British tanker. The fully combustible cartridge case eliminates "brass" disposal in the turret. All cartridge cases are stowed below the turret ring in pressurized water jackets for maximum safety.

It should be noted that the suspension of the *Challenger* is considerably simpler than those of the *S-tank* and of the *Type 74* as it is made up of self-contained units (one per road wheel) and there are therefore no complicated controls for altering the attitude of the hull and no interconnecting plumbing. However, like all other hydropneumatic suspensions, it is inherently superior to suspensions based on torsion bars or other metallic springs and offers a better ride over rough ground, which implies higher cross-country speeds. At the same time, the self-contained units of which it consists are mounted outside the hull and this makes them easy to replace and saves critical space inside the hull.

Weight and Armor. In spite of its excellent automotive characteristics, the mobility of the *Challenger* may be questioned on account of its weight, which, amounts to no less than 60 metric tons, or 132,000 pounds when combat loaded. This makes the *Challenger* the heaviest of the new generation of battle tanks. But there is a good reason for the heavy weight and it does not constitute as great a handicap in relation to



Individual self-contained hydropneumatic (British: "hydro-gas") suspension units for each road wheel give the *Challenger* good stability on rough terrain. Outside-the-hull placement provides ease of maintenance and replacement and save critical interior hull space.

other tanks as might be thought.

The reason for the heavy weight of the *Challenger* is its exceptionally heavy armor, which has been incorporated in it because of the importance attached by the British Army to armor protection. This had already manifested itself in the *Chieftain*, which was until recently the most heavily armored and the heaviest battle tank in service worldwide. Its heavy weight attracted criticism, but heavy armor protection was vindicated by the experience of the Arab-Israeli war. Moreover, several other tanks now weigh as much as the *Chieftain*. They include the *M1, Leopard 2* and the *Merkava*, all three of which weight around 55 metric tons. Thus, other armies have now accepted a weight of 55 tons for the sake of greater armor protection and if the British Army were to advance on the *Chieftain* and yet retain its basic configuration it was bound to end up with an ever heavier tank.

However, the *Challenger* is not all that much heavier than some other tanks. In fact, it is only 7 percent heavier than the *Merkava* and *M1E1*. And it is no heavier than the *Conqueror* tank, which the British Army used during the 1960s. The *Conqueror* weighed 66 metric tons (145,530 lb) and although there were problems with it, these were not primarily due to its weight.

Thus the weight of the *Challenger* is by no means excessive while the amount of armor that goes with it implies a high chance of survival on the battlefield. Due to its armor and armament the *Challenger* is a very formidable fighting vehicle, and when it is deployed it will strengthen considerably NATO forces in Central Europe.

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In the U.S. he has lectured at TACOM and other U.S. Army installations and participated in the Armored Combat Vehicle Technology Program and combat vehicle studies for the Defense Advanced Research Projects Agency. He is also the author of two books and numerous articles on armor, this being this 71st article in ARMOR.

Division 86 Maintenance Platoon

By Captain Daniel J. Bourgoine

Photos by Captain Barry Sprouse and Specialist Seth Blackburn

The implementation of the Division 86 restructuring study in the tank and mechanized infantry battalions will dramatically affect the organization and control of battlefield maintenance and recovery efforts in these battalions. The centralization of personnel and equipment, the impact of the recently adopted systems mechanic concept, and the characteristics of the fast-paced mechanized battle demand that the Army develop both doctrine and techniques for employment of maneuver battalion maintenance assets.

Organization of the Maintenance Platoon. The most radical change in maintenance operations of tank and mechanized infantry battalions is the centralization of personnel and equipment. All automotive, turret, and communications power-generating equipment, tools, and vehicles have been consolidated in the battalion maintenance platoon. Companies retain responsibility for operator-level maintenance only. The battalion maintenance officer is now directly responsible for *all* organizational maintenance. Though this creates an enormous planning and supervisory responsibility for the motor officer, it places a very significant instrument of support for the battalion under unified control.

The organization of the maintenance platoon in a tank battalion is identical to the mechanized infantry. The differences in personnel and vehicle allocations are based on type and density of the weapon system supported. The similarity between the tank and mechanized infantry maintenance platoons contributes to the support of task organized teams and task forces.

The missions and personnel authorizations are summarized below.

Platoon Headquarters: Provides control of organizational maintenance operations based on priorities established by the battalion commander. It includes the battalion motor officer (BMO), automotive maintenance technician, battalion motor sergeant, and a reports clerk.

Inspections/Quality Control Section: Responsible for inspection and quality control of organizational maintenance within the battalion. During tactical operations, inspectors accompany maintenance teams or the maintenance services section to assist in performing maintenance or making battle damage assessment. It includes a section leader' (E7), between two to five vehicle inspectors (E6), and a tactical communications inspector (E6). The vehicle inspectors are system specific (tank, infantry/cavalry fighting vehicles, or improved TOW vehicle) and trained in both turret and automotive maintenance.

Administration Section: Responsible for prescribed load lists (PLL) and maintenance administration. It maintains separate PLLs for line companies and a consolidated PLL for rear units. It includes a section leader (E6), PLL clerks, and the Army Maintenance Management System (TAMMS) clerks.

Recovery Support Section: Provides recovery support to the rear elements, backup recovery support to the company maintenance teams, and welding and metal-working support to the battalion. It includes a section leader (E6), eight recovery crewmen, and two welders. The recovery crewmen are all mechanics.

Maintenance Services Section: Provides maintenance support to the battalion rear elements, backup support to the line companies, and power-generation equipment maintenance for the battalion. The bulk of the platoon's repair capability is in this section. It includes a section leader (E7), system specific tracked vehicle and turret mechanics, light and heavy wheeled vehicle mechanics, power-generation equipment mechanics and communications mechanics. There are 22 personnel in the tank battalion and 38 personnel in the mechanized infantry battalion.

Company Maintenance Teams: Provide dedicated maintenance support to designated line companies and accompany them when cross-attached. They are capable of repairing all critical subsystems of the weapon system supported. Their primary function is to quickly assess the problem and determine whether to repair the equipment on-site or move it to the rear. Each team has a team leader (E7), recovery vehicle operators, automotive and turret mechanics and a communications mechanic. A tank battalion team has 11 personnel; a mechanized infantry team has 10 personnel. The antiarmor company team (unique to the mechanized infantry battalion) has eight personnel.

In order to accomplish these goals with the Division 86 organization, three concepts must be applied to the maintenance platoon. Support is oriented forward, the maintenance platoon is task-organized, and time-to-repair guidelines are established. The concept of "time to repair guidelines" is referred to by several names, depending on the source. "Maintenance time criteria," "maintenance time limitations," and "repair time limits" are synonymous terms.

Support Is Oriented Forward. Since all assets and responsibility for support are under battalion control, if the maneuver companies are to be adequately supported in battle, that support must be oriented forward; i.e., the *initiative* of support must be from rear to front, from battalion to company. This is a vital and fundamental doctrine of the Division 86 concept and a prerequsite to the success of the "fix forward" doctrine. This concept generates two implications. First, the support to the companies must be *pushed* forward, and the maintenance platoon must be heavily front-loaded to accomplish the task. In simple terms, this means that the platoon must be centered at the task force rally point[2] at or near the company trains (4 to 10 kilometers from the FEBA) to insure that they can respond rapidly to the needs of the maneuver company teams. Second, the leaders and technical personnel who drive the platoon operation (BMO, maintenance technician, organizational and direct support maintenance teams and inspectors) must be forward to insure a high degree of control for the platoon elements.

Task Organization. The organization of the maintenance platoon reflects a functional garrison maintenance structure. But its combat task organization is determined by the type of operation, time available, and the tactical situation. Normally the BMO divides the platoons into four echelons, each echelon with a distinct mission and location: the company maintenance teams, battalion maintenance teams, rally point group, and field trains group (figure 1). The number and type of personnel, vehicles, tools, and repair parts assigned to each echelon are tailored to fit the specific mission. The maintenance skills of the platoon are integrated within the echelons for maximum flexibility at each location.

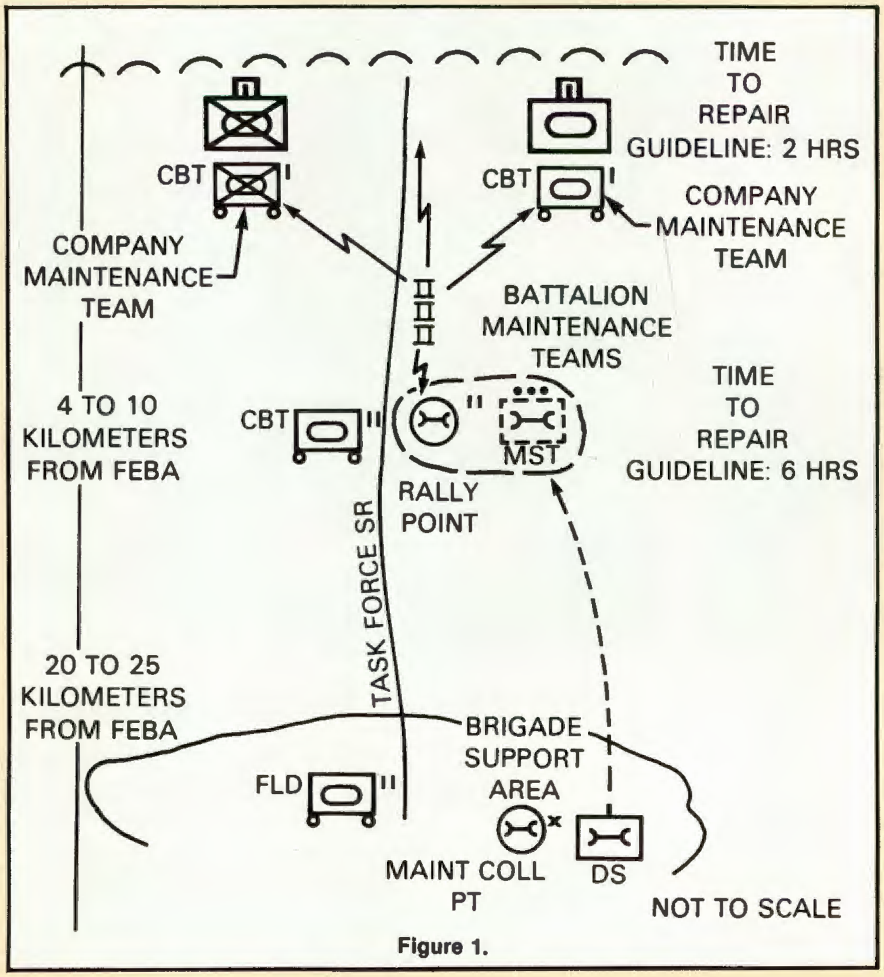

Figure 1.

Company Maintenance Teams. As noted in the mission summary, the company maintenance team is designed to provide a tank or mechanized infantry company with its automotive, armament, and communications maintenance and recovery support. The team deploys with its tracked *M-88A1* recovery and *M-113A1* maintenance vehicles. The team's trucks are habitually left in the field trains. It has the organic personnel to place mechanics with automotive, armament, and recovery skills on each of its armored vehicles, giving the team the flexibility to respond to two requests for support. Each team carries selected tools and repair parts on its tracked vehicles that enable them to perform rapid, on-site repairs at the maneuver company positions. (Many of these tools are basic issue items on the *M-88A1* recovery vehicle.) The types of tools and repair parts that are carried in the forward areas are based on those repair missions that *can* be performed forward.

The company maintenance team is part of the combat trains of the company it supports (figure 1). It moves on the battlefield with the medical armored personnel carrier as one element, using a column formation for control and dispersion. It observes the same tactical considerations as the rest of the company (speed, dispersion, camouflage, defilade positions, covered and concealed routes).

During fast-moving offensive operations the team moves with the company maneuver elements; thereby gaining security from their proximity. During slow-moving offensive operations it follows the company by bounds. The team's standing orders are to maintain visual contact with the company from a defilade position behind it. Disabled vehicles are repaired on-site whenever possible. If the repair is beyond the capability of the team, or if it exceeds its time-to-repair guideline, the team tows the vehicle to the battalion supply route. The emphasis during offensive operations is on maintaining the pace of the advance. Vehicles that cannot be rapidly repaired are left for the battalion maintenance elements to evacuate or repair.

During the defense, the company maintenance team is positioned in defilade immediately to the rear of the forward elements where it can immediately respond when a lull in combat occurs or a request for assistance is received. A disabled vehicle is towed to a defilade position where the team can work on it. If the problem is beyond its capability to repair, or exceeds the time-to-repair guideline, the team recovers the vehicle moving it only as far to the rear as is necessary to turn it over to a battalion maintenance team that will repair the vehicle or move it to the rally point. The greatest priority during the defense will be insuring rapid recovery from the battlefield of as many vehicles as possible.

Due to the independent action required by these teams, they must be led and manned by personnel skilled in navigation, map reading, and radio communication. The leader is the key to the operation of the team. He will usually be the first maintenance representative on the scene of an inoperative vehicle. He must make a timely and accurate diagnosis of the problem and determine whether the vehicle will be repaired on-site or recovered for movement to the rally point. He conducts coordination with the company he supports and responds to its battle orders.

Battalion Maintenance Teams. Immediate backup support for the company maintenance teams comes from the battalion maintenance teams. These teams are based at the rally point (figure 1), and operate between the rally point and the maneuver company locations to provide repair assistance and recovery to the rally points. Like the company maintenance teams, they are designed to be capable of repairing all three critical subsystems of the major combat vehicles of the unit.

Maximum use of cannibalization is made at the rally point, with the objective of returning the maximum number of weapons systems to combat in the minimum amount of time.

These teams are not built into the table of Organization and Equipment (TOE); they are formed by taking the tracked recovery vehicles and crews from the recovery support section and augmenting them with automotive and turret mechanics from the maintenance services section. Inspectors from the quality control section lead the teams, and provide the expertise in on-site damage analysis. The teams are equipped with selected repair parts from the battalion PLL (administration section) and tools from the maintenance services section to enable them to perform rapid repairs on-site.

The number of teams that can be organized to operate forward of the rally point will normally be restricted to the number of available tracked recovery vehicles because of the danger to soft-skinned vehicles within enemy mortar and artillery range. The teams are oriented forward but, unlike the company teams, are not committed to a particular company; therefore, they have complete flexibility to be sent to any critical area on the battlefield. To maximize on-site repairs during combat operations, the battalion teams may be authorized to perform certain limited direct-support maintenance tasks.

During offensive operations the battalion teams advance along the task force supply route, repairing vehicles left by the companies. Vehicles along the supply route that cannot be repaired on-site are recovered and moved to the rally point, or left in place and reported to the direct support maintenance company. Offensive operations will normally result in fewer evacuations, more on-site repairs, and greater time-to-repair guidelines since the tactical situation will allow maintenance elements to move forward as the battle progresses.

During defensive operations, they are committed to the critical points on the battlefield to assist the company teams in recovering damaged and inoperative vehicles from the battle positions. Depending on the tactical situation, these vehicles are either moved to defilade position and repaired or they are moved to the rally point. Like the company teams, the principal mission of the support teams in the defense is to recover as many vehicles as possible from the battlefield.

Rally Point Group. The nerve center of the maintenance platoon operation is the task force rally point. It is normally located at or in close proximity to the task force combat trains. The rally point provides a central clearing station where maintenance "triad" is performed on equipment recovered from the battle by the company and battalion maintenance teams.

The automotive maintenance technician normally supervises the rally point group. He controls the movement of the battalion maintenance teams forward of the rally point. He makes the damage assessment that determines whether vehicles will be repaired at the rally point or moved to the field trains or the brigade collection point. He maintains a close liaison with the S4 at the combat trains administration/logistics center where he provides and receives information on vehicle repair and recovery operations. This liaison will normally be established by wire between the rally point and the S4 vehicle.

In addition to the maintenance technician, the rally point group is composed of the platoon headquarters and mechanics from the maintenance services section. Depending on the tactical situation, a wheeled recovery vehicle can be based here, though normally they will operate from the field trains. A PLL clerk from the admin section is located here with selected parts and tools to support repairs in the rally point.

To support the "fix forward" doctrine the Division 86 concept also provides a direct support (DS) maintenance team to the task force rally point. The team is sent from the DS maintenance company in the brigade support area. It will habitually be deployed to support the same maneuver battalion, and will normally be based at the battalion rally point. The team provides immediately responsive close-in support forward with the task force; thus, reducing evacuation turnaround times, and providing DS maintenance for the critical weapon systems (tanks, IFVs, CFVs, ITVs) of the maneuver battalions. Like the other maintenance teams, it carries a basic compliment of small, high-usage parts and sufficient tools to make repairs forward.

Vehicles along the supply route that cannot be repaired on-site are recovered and moved to the rally point, or left in place and reported to the direct support maintenance company.

The maintenance technician and the DS support team leader work closely together. As a vehicle arrives at the rally point, they mutually determine the level of repair (organizational, DS, or higher), who will repair it if it is repairable on-site, or how far to the rear it will be moved. When DS repairs can be accomplished forward of the rally point, repairmen from the DS team satellite with a battalion team and deploy forward to the vehicle location. Maximum use of cannibalization is made at the rally point, with the objective of returning the maximum number of vehicles to combat in the minimum amount of time.

During the offensive operations, the pace of the advance may require the establishment of subsequent rally points along the supply route before the first has completed its work. The maintenance technician splits his group to accomplish this and insure that continuous forward support is maintained. If required, the DS maintenance company can take over the repairs at collection points to the rear, allowing battalion personnel to continue forward to new locations. In the defense, the critical factor is rapid recovery. Vehicles that can-

not be repaired in a timely manner at the rally point are recovered by the DS maintenance company and moved to the brigade support area or beyond.

The Field Trains Group. The last echelon of the maintenance platoon operation is the field trains group. It consists of personnel and equipment not required for the immediate support of combat operations and includes all personnel and vehicles operating or based behind the combat trains. It can be supervised by the battalion motor sergeant, the maintenance services section leader, or the administration section leader. It normally includes the administration section, wheeled vehicle and power-generating equipment mechanics from the maintenance services section, and the recovery support section wreckers and welding personnel. It may have track mechanics from the maintenance services section or the DS team to perform lengthy repairs not possible in forward locations. Tools that are not needed forward are stored at this location, and this element has the tentage and ancillary support equipment necessary to perform repairs under cover in any weather, day or night. The bulk of the platoon's wheeled cargo vehicles are located or based here, with only the minimum number needed for immediate support kept forward at the rally point.

The field trains group is the most rearward-based maintenance activity of the task force and will, therefore, normally have more time to conduct extensive repairs. Due to its relative security and proximity to the majority of the battalion support elements, wheeled vehicle recovery and repair are supervised and coordinated from this location. The power-generating equipment mechanics based here are sometimes attached to the tactical operations center (TOC) or combat trains to provide immediate repair of the critical generators located there. Repair parts resupply is made from the field trains by the administration section leader. Needed parts are obtained from the unit PLL trucks or from the DS maintenance company and sent to the rally point on cargo vehicles. The administration section leader insures a continuous system of supply and coordination of vehicles moving between the rally point and the field trains.

Fix Forward Doctrine. A U.S. Army analysis of maintenance lessons of the Arab-Israeli War of October 1973 resulted in the adoption of a doctrine that is the fundamental principle of combat maintenance—fix forward. Simply stated, equipment is repaired as far forward as possible by the lowest echelon that has the capability to do so; when it cannot be repaired on-site, it is moved only as far as necessary for repair. To support this principle, a maintenance concept must provide responsiveness to battlefield maintenance requirements and an effective on-site capability.

Time-to-Repair Guidelines. During the fast pace of offensive armored warfare, the amount of time available for repair is a significant factor. In the defense or retrograde, however, it becomes a *critical* factor. The tactical situations on the battlefield are likely to be the overwhelming considerations in determining whether equipment will be repaired, recovered, or lost to the enemy. Therefore, it is crucial that guidelines be established to provide the maintenance personnel with a sound basis for making repair and recovery decisions.

For instance, the U.S. Army Logistics Center has developed time-to-repair guidelines for the defense or retrograde that establish the maximum time that each echelon should spend in attempting to make repairs before considering recovery and movement to the next echelon. Company and battalion maintenance teams are given a 2-hour guideline to accomplish on-site repair, the rally point group and field trains are given 6 hours, and beyond 6 hours, the battalion should consider recovery and movement to the brigade support area.

The guidelines are a point of departure for analyzing other missions and situations, for each one may dictate a different standard. Based on coordination between the S-3, S-4, and BMO, time-to-repair guidelines are established by the task force commander for each tactical operation.

In addition to setting guidelines for recovery, the times are used to determine exactly which parts and tools are carried by the forward teams and the rally point; i.e., only those parts and tools that can be utilized within the time limitations are carried. Parts and tools that are not needed are left in the field trains. The maintenance allocation charts in the back of the vehicle organizational maintenance manuals are a valuable aid in determining both the types of repairs possible within a given time and the tools and repair parts necessary to accomplish those repairs.

Command and Control. The consolidation of the maintenance support assets within the battalion has made command and control of the maintenance effort a critical factor in the success of the Division 86 concept. The new organization and doctrine has affected the roles of the BMO, company XO, and 1SG, and the command and support relationship at both battalion and company level. It has also placed a distinct priority on the communications plan to support the maintenance platoon.

The role of the BMO has been expanded to control an organization of over 100 men and 30 to 40 vehicles. He is responsible to the battalion commander for all organizational maintenance in the battalion. His success or failure will depend on how well he pushes the support effort forward to the companies fighting the battle. The size of his job and dispersion of his elements require that he concentrate his efforts on planning, coordination, and personal reconnaissance. He must, therefore, entrust the actual execution of maintenance operations to the maintenance technician, the motor sergeant, and the maintenance team leaders. The BMO must "see" the battlefield; though he bases in the rally point, he stays mobile, keeping abreast of the tactical situation and monitoring the progress of the maintenance teams. He coordinates with the S4 in the combat trains and with the S3 in the TOC, keeping them informed of the maintenance status and staying up-to-date on both the logistics and tactical situation. Based on priorities established by the battalion commander, the BMO can adjust the support effort to weight the critical company or sector.

At the company level, the responsibilities for service support fall between the executive officer and the first sergeant in varying degrees, depending on the desires and operating procedures of the commander. Regardless of how the tasks are divided, the XO and 1SG must supervise the operation of the company maintenance team as part of their combat trains.

The relationship of the company maintenance team leader to the company he supports must be clearly defined if it is to be effective. Once assigned to support a company, the team leader is under the direct control of that company's XO or 1SG according to commanders desire. The team leader must be tied into their commo net by both wire and radio, kept abreast of their movements during the battle, and responsive to their requests for support. The team leader receives support and assistance from the maintenance platoon and coordinates freely with them, but his orders come from the company he supports.

The maintenance platoon will be widely dispersed in the execution of its mission. It is, therefore, critical that an efficient communications procedure be established as a standing operating procedure (SOP) and that all maintenance personnel can function with it. Maintenance teams maintain radio contact with the rally point. The rally point is fully integrated with other logistics elements, including combat trains, the field trains, and the DS maintenance company. Maintenance elements tie in with the command and communications at any location where they are operating; this not only reduces the number of radios necessary, but also insures maximum coordination and unity of effort at each location. To reduce the extremely vulnerable radio signatures, alternate means of communication are developed and utilized. Wire is used as the primary means between stationary elements whenever possible. In addition to wire, a message system is established for routine information flow; resupply and evacuation personnel moving back and forth between the rally point, combat trains, and field trains carry messages that are not time critical. Information that must be sent by radio; i.e., immediate requests for support, are reduced to the minimum necessary information by preplanned formats and brevity codes established by SOP and communication and electronic operating instructions.

Weaknesses. The Division 86 maintenance platoon TOEs have one major unresolved weakness. There are not enough armored vehicles for the personnel who should be at or forward of the rally point. This condition requires an unpleasant trade-off. The maintenance effort must be forward to be effective, but placing it far forward subjects it to enemy mortar and artillery fire. It is a question of survivability versus mission accomplishment.

The lack of armored vehicles for the majority of the maintenance platoon necessitates placing the maintenance teams on recovery vehicles. This restricts the platoon from employing recovery and maintenance personnel separately to respond to different missions. It also limits the number of teams that can operate forward. The necessity of using wheeled vehicles in the rally point places an unnecessary vulnerability on the maintenance platoon and the DS maintenance support team.

The solution to this problem is to put *all* rally point elements of the remaining platoon in armored vehicles. Though this creates additional demands for the *M-113A1* armored vehicles, which are already in short supply, in the absence of this solution the Army must accept either reduced survivability or reduced effectiveness in the maintenance platoons when the next battle begins.

Conclusions. The Division 86 maintenance platoon concept for tank and mechanized infantry battalions is essentially sound and workable if employed with techniques that support the "fix forward" doctrine around which it was developed. This article has explored concepts and techniques which can be used as a foundation for the establishment of maintenance SOPs, and a springboard for further analysis and doctrinal development.

Footnotes

[1] The NCOs in charge of maintenance sections and teams are referred to in concept papers and proposed TOEs variously as "section chief," "NCOIC" and "maintenance supervisor."

[2] The term "Unservicable Equipment Rally Point" has replaced the old battalion maintenance collection point.

CAPTAIN DANIEL J. BOURGOINE was comissioned in infantry from Wheaton College in 1976. He is a graduate of the Airborne, Ranger, Infantry Officer Basic, Jungle Warfare, Motor Officer, and Armor Officer Advanced courses. He has served in mechanized infantry battalions in Korea, Ft. Riley and Ft. Benning. He served as a mechanized infantry platoon leader, executive officer, and battalion motor officer. He is currently a tactics instructor at the Infantry School, Ft. Benning.

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 47)

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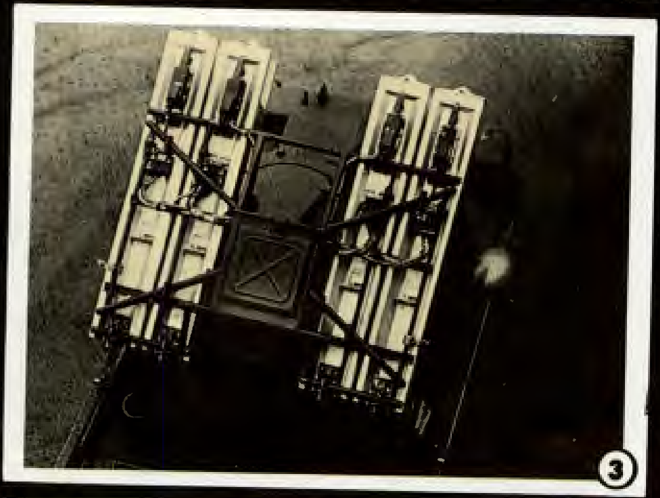
②



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PROFESSIONAL THOUGHTS

Weather Effects on the Battlefield

Although lip service is paid in some quantity to the idea of training for war under adverse conditions, in reality training is most often conducted when the weather is sunny and warm, the training area is dry, and visibility is unlimited. In these cases, safety and the well-being of the troops are the leading considerations, and justifiably so. However, with the realities of weather and its effects on the German countryside, we have to provide for training in a weather-restricted, limited-visibility environment. We have to be able to employ weather forecasts and data to the ground we occupy and defend, and to the weapons systems to be used. Commanders down to *brigade level* need to have weather forecasting personnel *assigned* and they and their subordinate commanders, must learn to apply weather data to operational plans and the execution of those plans. The assumption that high-technology weapons systems will reverse numerical superiority is sound, but dense fog and other weather phenomena will have an adverse effect on the weapon systems upon which that assumption is based.

Most battalion and company commanders don't get detailed weather data to plan from, other than that which is included in the situation paragraph of the operations order. Many times that data is general in nature, vague, or limited in applicability. It tells the commander more about how to dress than where to be on the battlefield, or what assets he should use for a given operation. With very little redefinition, weather data could be a tool with which to construct a defense or plan an operation, just as though it were another overlay of the operations order.

For example the terrain of the Federal Republic of German is characterized by rolling hills, dense woods, and valleys that tend to channelize movement. Under the best conditions, visibility will be out to the full extent of weapons' capability. However, an enemy will not attack under optimum weather conditions, and perfect weather is not that frequent in any case. Seasonal, as well as morning and evening fog or other conditions that impair visibility will reduce the effectiveness of long-range optical tracking, tend to degrade the effectiveness of laser designators, and could possibly eliminate the effectiveness of "smart" weapons altogether.

The obvious point is to be able to predict with accuracy when adverse weather will arrive and when it will leave the area, and to analyze its effect on the weapons and equipment being used in a given operation. With even minimal notice, a commander could plan to use most of his weapons by firing from range card data on predetermined targets or areas, or to relocate weapons based on expected visibility and target locations.

Unless the commander *knows* the extent of weather effects on his area of operation, he will be taking an additional risk and can not be certain or even reasonably sure of the effectiveness his planning. On the other hand, when data is incorporated in plans as a matter of routine common sense, the battalion and company commanders can provide their troops with an additional confidence factor that efficient use of the weather conditions *can* give. No one feels completely comfortable when visibility is less than the best or when their individual situation is not certain. However, if we train realistically, employ the existing weather forecasting assets, and act on accurate information, effective operations in poor weather could become as routine as operations at night under fair weather conditions. Again, taking the apparent disadvantage and making it work to our benefit is absolutely vital.

SAMUEL T. CONN
Major, Armor
KSARNG

Close Air Support

Trends in air defense within the last decade show that our "old style" close air support (CAS) tactics are definitely invalid against a well-equipped, modern enemy. The Soviets and Warsaw Pack Forces have worked diligently to produce air defense systems that can defeat ground attack aircraft.

Most of us would agree that current US doctrine for CAS is valid for the low-threat environment. However, against a sophisticated threat, the ground commander will require CAS to neutralize the opposing threat during day or night under all weather conditions, against extensive electronic warfare (EW), and possibly against nuclear, biological, or radiological attacks. It will be conducted against a comprehensive, dense, and mobile antiaircraft artillery/surface-to-air missile (AA/SAM) threat. We must be able to implement certain tactics and procedures in our airground task forces to assure success. The air and ground components will share this challenge. Accordingly, the problem must be solved together.

In examining a proposal on how CAS might be conducted against a sophisticated, modern enemy, we find that the enemy ground forces will certainly include an air defense to counter both low- and high-altitude CAS aircraft. Therefore, CAS aircraft must be routed around known enemy air defense positions and approach and retire from the forward edge of the battle area (FEBA) at high speed and low altitude to remain out of the AA and low-level SAM fire to accomplish the mission and survive.

The ground commander requesting CAS, must conduct the battle and at the same time suppress enemy air defenses (SEAD) just prior to the low-altitude CAS attack. This air-ground coordination will be necessary to insure CAS survivorability and subsequent target neutralization. In essence, CAS aircraft will not be available for repetitive use if effective

OPMS-EPMS

Promotion Boards

The Major promotion board will convene this spring. Captains whose dates of rank fall before 30 September 1976 will be in the primary zone; those whose dates of rank fall before 30 September 1977 will be in the secondary zone. This board, and all promotion boards, receives *no input* from Armor Branch and its results are not released until the list is announced. Tentatively, the selection board will be in session 25 May to 2 July, 1982. Results will probably be released in early Fall 1982.

The Lieutenant colonel promotion board will tentatively be in session 27 April to 4 June, 1982.

A change to promotion board procedures was announced in January 1982 concerning processing promotion selection board "loose paper."

"Loose paper" is a term for documents that are received for file in the board folder before or after a board convenes. They consist of letters to the board from the officers being considered, evaluation reports recieved too late to be added to the microfiche, and miscellaneous items (photographs, award orders or citations, letters of appreciation or commendation, school-related documents, etc.) that would normally be filed in the OMPF.

As of this date, the following ODCSPER approved policy is established for providing loose papers to DA promotion selection boards.

Letters to the board will be added to an officer's board folder if received not later than the date on which the board convenes. Letters received after the board's convening date will be retained in Promotions Branch as "not seen" documents.

Evaluation reports and academic reports will be provided to the board if received on or before the convening date of the board; or if received after the board convenes but before a cutoff date established by the board president for: evaluation reports that are 60 or more days old (computed from the through date) as of the convening date of the board, and promotion reports (Code 11).

Miscellaneous loose papers will be added to the board folders up to the day the board convenes. Items received after the convening date will be forwarded to the Officer Personnel Records Division for inclusion in the officer's OMPF.

Officer Advanced Courses

Most Armor officers attend the Armor Officer Advanced Course (AOAC) following completion of their first long tour assignment. Some Armor officers are carefully selected to attend the Infantry, Field Artillery, Air Defense Artillery, and Engineer Officer Advanced Courses, (OAC) or the U.S. Marine Corps Amphibious Warfare Course.

Armor Branch automatically screens the records of all officers who have not completed advanced course and each officer is generally programmed for an OAC following the date of availability (DTAV) that appears in his Officer Record Brief. The DTAV is normally 37 months after the officer reports for his long-tour assignment. It is not necessary for an officer to request attendance at AOAC. However, if an officer wants to be considered for the OAC of another branch, he should make his wishes known in the remarks section of DA Form 483. After selections for the OACs are made, orders directing attendance are issued 5-6 months before the class reporting date.

A request to attend AOAC earlier in the career progression pattern will be considered for hardship or compassionate reasons, and must be submitted through the appropriate chain of command.

Eligibility for attending and OAC is limited to Regular Army and Reserve Officers who have been accepted for competitive voluntary indefinite (CVI) status or final voluntary indefinite status. Obligated volunteer Reserve officers who wish to attend an OAC must request and be accepted for CVI status.

The question is often asked as to whether it is better for an officer to command before OAC, or after. The answer is that whether you command before or after OAC is not as important as how well you perform as a commander. It should also be noted that OACs are designed to prepare officers to command and train at the company level, and to serve as battalion and brigade staff officers.

The matter of command before attending an OAC does have an affect on assignments, however. Shortly after an officer is ordered to attend an OAC, he will receive a DA Form 483 and an OAC questionnaire. These are to be completed and mailed back immediately. Branch then requests assignment allocations from the Distribution Divison, MILPERCEN and advises each OAC student of his future assignment. Officers who have not completed company command will be assigned to a post where there is an opportunity to command. Officers who have completed a company command tour will be programmed for assignments as service school instructors, or for duty with Recruiting Command, ROTC, or Army Readiness and Mobilization Regions. The preference statement and OAC questionnaire play an important role in determining assignments but the needs of the Army continue to be the most important factor.

AOAC classes for FY 82 are scheduled to begin 13 April and 27 July. FY 83 classes will begin 7 October 1982 and 11 January, 12 April, and 26 July 1983. The OACs of other service schools correspond approximately to this schedule.

Additional information concerning OACs is presented in AR 351-1, DA PAM 351-1, and DA PAM 600-3 w/3 changes.

Assignment Officers/Assistants

LTC Norman E. Beatty	Branch Chief
LTC Kendall M. Lemley/Ms. Gloria R. Johnson	LTC
MAJ Israel P. Anderson/Ms. Janice P. Boyce	MAJ
MAJ James E. Quinlan/Mrs. Laurie J. Bennett	CPT
CPT Joseph G. Pallone	CPT
CPT Craig B. Whelden/Mrs. Diana D. Lueker	LT

Address
HQDA MILPERCEN
ATTN: DAPC-OPE-R
200 Stovall Street
Alexandria, Virginia 22332

Telephone Numbers
Autovon 221-6340/6341/9696/9658
Commercial (202) 325-

Official Military Personnel File Available

You can obtain a free copy of your official military personnel file (OMPF) by writing to the following address: HQDA MILPERCEN, ATTN: DAPC-POR-RS, 200 Stovall Street, Alexandria, Virginia 22332. Please furnish your name, grade, social security number, and address. Allow 3 weeks for delivery.

news notes

Battle of Bulge Heroes Honored

It took 15 years, but the CO of the reconnaissance platoon of the 394th Infantry Regiment, 99th Division, finally won his fight.

He was fighting for recognition of his men's heroic action during the Battle of the Bulge, December 1944, in Belgium.

The platoon received 'hold at all costs' orders on 16 December 1944 at Lanzerath, Belgium. They held against three German attacks until they ran out of ammunition and were forced to surrender. For their actions, 18 members of the platoon were recently decorated by the Secretary of the Army, John O. Marsh Jr. Dr. Lyle Bouck Jr., of St. Louis, the platoon's commander during the action, had been fighting for the awards ever since 1966 when he learned that no one in the unit had been decorated.

Super Six "Hams"

A FAR NET, a ham radio association composed mainly of Sixth Armored Division radio operators, is looking for new members. A FAR NET now has 60 members in 28 states. Qualifications for membership include being a licensed amateur radio operator, a veteran of, or presently in, the armored service, or a relative of an armor serviceman or vet. This is a no dues organization, and interested persons should contact Mr. Harry B. Thomsen, 348 Jefferson Ave., Apt. 15, Canandaigua, NY 14424. His ham call sign is W2PJH.

Lieutenant Sabelhaus Wins Mershon Award

First Lieutenant Joseph W. Sabelhause, Troop C, 1st Squadron, 17th Cavalry, 82d Airborne Division, recently was selected as the Mershon Award winner. He was selected as top Armor distinguished military graduate for the ROTC. Major General James J. Lindsay, 82d Airborne Division commander, presented Sabelhause with a saber and a check.

The Mershon Award is presented annually from the estate of the late Colonel Ralph D. Mershon, scientist and reserve officer.

Armor Association Certificates

U.S. Armor Association Certificates of Appreciation have been sent to over 300 members who have maintained their Association membership for over 25 years. In addition, 27 Association members have been on the rolls for 50 years. A permanent plaque listing the name of each 50-year member will hang in the office of the Association. The names of those attaining 50-year membership will be added to the plaque yearly.

Welcome Packs for AOB/AOAC Students

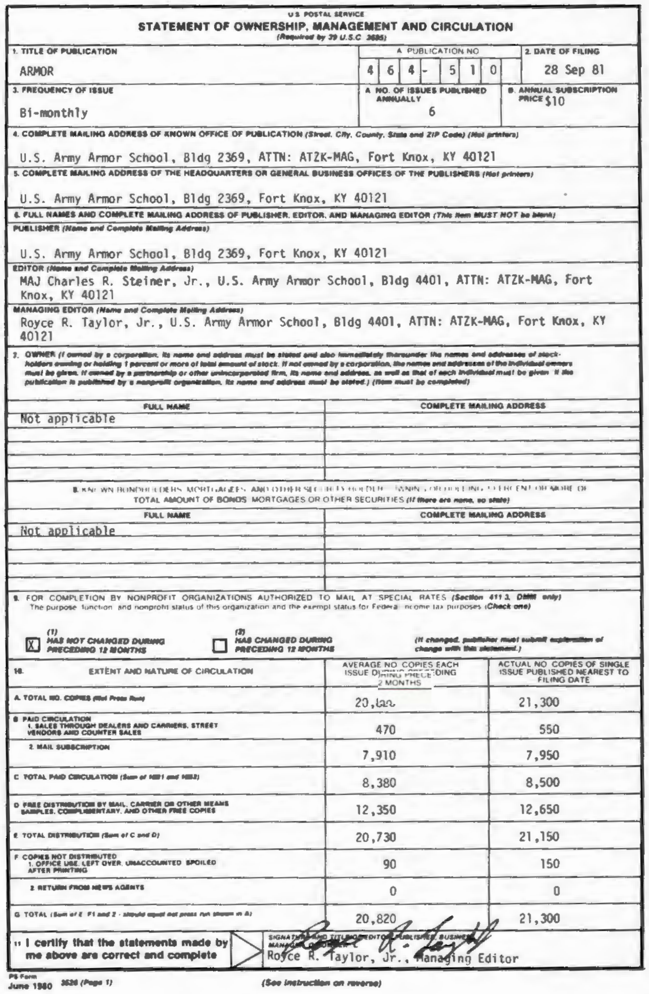
Officers assigned to either the Armored Officer Basic or the Armored Officer Advanced Course who receive late notification of such assignment should write immediately for their Welcome Packet, which will answer questions on housing, what to bring, facilities, etc. The address is Commander, 1st Battalion, Center/School Brigade ATTN: S1, US Army Armor School, Ft. Knox, KY 40121 or phone: AV 464-5928; Comm (502) 624-5928.

.22 Cal Tracers For ARNG

The Ammunition Branch, NGB, announces that .22 caliber rimfire tracer ammunition is available to support ARNG subcaliber tank gunnery.

Recent tests by the 50th Armored Division, NJARNG, demonstrated that .22 caliber rimfire tracer ammunition fired from the rimfire-adapted M16A1 rifle mounted in the Brewster Device, will increase training proficiency gained through scaled range tank gunnery.

ARNG Armor and Cavalry units should identify .22 caliber tracer ammo requirements in ARNG-TAMIS. Requests should list DODAC-A090, Cartridge, Cal .22 Long Rifle, Rimfire, with Tracer. Authorizations will be distributed to states through ARNG-TAMIS.



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11. **I certify that the statements made by me above are correct and complete**

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Royce R. Taylor, Jr., Managing Editor

PS Form June 1980 3526 (Page 1)

(See instruction on reverse)

BOOKS

ARTILLERIE DES 20. JAHRUNDERTS (ARTILLERY OF THE 20TH CENTURY) by Franz Kosar. Bernard & Graefe Verlag, Munich. 1971-78. 3 volumes.

Volume 1 covers field guns up to 90-mm, howitzers to 122-mm and all mountain artillery pieces. Volume 2 includes guns from 91-mm to 155-mm as well as howitzers from 123-mm to 155-mm. The third volume discusses cannon larger than 155-mm and railway artillery regardless of caliber. Permanently emplaced coastal guns are not treated, nor are many of the rail transported (but not fired) guns used in both field and coastal roles. A further limitation of the coverage is that non-European countries are not discussed, except for Japan and the United States. Anyone seriously interested in this history of weaponry in the late 19th and 20th centuries should buy all three volumes.

DR. ARTHUR G. VOLZ
U.S. Army Russian Institute

KHAKI-COLLAR CRIME: DEVIANT BEHAVIOR IN THE MILITARY CONTEXT by Clifton D. Bryant. The Free Press, New York, NY. 1979. 388 pages. $14.95.

Bryant has given us an excellent scholarly work on criminal behavior in the military. Drawing upon the author's experience as a Military Police Officer, this book offers authenticity coupled with readability. This is a monumental effort complementing research with experience; personal feeling with cold hard facts.

In part one, we concern ourselves with military crime and punishment both placed in perspective with their social setting. We learn just how the military facilitates crime and at times seems to encourage such activity. We learn also of how eyes and ears are closed to less than honorable performance.

"Moonlighting requisitioning, scrounging, and midnight salvaging" are often viewed as being necessary for mission accomplishment. But yet this misappropriation or "reappropriation" of government property is as illegal as any other employee stealing from his employer. In the military, however, the best scrounger is rewarded for his criminal activity and seen as a hero.

This books tells us that the honorable men of arms are sometimes not honorable at all.

ROBERT R. CORDELL
Sergeant First Class
Third ROTC Region Senior Program
Northwestern Oklahoma State University
Alva, OK 73717

WHY THE VIET CONG FOUGHT: A STUDY OF MOTIVATION AND CONTROL IN A MODERN ARMY IN COMBAT, by William D. Henderson, Greenwood Press, Westport, CT. 1979. $17.95.

> "Two major armies fought in Vietnam between 1965 and 1972, the United States Army and the North Vietnamese Army (PLA). One Army endured and the other did not. By all traditional methods of measuring military power, the final victory of the U.S. forces should have never been in doubt."

Since the end of Vietnam, many authors have sought to explain the results of the war in terms of what happened to the American Armed Forces, most notably the Army. *Why The Vietcong Fought* takes a different approach by examining why the North Vietnamese sustained themselves as a viable combat forces despite the massive combat power of their foes. William Henderson, the author and a company commander in that conflict, does not contend our adversaries were superhuman or better fighters but emphasizes

> "...the PLA soldier was much like the US soldier who suffered under the stress and hardship of combat. Fear, lack of sleep, rain, heat, and fatique affected the PLA much the same as they did the Americans. ..."

The author's answers to why the PLA sustained are found in the internal organization and heritage of the PLA.

Based on Rand Corporation interviews with North Vietnamese POWs and defectors between 1965 and 1967, this book explores the idea that the North Vietnamese developed a highly cohesive combat force by the intentional and skillful utilization of small group psychology and traditional communist organizational structure. A force built on a small tight-knit cell (primary group) is not really earth-shaking. One of the major studies of combat during World War II, the famous Shils and Janowitz study of the *Wehrmacht,* indicated that unit cohesiveness and ability to sustain combat stress was achieved by small, intimate group relationships rather than any belief system.

The book is well organized and written. Readers unfamiliar with organizational behavior terms may have some slight difficulty in the early stages of the book. The author, however, attempts to explain the various concepts in a readable fashion.

ALBERT F. LEISTER, JR.
Captain, Armor
Department of Behavioral Sciences and Leadership
USMA

DAS UNTERNAHMEN TANNENBERG by A. Spieb and M. Lichtenstein. Limes Verlag, Munich. 22. Deutschmark.

What was Hitler's initial reason for the outbreak of World War II?

Three serious "border violations" took place on the eve of 1 September 1939 in the German/Folish frontier area. That they were instigated, planned, and executed on direct orders by Hitler to give him the "propaganda cause" to start the war with Poland is the contention of this book.

After the war the state prosecutor in West Germany opened the case of murder against those actively involved. Forty years after the crime, the files were then turned over the public, and a prosecutor and a well-versed radio journalist evaluated them for this book. It is a dreadful scheme of criminal doings ordered and sanctioned by the Reich Government—and there is no doubt who was responsible—as many witnesses and participants give testimony.

Hitler's statement, "I will give a propaganda cause for the outbreak of war, no matter how incredible," is a warning message to the free world as to what dictators will do to further their aims.

Reading this minute-by-minute account, one is apt to draw parallel lines to more recent history.

Facts, style, maps, sketches, and pictures make the book most recommendable reading.

W. GERHARDT
Colonel, GS
German Army

Detach Here—Fold, Staple, and Return

PLEASE TAKE A FEW MINUTES TO COMPLETE THIS SURVEY. YOUR ANSWERS DO INFLUENCE THE EDITORIAL POLICY, CONTENT, AND FORMAT OF ARMOR.

1. **How many copies of ARMOR have you seen during the past 12 months?** 1 2 3 4 5 6

2. **How do you usually receive a copy of ARMOR?**

_____Subscription
_____See it in the unit dayroom
_____See it in the library
_____Other. Explain_____________________________

3. **Do you read the following, if so how thoroughly?**

Letters to the Editor	__All	__Most	__Scan	__No
Commander's Hatch	__All	__Most	__Scan	__No
Forging the T-bolt	__All	__Most	__Scan	__No
Master Gunner's	__All	__Most	__Scan	__No
Driver's Seat	__All	__Most	__Scan	__No
OPMD-EPMD	__All	__Most	__Scan	__No
Book Reviews	__All	__Most	__Scan	__No
Recognition Quiz	__All	__Most	__Scan	__No
Professional Thoughts	__All	__Most	__Scan	__No
Steel On Target	__All	__Most	__Scan	__No
Regimental History	__All	__Most	__Scan	__No

4. **How often do you read articles pertaining to the subjects?**

Tactical Doctrine	__Always	__Seldom	__Never
Logistics	__Always	__Seldom	__Never
History	__Always	__Seldom	__Never
Maintenance	__Always	__Seldom	__Never
Personnel	__Always	__Seldom	__Never
Research & Development	__Always	__Seldom	__Never
Equipment	__Always	__Seldom	__Never
Training	__Always	__Seldom	__Never

5. **How do you rate ARMOR's mixture or balance of departments and features?**

____Excellent, ____Good, ____Fair, ____Needs more articles on_____________________________ Needs less articles on_____________________________

6. **How do you rate ARMOR's performance in the following areas?**

It is interesting and informative:
______Always, ______Sometimes, ______Never.

Its layout and design is: ____Outstanding, ____Excellent, ____Good, ____Fair, ____Poor.

It has helped increase my professional knowledge: ____Significantly, ____Somewhat, ____Not at all.

It is a stimulating forum for new and diverse ideas: ____Always, ____Sometimes, ____Never.

7. **What is your reaction to the following statements about ARMOR?**

Its appearance (layout and design) is: ____Outstanding, ____Excellent, ____Good, ____Adequate.

Its articles are: ____Always timely, ____Usually timely, ____Sometimes outdated, ____Other (explain)__________

Its authors are: ____Experts in their field, ____adequately knowledgeable, ____uninformed, ____too opinionated, ____Other (explain)_____________________________

Articles in ARMOR are: ____too difficult to read, ____written in too technical language, ____easy to read, ____below the reading level of most readers, ____Other (explain) _____________________________

8. **The artwork in ARMOR:**

____is outstanding
____contains too many drawings
____doesn't have enough drawings
____is well balanced
____uses too much space
____other (explain)_____________________________
____

9. **The cover of ARMOR is:**

____OK as is
____should be standardized with one design for all issues
____should have photographs of armored vehicles
____other (explain)_____________________________
____

10. **The type faces in ARMOR are:**

____hard to read
____easy to read
____sometimes hard to read (explain)__________________
____

11. **The content of ARMOR should be changed to include more or less articles on the following:**

Platoon-level tactics	__more	__less	__same
Company-level tactics	__more	__less	__same
Large-unit tactics	__more	__less	__same
Historical analysis	__more	__less	__same
Research & development	__more	__less	__same
Training	__more	__less	__same
Gunnery	__more	__less	__same
Maintenance	__more	__less	__same
Communication	__more	__less	__same
Logistics	__more	__less	__same
Professional development	__more	__less	__same
Leadership	__more	__less	__same
Personnel management	__more	__less	__same
Book reviews	__more	__less	__same

12. **How do you rate ARMOR as a professional journal?**

____Outstanding, ____Excellent, ____Good, ____Fair, ____Poor

COMMENTS (continue on reverse if necessary)__________
____
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____
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* * * * * * * *

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STEEL ON TARGET

No series of editorials recognizing the contributions of people to the Armor Force would be complete without acknowledging the important role played by the wives of our mounted soldiers.

The wives of today's tankers or cavalrymen share much in common with those stalwart women of the Western Frontier who waited patiently, often wearing yellow ribbons, while their husbands were on patrol. Whether she is a private's wife in a lonely trailer near a stateside post, a sergeant's wife in a stairwell apartment on a kaserne, or a colonel's wife in quarters on officers' row, the common thread that connects these women of the present with those of the past is the quiet courage they have displayed as they sacrificed their own desires for the good of the service and the security of the nation.

Their commitment is guaranteed by no oath of office nor enlistment contract. No uniforms identify them and no medals adorn them. But, the gold bands that unite them with their spouses have committed them to a demanding way of life.

In peacetime, these women have left family and friends to follow their tankers or cavalrymen wherever they were posted. They have sampled life at home and abroad, life on the prairie, and life on the Potomac. So, too, have they sampled life alone when they stayed behind to keep the home-fires burning; when the sharing and caring was possible only through letters, tapes, and those short, static-filled phone calls from places called "short-tour" areas. Despite household moves and occasional separations, our wives are the heart of our homes, and have freed us, the heads of our households, to devote our unfettered attention to the demands of our profession.

In wartime, wives face their most trying commitment when they must give up their spouses when the nation calls them to battle. Forced to stay behind and await the outcome, these women keep their own counsel and view the Threat in very personal terms. For most, the separation is temporary. For some, it is permanent. For all, it is a time to endure.

ARMOR salutes the wives of the men of the Armor Force. From you much has been demanded. You have not been counted on the rolls nor figured in the readiness equation, but your contributions to your home, your community, and your nation are significant, recognized and appreciated. As we, who are warriors, have been foremost in your hearts, so will you always be in ours wherever our calling takes us. Through your example, we have learned the true meaning of sacrifice, courage and selfless dedication. If the call comes, we will meet the Threat courageously and boldly, armed with the strength and spirit you have imbued in us and in our families.

64th ARMOR

We Pierce

Lineage and Honors

Constituted 13 January 1941 in the Regular Army as 78th Tank Battalion. Redesignated 8 May 1941 as 758th Tank Battalion (Light). Activated 1 June 1941 at Fort Knox, Kentucky. Reorganized and redesignated 3 May 1945 as 758th Light Tank Battalion. Inactivated 22 September 1945 at Viareggio, Italy.

Redesignated 23 May 1946 as 758th Tank Battalion. Activated 14 June 1946 at Fort Knox, Kentucky. Reorganized and redesignated 15 January 1948 as 758th Heavy Tank Battalion.

Redesignated 3 November 1949 as 64th Heavy Tank Battalion and assigned to 2d Armored Division. Relieved 13 August 1950 from assignment to 2d Armored Division and assigned to 3d Infantry Division. Reorganized and redesignated 6 March 1951 as 64th Tank Battalion. Inactivated 1 July 1957 at Fort Benning, Georgia, and relieved from assignment to 3d Infantry Division.

Redesignated 25 January 1963 as 64th Armor, a parent regiment under the Combat Arms Regimental System.

Campaign Participation Credit

World War II
- North Apennines
- Po Valley

Korean War
- CCF intervention
- First UN counteroffensive
- CCF spring offensive
- UN summer-fall offensive
- Second Korean winter
- Korea, summer-fall 1952
- Third Korean winter
- Korea, summer 1953

Decorations

Republic of Korea Presidential Unit Citation, Streamer embroidered *Uijongbu corridor to Seoul* (64th Tank Battalion cited; DA GO 20, 1953)

Republic of Korea Presidential Unit Citation, Streamer embroidered *Iron Triangle* (64th Tank Battalion cited; DA GO 29, 1954)

Chryssoun Aristion Andrias (Bravery Gold Medal of Greece), Streamer embroidered *Korea* (64th Tank Battalion cited; DA GO 2, 1956)

Symbolism

The elephant symbolizes the heavy assault of a tank battalion. Elephants were used in ancient times to lead the attack in a manner comparable to the present-day use of armored organizations.

The Catherine wheel with its hooked spikes symbolizes the armored tracked vehicle and its function, the spikes further representing eight battle honors for the Korean War and the gold disc in the center referring to the award of the Bravery Gold Medal of Greece. The elephant tusks in a trophy base decorated with a Korean taeguk are symbolic of two awards of the Korean Presidential Unit Citation. The three peaks allude to service in the North Apennines in World War II, and the valley between the tusks to the Po Valley Campaign.

Distinctive Insignia

The distinctive insignia is the shield and motto of the coat of arms.

ARMOR

The Magazine of Mobile Warfare

May-June 1982

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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May-June 1982 Vol XCI, No. 3

FEATURES

DEPARTMENTS

COVER

Beginning on page 26, Captain Gerald A. Halbert compares the Bradley fighting vehicle with similar Threat vehicles that it could face in future conflicts.

LETTERS

Running Shoes Reduce Injuries

Dear Sir:

Because we have been studying various PT-related issues in Initial Entry Training (IET) here at Ft. Leonard Wood for some time, I read with interest the Commander's Hatch and the Driver's Seat articles by MG Wagner and CSM Gillis in the January-February 1981 issue of *Armor.*

The thrust of our efforts and experiments was to increase overall attendance at training by avoiding the excessive number of foot and leg injuries we were experiencing, especially early in each training cycle. We conducted some tests to determine the effectiveness of running shoes in reducing the number of foot and leg injuries that a new soldier might receive during IET. In addition to running shoes, we used static stretching exercises, warm up and cool down period, prohibited some deep knee bend exercises, and reduced running during week three of training. Among our results were:

- In the companies that used running shoes for the first four weeks of training, there were fewer foot-related injuries than in those that ran in Physical Readiness Training in combat boots.
- The two-mile run times on the final Army Physical Readiness Test (taken by all units in combat boots) were lower overall for the units that initially wore running shoes.
- We also found that the use of running shoes by all soldiers in the company helped to build esprit and a desire to run.
- There was a measurable decrease in the number of foot and leg related problems as a result of these techniques. The decrease was noticed not only by those of us involved in the experiment but also by hospital personnel and others outside the brigade.

In the final analysis, however, we discovered that the most important factor in reducing injuries and building an effective program is the concern by the chain of command for the welfare of their soldiers.

MICHAEL L. SCHANY
Captain, Armor
Fort Leonard Wood, MO

Burn The Threat!

Dear Sir:

Since we all know that our forces in Europe are greatly outnumbered by the Warsaw Pact forces, I send along these thoughts on how those forces can be defeated, once and for all.

*Fire*power Will Defeat The Threat!

It is a psychological fact that man will not face fire. This fear of fire is as elemental in each of us as is the fear of water. Many of us learn to swim and overcome, to a point, our fear of water. None of us has ever learned to swim in fire.

If the NATO forces were to rearm exclusively with incendiary ammunition in every caliber—and if that fact were widely advertised to the Threat forces and they were told what would happen to them—to every man, if they attack, then the Threat leaders would be hard-pressed to find men to mount that attack.

NATO air forces, as well, should be armed with incendiary type ammunition.

Fire is the absolute deterrent.

What is a tank? A tank is a steel box on tracks. Steel is one of the most effective transfer mediums of heat and cold. Set a tank on fire and the crew has the choice—burn inside or bail out. Which would *you* do? A tank set on fire is a "dead" tank.

Bullets and shells are invisible, and time and again men have braved the invisible storm to press home their attack. The finest example of such courage that comes to mind is Pickett's Charge at Gettysburg. Fifteen thouand men advanced in close order across open fields for a mile in the face of shot and shell and canister and grape and, finally, massed infantry fire. They pressed home their attack and fought hand-to-hand with the Union forces before being repelled. But had those indomitable men been subjected to flame weapons, they never would have advanced one half that fearful distance.

War, gentlemen, is not pretty. If we *have* to fight, then for the sake of ourselves, our families and our country, we must fight to *win.* And only *fire*power will guarantee our success.

Burn the Threat!

J.V. CALUMET
Sergeant First Class, Armor

Hungarian Heraldist

Dear Sir:

I would like to make some comments about the unit histories that you print each month. I am a heraldist and an honorary member of the Heraldy Society of England.

I recognize that the descriptions and comments on the unit badges are not written in professional heraldic language, but there are some errors that I have seen. As for example the badge of the 37th *Armor* (December, 1981 ARMOR) contains a "wyvern", but the picture shows a legless creature although the wyvern always has *two* legs. So, we must call it "wyvern without legs," which seems not a grand name for a mobile unit. Or, I would suggest, a "chimera," which is similar to the wyvern and has no legs. Also I noted that the description of the shield states that it is a green and white shield, I guess it is a white shield and green figure because the wyvern is darker. If possible, mention first the color of the shield as you did in previous numbers.

If you suggest, I could point out other, but minor mistakes in the description as well as the picture.

Thank you for your kindness.

DR. LOUIS VISEGRADY
Hungary

More On XO As Commander

Dear Sir,

Major Boyd's article, "The Executive Officer As Commander" (January-February 1982 ARMOR) was interesting and certainly thought-provoking. Headquarters company commanders are certainly some of the most frustrated officers to be found. Boyd's article does provide an apparently reasonable solution. However, I am a traditionalist and must take issue with Major Boyd.

The central issue is not the problem of the headquarters company commanders, but the role of the battalion XO. Being a traditionalist, I view the battalion XO as the staff coordinator. First and most important is that the battalion XO must have a breadth of knowledge that goes well beyond the scope of headquarters company and the state of training or operations of the battalion. The second is that he must have supervisory control of the battalion staff.

If the battalion XO is to perform the function I have outlined, he cannot command headquarters company—his focus becomes too narrow. His concern with the "nitty gritty" of company operations would, in fact, occupy his time. His perspective, if he is to be more than a figurehead commander, must be from the company's perception.

Major Boyd indicates that the battalion XO would remain responsible for all logistical activities, yet he would control all staff supervisors. Later he goes on to say that the real heir apparent if the mantle of command must be passed should be the S3; it is he who is totally abreast of the situation. There are two difficulties with that solution. The logic of the S3 assuming command rests on the assumption that the reason for the change will occur during active combat. While that may be so, there are several other situations where a change of command could occur. The S3 might take immediate control of the situation, but in the main the man who should be intimately involved in **all** aspects of the battalion's activities is the XO. It is he to whom one must look for continuity of command. Finally, if the S3 were the number 2 officer in the battalion, then it would seem that he would be moved outside the XO's supervisory control. (Supervisory control means that the XO rates or senior rates all members of the staff.)

It would seem that Major Boyd's article was really directed at easing the pain of headquarters company command. I believe that it is part and parcel of the battalion XO's responsibility to do just that. He must be cognizant of the HHC commander's unique problems and make the battalion staff officers, NCOs, and men toe the mark—to do otherwise is criminal.

The battalion XO's job requires a broad perspective, one he would lose if required to command. Major Boyd's solution might solve some chain of command problems, but it would create a new one through friction between the S3 and the XO.

As I noted earlier, the article was thought-provoking. It caused me to rethink my own organizational concepts. It reinforced (not ossified) my conclusion that the battalion XO is the senior, major staff coordinator, and next in line to command the battaltion—not first in line of command.

STEVEN W. WOLFRAM
Lieutenant Colonel, Infantry
Professor of Military Science
University of Oregon

Mortar Possibilities

Dear Sir:

Major Lancaster's comments on the need for increasing the effectiveness of organic mortar units "The Armor Force in the Air Land Battle", ARMOR, January-February 1982, are very interesting. There may well be some ideas that can be of use for this purpose.

A major problem seems to be the enemy's mortar-locating radar. It works by "looking" at the mortar round in flight at two or more points on the trajectory, then extrapolating back to the firing point. Such radars are effective and rapid, thus the problem for our own mortar units.

First idea is to reduce the radar image of the mortar projectile by coating its fins with a radar-absorbing material, similar to coatings applied to the masts of warships near the radar antennae. This concept should sharply reduce the image available to the hostile radar.

Second idea is to adapt the conventional illuminating round to serve as a chaff carrier shell. Chaff can screen the trajectories of the mortar rounds from observation by the enemy's mortar-seeking radar, making his job more difficult.

Third idea is more involved. Ideas one and two, combined with electronics countermeasures, may reduce the effectiveness of the mortar-locating radar, but there are entirely too many "hostiles" out there to allow our mortar units time enough to complete many fire missions before drawing return fire. This idea involves the use of multibarreled mortars in order to be able to get out a burst of intensive fire in a short period of time, then move out to the next position before fire is returned. Sustained fire is achieved by using two or more loaders to keep some of the barrels firing on each multiple mounting. A sixteen-barrel 81-mm mortar on a halftrack was used by German forces in France in 1944 as an improvised antiinvasion weapon. Made from captured French materiel, this system could put out a lot of firepower using a crew of only three or four.

For the *M125* 81-mm mortar carrier (on *M113* chassis) a quadruple 81-mm mortar mounting is proposed. The mortars, using the Navy's 81-mm Mk1 Mod 0 recoiling selective fire (i.e., drop-of-trigger fire) mortar, consist of a cluster of two rows of two mortars each, all fitted to a beefed-up turntable inside the vehicle. Loaded while inside the vehicle under armor, the roof hatch would be popped open for a quick shoot, then reloaded enroute to another position. May need to spring-load the hatch for ease of opening and closing it.

For the *M548* tracked carrier, a full sixteen-barrel 81-mm mortar mount is proposed. Capable of being rotated 360°, this mounting will be able to put out a burst of fire similar to a light barrage rocket launcher *without* the telltale back blast "signature" that draws return fire. The entire vehicle is given a light armor shielding similar to that given the Rapier-armed vehicles on this chassis. A complete shield is proposed for the mortar mount, with a folding hatch over the mortars so that they can be loaded under protection, then fired quickly with the hatch open. Variants of both schemes can use different sizes or numbers of mortars as desired.

A final idea is to try fitting the 66-mm *M72* LAW warhead onto the 81-mm *M43A1* HE mortar shell body for better AT performance against armored vehicles. If ballistics are matched to the standard *M43A1* round this enhanced AT mortar round should be simple to use.

There you are, gentlemen, a few ideas by an interested amateur for your consideration. Feel free to criticize these ideas and introduce some of your own on improving the efficiency of mortars in close fire support.

GORDON J. DOUGLAS, JR.,
Fullerton, CA.

Update on Reich Battles

Dear Sir:

I was bothered by Robert Smith's remarks in his "Defense of the Reich" article in the January-February '82 issue of ARMOR. While Soviet military history is frequently of shoddy quality, to totally dismiss it, as Smith seems to do, in favor of relying "more and more exclusively" on German sources alone is amateurish. One must take great care in handling Soviet military history sources, but there is a wealth of data on Soviet military doctrine, tactics, and outlook to be found in the better histories. There are many very useful unit histories of the 1941-45 campaign published in Russian that are essential to any serious historian dealing with the Eastern Front during WWII. An excellent example of the careful and *critical* use of Soviet sources is John Erikson's superb *The Road to Stalingrad.*

In reading the section on the battle of Kustrin, I was surprised not only by Smith's total lack of insight into the battle, but by his factual errors. To call the battle at Kustrin an example of the last real successes of the Panzer Force is dubious in the extreme.

Mr. Smith does not even seem to have his basic geography straight. The German armored units he mentions could hardly have been holding the eastern approaches to Kustrin in late March 1945 considering that the eastern part of Kustrin had already been taken by the Soviets, and the Germans were only holding the Kustrin fortress in the middle of the Oder and Warta rivers during the battle of 22 March. The forces he mentions in fact were located behind the city, sandwiched between Soviet bridgeheads.

Mr. Smith's fanciful account of long-range tank duels is belied not only by the confined terrain in which the battle was fought, but also by the fact that the battle was primarily conducted by Soviet infantry and artillery. The Soviets joined their two armies on the afternoon of 22 March when a regiment of the 47th Guards Rifle Division seized Gorgast and fought back a last-ditch tank attack with captured *panzerfausts.* How this minor 12-hour battle represents a last glorious stand of the Panzer force is beyond me. If any aspect of the German defense of Kustrin deserves respect, it was the infantry that held the Kustrin fortress and Old Town from the beginning of February through 29 March when the Soviets finally overwhelmed the fortifications after heavy casualties.

STEVE ZALOGA
Greenwich, CT

Ground Cavalry Role Important

Dear Sir:

The role of ground cavalry remains extremely important on the modern battlefield. Too much emphasis has been placed on expanding the air cavalry at the expense of ground cavalry. Air cavalry, even taking into account recent advances in technology, will not be an effective reconnaissance force in inclement weather. Air cavalry, furthermore, has a very limited ground-holding capability. Air cavalry is also vulnerable to a wide variety of direct ground fires, including infantry small arms. Finally, the air cavalry's ability to survive in a mid-to-high intensity air battle is, to say the least, doubtful.

Current Division 86 restructure concepts seem to indicate that ground cavalry is being slowly replaced by air cavalry.

It is my contention that air cavalry can never replace the ground cavalry. This is not to say that there is no place for the air cavalry; on the contrary, it has a very important role to play on the modern battlefield. Nevertheless, air cavalry's role should be enhancement rather than replacement of the ground cavalry forces.

STEPHEN JASPER
Second Lieutenant, Armor
Fort Knox, KY

Wants Armor Beret Or Badge

Dear Sir:

I read Command Sergeants Major Gillis's article "An Armored Force Badge Is Needed," in the September-October 1981 ARMOR Magazine. Also, in the same issue, I read the letter "Wants The Black Beret" by Sp5 Michael P. Burkhardt.

I am in the delayed entry program (DEP) and have signed up for Armor. I have studied armor's role in WWII, Korea and Vietnam and feel that we will have an increasing need for armor in the future.

I believe that either the Armored Force badge or a special beret should be made available for Armor troops.

RICHARD LEE ORTON
Bowling Green, FL

Mobility in Perspective

Dear Sir:

I have read Lieutenant Colonel (Ret) Boudinot's article "Ground Mobility in Perspective" in the January-February 1982 issue of ARMOR magazine, and want to say that in most respects you hit the subject right on the head.

Although I have designed both tracked and wheeled vehicles over the past thirty years and have developed a soft spot in my heart (and possibly in my head) for tracked vehicles, I would never suggest using a tracked vehicle to take my family on vacation from here to Lake Tahoe on Highway 80.

I guess where I really get "hung up" is on the issue of the uncertainties about the relative performance of tracked and wheeled vehicles, and the constant reference to theoretical models. Considering the seriousness and the importance of the subject, I am surprised that more definitive test work has not been done over the years. One of the best starts was the test between the 6x6 wheeled armored reconnaissance scout vehicle from Lockheed and the tracked armored reconnaissance scout vehicle from FMC. However, before that program got well underway, it was canceled in favor of the *M3*. Tests have been performed at Operation Swamp Fox in Panama and Operation Mudlark in Thailand by the British Army; but those, to a large extent, were in extreme environments and did not permit the tabulation of a broad spectrum of information concerning relative mobility, performance, maintainability, reliability, durability, and other factors as good examples of both wheeled and tracked vehicles. I have also seen tests in Europe—in Belgium and Holland—and felt that some of the conclusions did not relate to the generic capability of either tracks or wheels, but rather the capability of the specific company to design good, reliable vehicles.

I don't know if the problem will be solved in our lifetimes, but Colonel Boudinot's article certainly puts things in perspective and eliminates a lot of the emotional pros and cons which are usually based on very little knowledge of test experience.

J.J. MacROSTIE
San Jose, CA

M1 Resupply Problems

Dear Sir:

The article "The Best Tank Ever Built" (Jan-Feb '82) was an encouraging report on the outstanding capabilities of our new mount. However, I was surprised at the 1st Cavalary Division Commander's comment, "In terms of resupply, I don't see the resupply problem, for ammunition for example, as being that much more difficult than what we are operating with now in terms of the procedures we use to resupply a tank." Unfortunately, current ammunition resupply procedures are woefully inadequate, so the comparison is essentially an indictment.

The rationale that loading will be simpler because the *M1* holds 8 fewer rounds than the *M60* (even fewer with the 120-mm round) evades the issue. The fewer rounds that a vehicle carries, the more frequently it will need to be replenished. Each replenishment involves additional coordination, a break in temps, and exposure of crew members and resupply personnel (the latter in thin-skinned, wheeled vehicles). Furthermore, the switch to the larger 120-mm round will not only reduce the capacity of the tank, but also that of the resupply vehicle. The result is more frequent trips to the ammunition supply and transfer points. These journeys are extremely time consuming due to distance, waiting, loading, and route congestion. Add to this the incredible problems of unpacking the rounds and we have a real challenge.

Granted, the *M1* did not create all of these problems, and if a 120-mm round is required to do the job, then so be it. However, no attempt was made in designing the *M1* to facilitate rapid reloading of the vehicle. It still involves several crew members handling single bare rounds up to the sponson and then down the loader's hatch—slow, tedious, and back-breaking work. We continue to let the package ard current procedures perpetuate existing inadequacies instead of taking the initiative with improved weapon design.

Refueling operations, as the article pointed out, have increased in difficulty. The fuel transfer solution used during Operational Test III was to move the tanks through parallel lines of Goer fuel tankers creating ". . . a significant hazard because there is a lot of fuel around the tank." The division commander simply wrote this off to the hazards of war. There is, however, a better solution—closed circuit refueling. Aviation has had rapid refueling capability for over a decade, using a simple system in which the nozzle is locked into the fuel inlet port, fuel pumped in at a rapid rate, and the displaced air from the fuel tank vented elsewhere.

The *M1,* on the other hand, has four separate fuel ports, each capable of accepting only 50 gallons per minute. As on the *M60,* there is considerable delay due to foaming because the displaced air is vented out the inlet port. Using multiple fuel ports involves several crewmembers in the refueling, requires several fuel lines scattered about, and creates the hazardous conditions described in the article.

Ironically, each Goer has (along with its two 1½-inch 50 gal/min lines) a 2-inch line capable of pumping 100 gallons per minute. An *M1* refueling analysis conducted by the U.S. Army Quartermaster School in April 1978, suggested throttling back to the rate on the 2-inch line or using a Y-reducer to create even more lines! It would seem more logical to use the full capability of refueling technology and do the reducing and branching of the flow within the receiving vehicle, thus eliminating the external tangle of hoses, nozzles, and operators. Instead of marching backwards, we need to apply a closed-circuit modification to the tank that will allow it to make a one nozzle, high pressure pit stop with minimal time, effort, and personnel exposure.

The *M1 Abrams* tank is a quantum improvement over the *M60* and is desperately needed. These comments are not intended to detract from its many strengths. It is a shame, however, that the designers who gave it such outstanding firepower, mobility, and survivability did not adequately consider the more mundane but critical aspects of rearming and refueling.

Sincerely,

JOHN R. DREBUS
Captain, Armor

The .50-Caliber Is a "No-Go" Against BMP

Dear Sir:

I read with a great deal of interest the article "Tank Gunnery Qualification in the 1980's" by Major C.D. McFetridge, in the January-February 1982 issue. I believe the author has properly addressed some problems with the current methods of tank crew qualifications.

I believe there is one major error on page 11, where a weapon of choice against the BMP is the .50 caliber machine-gun, in addition to the main gun. In TRADOC Bulletin 7, "The BMP," the effectiveness of the BMP is addressed. Briefly, the .50 caliber machinegun cannot generate the glacis plate at any range or the sides of the BMP at ranges greater than 200 meters. Considering that the BMP main gun is effective against the *M60* tank at ranges of 800 meters, using only a .50 caliber against the BMP is not recommended. Any tank gun round will destroy the BMP.

Since the thrust of Major McFetridge's article is to properly train tankers, tankers should be aware that engaging BMPs with .50 caliber machinegun fire is not conducive to one's health.

GERALD A. HALBERT
Captain, Military Intelligence
Fort Knox, KY

COMMANDER'S HATCH

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

Specialty Proponency

On 1 October 1981, the mission of specialty proponency was transferred from the Army Staff to the "field" — to U.S. Army Training and Doctrine Command school commandants, where appropriate. This, in effect, shifted those responsibilities associated with proponency for officer specialty codes (OSC), warrant officer military occupational specialties (MOS), and enlisted career management fields (CMF) to the respective school commandant. This shift was intended to enable the commandants to become more attuned and responsive to the professional needs of the members of their branches. Under this tasking, the Commandant, U.S. Army Armor School (USAARMS), as the titular Chief of Armor, is the proponent for OSC 12 and enlisted CMF 19.

While this generally describes the concept of specialty proponency, it does not specifically define what specialty proponency is.

The U.S. Army Soldier Support Center has provided a synopsis of what a proponent is supposed to be and do: A proponent is, "An advocate responsible for voicing the professional needs of, and recommending actions to maintain accessions and sustain the specialty . . . The proponent is the chief lobbyist for furthering issues important to maintaining high levels of professional competence, assignments, promotion and selection opportunities, and transitioning to new postures based on changes in Army doctrine and supporting systems." In effect, the proponent is charged with monitoring the health of his specialty and to recommending changes to correct problem areas.

The Office of Armor Force Management and Standardization (OAFMS) has been designated as my representative and charged with coordinating this role at the USAARMC, and works hand-in-hand with the operative agencies — Office of the Deputy Chief of Staff for Personnel and the Military Personnel Center. AR 600-101, *Specialty Proponency (Draft)*, provides guidance to the proponent and lists 24 responsibilities that are functionally related to the personnel management life cycle functions. Those functions are:

• *Procurement* — Recommending future authorizations by grade, special skill identifier, and additional skill identifier; developing recall criteria for mobilization.

• *Training and Education* — Identifying civilian and military education requirements; developing and recommending standard criteria and AERB requirements.

• *Distribution* — Assessing inventory vs authorization vs requirements, recommending optimal specialty code pairings, and evaluating assignment policy.

• *Sustainment* — Maintaining a line of communication with constituents, evaluating retention and stabilization policies, and recommending initiatives to improve same.

• *Separation* — Evaluating separation and retirement procedures, recommending continuation or elimination standards, and developing qualification standards.

As the lead staff agency for proponency, OAFMS gathers information regarding the specialties and then evaluates that information to identify important issues. It then prioritizes those issues, further analyzes and refines them, and formulates a plan of action for coordination with all affected agencies. After coordination, and my approval, the proposal is then forwarded to the proper action agency to cause change and improve the health of the specialty.

The process just described is a dynamic one and issues are in constant flow, either at a stage of formulation, coordination, or recommendation. However, the key to the total effort is something that must be fostered and maintained by everyone involved — communication. USAARMC Branch Training Team (BTT) visits, and the questionnaires and surveys associated with them, have surfaced many proponency-related issues that have been acted upon. The BTT is a major factor in the communication process, and must be actively supported if we are to make specialty proponency a success.

Specialty proponency is designed to improve the health of the specialty. Specific individual problems do not normally fall under this umbrella unless the issue affects the armor community *in toto*. Generally speaking, issues will deal with the future — "where are we today, where should we be in 1990, and how do we get there?" Proponency will allow us to more closely monitor the force, and cause us to change those items that adversely affect armor readiness. The essential ingredient is effective communication; without it we perish, with it we flourish. I solicit your support.

DRIVER'S SEAT

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

Sergeants' Business

At the conclusion of each Armor Advanced Noncommissioned Officer Course (ANCOC) at Fort Knox, a seminar is conducted with 10-12 selected NCO's from the class attending. Subjects include their opinions on course content, training in units, caliber of the NCO Corps, how well trained the new soldiers are when received in units, etc.

During one such seminar, the subject was the quality of platoon leaders assigned to the unit after graduation from the Armor Officer Basic Course. One young staff sergeant (who was the platoon sergeant in his unit) stated that during the Officer Basic Course, the lieutenants should be told that they do not inspect the platoon in formation without first telling the platoon sergeant, as the appearance of soldiers is "sergeants' business"—the platoon sergeants' responsibility. Another staff sergeant agreed, adding that the platoon leader should not inspect the platoon billet area without first telling the platoon sergeant as this, too, is "sergeants' business." Three other young staff sergeants from the following ANCOC class made similar comments during their seminars. All were sincerely convinced that their statements were accurate.

The fact that these young staff sergeants were wrong is not as important as why they thought the way they did. The answer in part is their failure to fully understand "sergeants' business." There is some logic as to how this may have occurred.

"Sergeants' Business" was the title of an address given by General Starry on 3 November 1977 at the US Army Sergeants Major Academy. Shortly thereafter, a condensed version of the address appeared in *Military Review* and a videotape was distributed throughout the Army. Dealing with individual training of soldiers, "Sergeants' Business" clearly defined the responsibilities of the NCO and the officer. The senior leadership of the Army, officer and NCO, took it to heart and expanded upon it, defining responsibilities for other tasks belonging to the NCO or the officer. It was understood at the platoon sergeant level and above that, while the tasks belonging to the officer or NCO were more clearly defined by this expansion of "sergeants' business" into other areas, the officer was still accountable for mission accomplishment and unit performance and the NCO was still accountable to his officer for tasks required to attain both. In many cases the specialists four and sergeants E5 did not understand this and perceived a total separation of tasks and *accountability*. In other words, when the platoon sergeant stated "This is sergeants' business," he knew he was talking about a *task* that was the NCO's responsibility to perform. When the specialist four and sergeant E5 *heard* the same, they understood it differently. They identified it with a *mission* (i.e., inspecting billet areas), that was no business of the officer. Over 4 years have passed. These same specialists four and sergeants E5 are the staff sergeants of today's Army. Unfortunately, some still have the same misguided definition of "sergeants' business."

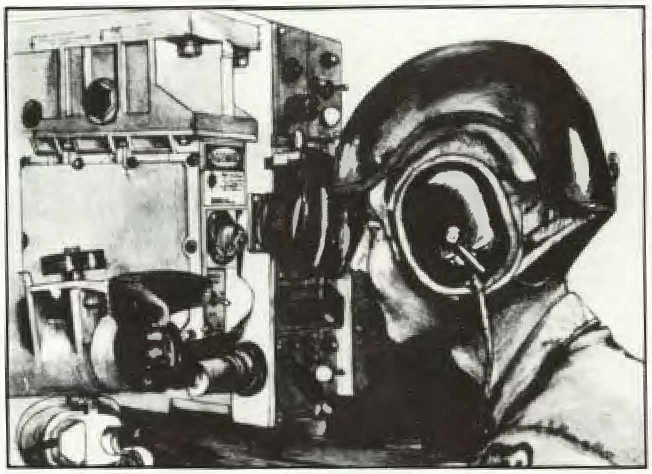
The staff sergeants in the seminars failed to understand that they were responsible for the task of *preparing* their platoons for the inspection in ranks and/or inspection of billets. They are accountable to their platoon leaders for this task, while platoon leaders are accountable to their company commanders for the task of *inspecting* the platoon. The accountability for each task does not change, even though the responsibility to inspect is delegated to the platoon sergeant. Understanding correctly the task of the NCO and the task of the platoon leader eliminated the misconception that the platoon leader has to tell the platoon sergeant when or if he is going to inspect.

The leadership at battalion and company level should evaluate their commands to see if the duties and responsibilities of officers and NCO's (which may overlap) are not confused to the point where one or the other fails to recognize who is accountable for what.

We have suffered in the past from this lack of a clear understanding of the duties and responsibilities of the officer/NCO. The disaster of "VOLAR" in the late 1960's and early 1970's was at least partially the result of failing to recognize who was accountable for what. The same was true in the mid-1970's when, in our eagerness to rebuild the NCO Corps, attempts were made to redefine some officer duties as belonging to the noncommissioned officer. History has a habit of repeating itself. If we don't insure that all have a complete understanding of "sergeants' business," or the duties and responsibilities of the officer and the NCO, or however else it is referred to . . . it will!

John W. Gillis

MASTER GUNNER'S CORNER



MSG Emil M. Dular
Senior Enlisted Advisor
1st Bn. 632d Armor
WIARNG

Density Altitude and Tank Gunnery

Air density directly affects the aerodynamic performance of a given projectile and is one of several elements of fire control data processed by computers aboard *M60A3* and *M1* tanks. Air density is an expression of mass per unit volume. Air at standard sea level conditions has a density of 0.002378 slugs per cubic foot. The mass of a cubic foot of air decreases as altitude increases. Since the density of the air working on a projectile in flight directly affects the amount of aerodynamic forces produced, it becomes apparent that a round will travel farther if density and, therefore, drag decreases. In addition, rounds that are spin stablized will not drift as much when air density is reduced.

The international Civil Aviation Organization has defined a standard atmosphere to provide a common denominator for comparison of aircraft performance and a standard for instrument calibration. As can be noted in the firing tables, this latter is also the standard used for ballistic computations. Since weather patterns cause changes in pressure and temperature, actual operating conditions are rarely under "standard conditions." (See figure 1 for standard atmosphere.)

Air temperature also has another affect apart from its effect on air density. The second effect is termed the true temperature effect and is a result of the relationship between the speed of a projectile and the speed of the air compression waves that form in front of or behind the projectile. These compression waves move at the speed of sound, which is directly proportional to the temperature. Considering the nature of tank gun projectiles, coping with supersonic aerodynamics is greatly affected by this phenomenon.

Density calculations are accomplished by the *M60A3* and *M1* computers, but the data required from the crewmember is not the same in each case. The *M21* computer has an altitude knob and a temperature knob, while the computer on the *M1* tank requires pressure entry in inches of mercury (in. Hg.) and a temperature entry. It is axiomatic that for a computer to do its job, it needs accurate information.

The *M21* computer on the *M60A3* tank requires that pressure information be entered by means of an altitude knob graduated in meters. Presently, this information is determined by the crewmember referring to the mapsheet and using contour lines to determine his true altitude above sea level. This technique disregards the variations in barometric pressure that occur in nature. The data actually required by the computer is the *pressure* altitude. Pressure altitude is the height measured above the 29.92 inches of mercury pressure level (standard datum plane). This is the altitude in the standard atmosphere corresponding to a particular pressure. The effect of not using pressure altitude is to introduce errors easily as great as plus or minus 300 meters (1,000 feet) on the altitude knob.

A possible example of this type of error is the problem encountered by an *M60A3* tank at a true altitude of 300 meters (1,000 feet) above sea level on a day when the barometric pressure is 30.92 in. Hg. If the crewmember were to index 300 meters on his altitude knob, he would cause his gun to hit slightly low. This is because indexing higher than standard pressure, in effect, lowers the tank's altitude. Using the standard atmosphere table, the pressure ratio for an altitude of 300 meters (1,000 feet) is .9644. By multiplying this factor with the barometric pressure from the weather report, 30.92, an ambient pressure of 29.82 exists at the firing location. This equates to a pressure altitude of 30 meters (100 feet). Since the altitude knob of the *M21* computer is calibrated in 100 meter increments, the closest setting is zero (sea level).

The barometric pressure used in this example is the local pressure reduced to its sea level equivalent. All the examples in this article use pressures corrected to sea level in inches of mercury, unless otherwise noted.

This method, while accurate, is time consuming to apply and requires the use of the standard atmosphere table. An alternative would be to supply each tank with an altimeter set to 29.92 in. Hg. so that the crewmember could read the pressure altitude from the face of the instrument. A more feasible approach that will closely approximate the correct setting exists. The formula is given in meters so that no conversions will be required to enter the data in the compu-

ALTITUDE		DENSITY		PRESSURE				TEMPERATURE			SPEED OF SOUND
feet	meters	slugs/ cu. ft.	ratio	lbs/ sq. ft.	in/ Hg	mb	ratio	F.	C.	ratio	knots
0	0.0	.002377	1.0000	2116	29.92	1013.2	1.0000	59.00	15.00	1.0000	661.7
1000	304.8	.002308	.9711	2041	28.85	997.1	.9644	55.43	13.02	.9931	659.5
2000	609.6	.002241	.9428	1968	27.82	942.1	.9298	51.87	11.04	.9862	657.2
3000	914.4	.002175	.9151	1897	26.81	908.0	.8962	48.30	9.06	.9794	654.9
4000	1219.2	.002111	.8881	1828	25.84	875.1	.8637	44.74	7.08	.9725	652.6
5000	1524.0	.002048	.8617	1761	24.89	843.0	.8320	41.17	5.09	.9656	650.3
6000	1828.8	.001987	.8359	1696	23.98	812.0	.8014	37.60	3.11	.9587	647.9
7000	2133.6	.001927	.8106	1633	23.09	781.8	.7716	34.04	1.13	.9519	645.6
8000	2438.4	.001868	.7860	1572	22.22	752.6	.7428	30.47	- .85	.9450	643.3
9000	2743.2	.001811	.7620	1513	21.39	724.2	.7148	26.90	- 2.83	.9381	640.9
10000	3048.0	.001755	.7385	1455	20.58	696.8	.6877	23.34	- 4.81	.9312	638.6

Figure 1. Standard Atmosphere.

ter. The current barometric pressure required is obtained from aviation or artillery units that already have a requirement for the data.

$PA = [(29.92 - BP \times 300)] \times TA$ where:
PA = pressure altitude
29.92 = standard pressure
BP = current sea level pressure
300 = constant, in meters
TA = true altitude above sea level, in meters

Using the data from the previous example:

$PA = [(29.92 - 30.92) \times 300] + 300$
$PA = [(-1.00 \times 300)] + 300$
$PA = [-300] + 300$
$PA = 0$

The computer design of the *M1* tank causes a different problem. The computer has provisions to enter the ambient static pressure; however, the pressure data that the crewmember is likely to receive from weather reports will have been corrected to represent a sea level pressure. If this pressure reading is entered into the computer, the actual height of the tank above sea level is ignored, along with the attendant change in pressure. Unless the crewmember and his tank are employed on a landing ship, he will have to make some corrections to the data so that it can be used by the computer.

Consider a tank operating at Fort Carson, CO on a "standard day." Entering 29.92 on the computer would cause the gun to hit high. Since Fort Carson averages 1,500 meters (5,000 feet) above sea level, the actual ambient pressure existing there under standard atmosphere conditions is 24.89 inches of mercury.

To compute ambient pressure:

$AP = BP \times PR$

where:

AP = ambient pressure
BP = current sea level pressure
PR = pressure ratio for the true altitude

A tank is operating around Leadville, CO. The map shows the true altitude to be 3,048 meters (10,000 feet). Current weather gives the barometric pressure as 28.65 inches of mercury. Thus:

$AP = 28.65 \times .6877$
$AP = 19.70$

The crewmember would index 19.70 in his computer. Should a standard atmosphere table not be available (likely it will not be) an alternate method exists to approximate the correct setting. It is based on the rule of thumb that pressure drops at the rate of 1 inch of mercury for every 300 meters (1,000 feet) of altitude gained. An example for Fort Knox, KY area might be: current barometric pressure, 29.75; true altitude, 228 meters (750 feet). Therefore, $29.75 - .75 = 29.00$. 29.00 is entered into the computer. This method is useful to altitudes of 300 meters (1,000 feet).

At this point, it may seem that the most obvious strategy for the *M1* computer has been overlooked, that of simply asking the local weather station for the ambient pressure. During the *M1* tank Operational Test (OT) at Fort Bliss, TX, this is precisely what was done. For the duration of OT II, the weather station at White Sands Missile Range provided pressure data without sea level corrections to the crews of the test vehicles.

It is apparent that unless the reporting stations and the firing location are at the same altitude, differences in pressure will exist between the two points. Thus, corrections will still have to be made to the pressure values before they can be used by the computer. An example of this would be a station at 300 meters (1,000 feet) above sea level measures an ambient pressure of 28.65 in. Hg. The firing tank on a nearby hill is at an elevation of 457 meters (1,500 feet). Since there is a difference of 157 meters (500 feet) between the two points, the ambient pressure at the tank's location would be reduced to 28.15 in. Hg.

The real drawback to this approach is that the altitude of the measuring station must be known in order to make any calculations that might be required. Obviously, this might not be a problem in areas that have very flat terrain, but where there are terrain features it must be considered. On the other hand, when pressure figures are used that have been reduced to sea level equivalents, a common reference is established, and it becomes only necessary to know the altitude of the firing location. The National Weather Service standards for the collection of pressure data require observing stations to report their readings as sea level pressures in millibars. Pressure data disseminated through general, marine, or aviation weather services of the National Weather Service are sea level pressures using various units of measure, with inches of mercury being the most common. Army MET stations report and transmit through artillery channels uncorrected pressure data in millibars and percentages of standard, depending on the type of MET message. Regardless of the source, it is important to determine the type of pressure indicated by the report, sea level or ambient, before it is used.

Since it can be seen that density is determined by pressure and temperature, and that pressure varies with altitude and weather, it follows that it would have been more convenient if the computer had entries for true altitude, barometric pressure, and temperature. Since that is not the case, alternate methods of determining the correct data are required. The handiest solution might be to include graphs in the operator's manual, similar to the graphs in aircraft flight manuals dealing with density altitude problems. Examples of such graphs for the *M60A3* and *M1* are in figures 2 and 3.

Another point to be considered is how to obtain pressure information in a useful form. Convenience, flexibility, and ease of computation make sea level equivalent pressure in inches of mercury the desired form. Currently, there is no doctrinal requirement for this data to be made routinely available to armor units, much less individual tank crews. This information is readily available for most areas of operation from aviation sources as the current altimeter setting. USAF AWS (Aviation Weather Service) provides this support to the Army.

A typical aviation weather sequence report will look like this: FTK 15SCT M25OVC 1R-K 132/58/56/1807/993 R18VR20V40. Translated, it reads: "Fort Knox observation, 1,500 scattered ceiling 2,500 overcast, visibility 1 mile in light rain and smoke. Sea level pressure 1013.2 millibars, temperature 58, dew point 56, winds 180 degrees at 7 knots. Altimeter setting 29.93 inches. Runway 18 visual range 2,000 varying to 4,000 feet."

The altimeter setting can be used for the computations required to correctly determine pressure data for the fire control computers. Since this type of observation is made hourly, it is easy to get current information.

The only artillery MET message which can be readily used to determine the required data is the Computer MET Message. However, since the pressure data is given in millibars, and not reduced to sea level equivalents, the data will have to be manipulated to a useful form.

A typical computer MET Message heading will look like this:

METCM1347983
192000040972

Translated: Army MET computer message for octant 1, prepared by a station located at latitude 34.7 degrees north, longitude 98.3 degrees west on 19 day of the month at 2,000 hours Zulu time. Station height is 400 meters above sea level and the ambient pressure at the surface is 972 millibars. The last six digits of the second line provide the station height in tens of meters (040 = 400 meters) and the surface, uncorrected, pressure in millibars (972). To compute a local pressure from this type of message, the following formula can be used.

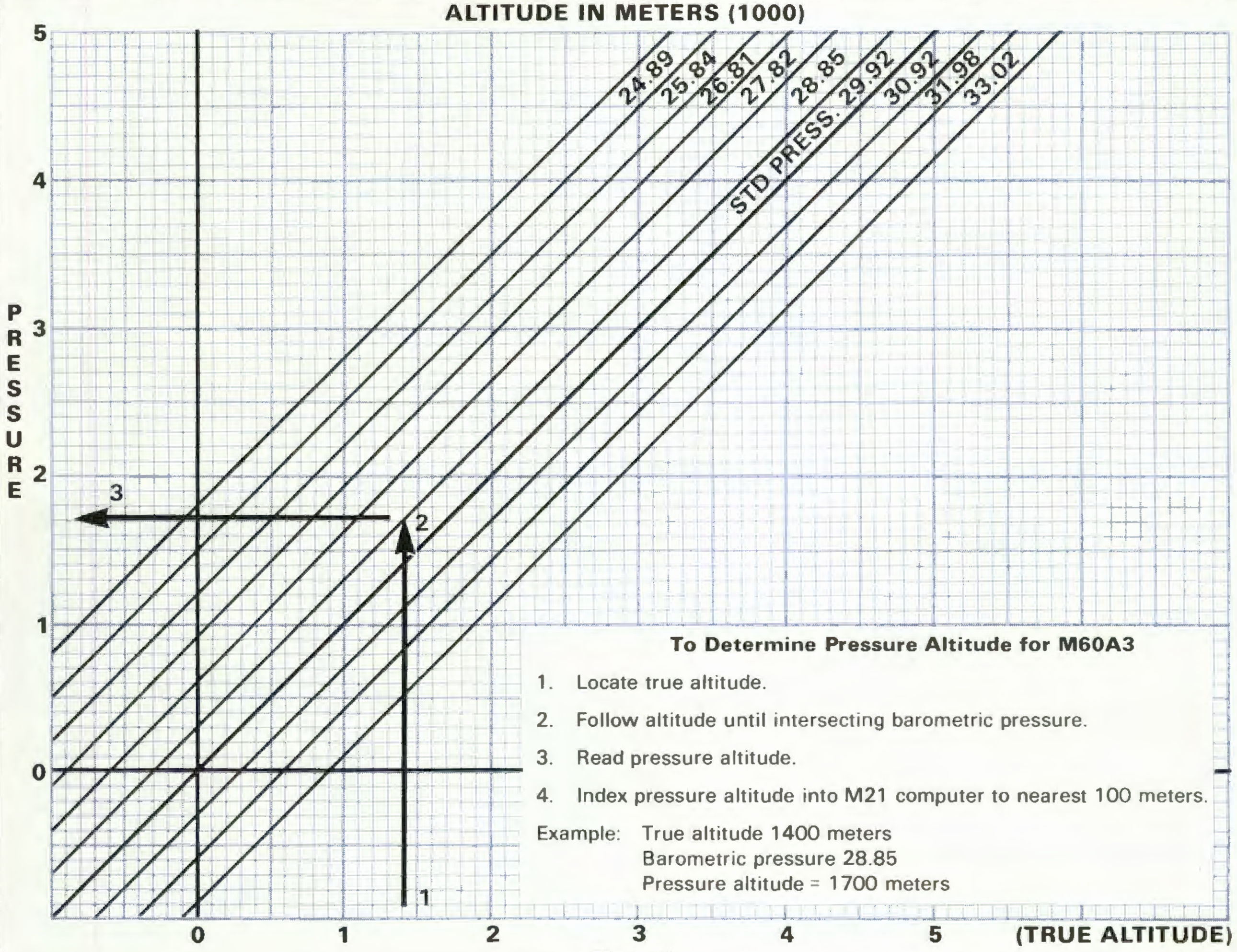
$$LP = \frac{SP + (SA - LA)}{34} \qquad \text{where:}$$

LP = local ambient pressure in inches of mercury
SP = station ambient pressure in millibars
SA = station altitude in tens of meters
LA = local altitude in tens of meters, from map
34 = millibars per inch of mercury

From the message for a local altitude of 720 meters.

$$LP = \frac{972 + (40 - 72)}{34} \longrightarrow LP = \frac{972 + (-32)}{34}$$

$$LP = \frac{940}{34} \longrightarrow LP = 27.65$$

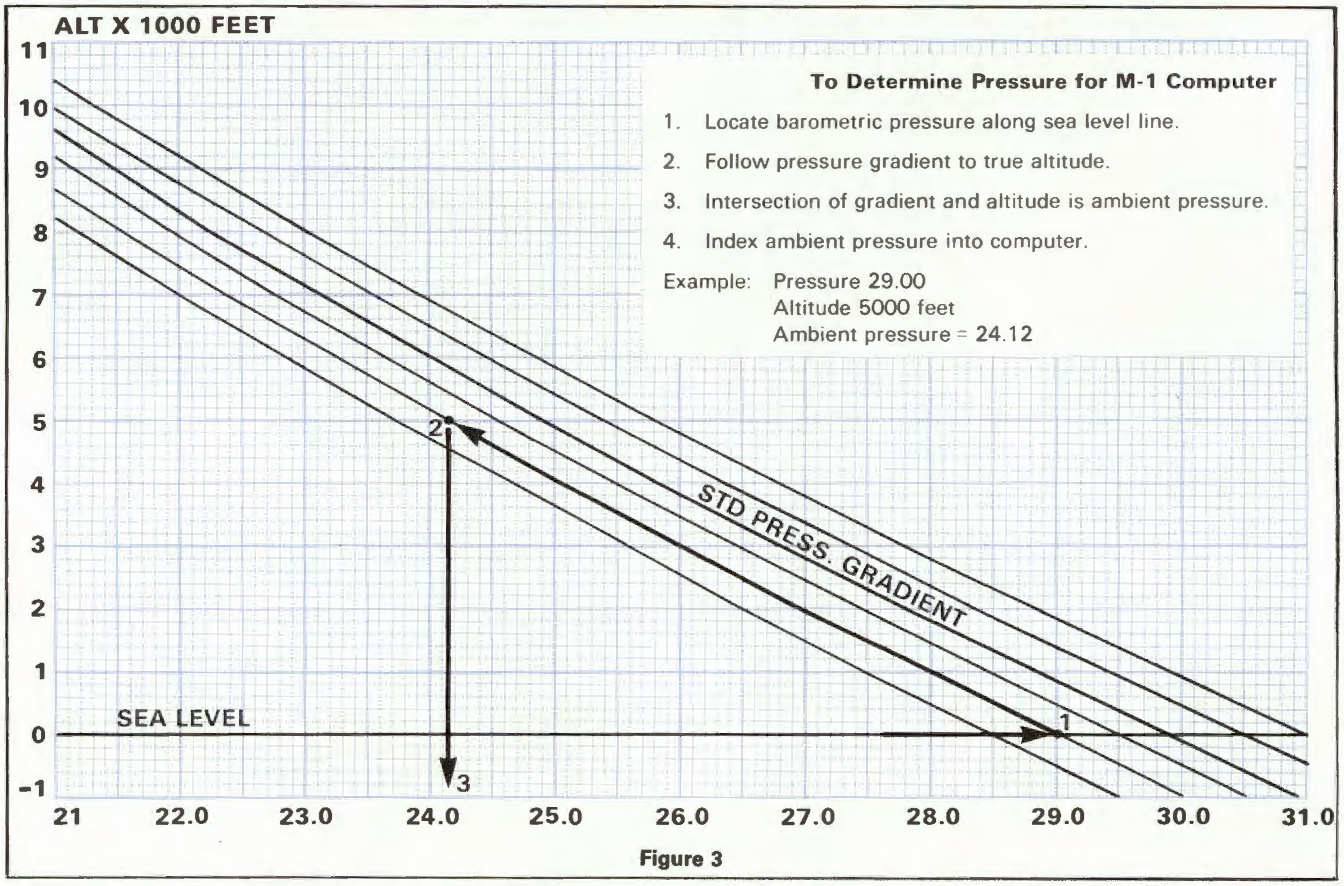


To Determine Pressure Altitude for M60A3

1. Locate true altitude.
2. Follow altitude until intersecting barometric pressure.
3. Read pressure altitude.
4. Index pressure altitude into M21 computer to nearest 100 meters.

Example: True altitude 1400 meters
Barometric pressure 28.85
Pressure altitude = 1700 meters

Figure 2



To Determine Pressure for M-1 Computer

1. Locate barometric pressure along sea level line.
2. Follow pressure gradient to true altitude.
3. Intersection of gradient and altitude is ambient pressure.
4. Index ambient pressure into computer.

Example: Pressure 29.00
Altitude 5000 feet
Ambient pressure = 24.12

Figure 3

The last item to be discussed is just how much do changes in density really affect the strike of the round. Figure 4 is an extract of an expanded firing table outlining the effects for a one percent change in density. Consider a tank at Fort Bliss, TX, 1,372 meters (4,500 feet) above sea level, barometer, 29.00 and a temperature of 110 degrees (not uncommon on Donna Ana Range). This amounts to a density altitude (the height in the standard atmosphere where air of a particular density would be found) of just more than 300 meters (1,000 feet). This is about a 26 percent change from standard sea level conditions. A HEAT round fired at a target 1,500 meters (5,000 feet) away would strike .91 meters (3 feet) (.6 mils) higher than intended. A HEP round fired under the same conditions would fly 3.03 meters (9.94 feet) higher (2.0 mils) and drift .31 meters (10.2 inches) (.2 mils) less. APDS, with its higher velocity and more efficient aerodynamic shape, would be affected least of all; .04 meters (1.5 inches) higher and .003 meters (.11 inches) less drift.

Some might argue that since kinetic energy rounds are our primary rounds and the effect of them is so small, even under the extremes of the example, why bother? Others may content that once a tank is zeroed, "all that stuff will be zeroed out. Besides, a tank won't move around enough to encounter such changes in terrain." The fallacy behind these arguments is that they ignore the fact that any improvements made to the fire control solution will also reflect on hit performance, no matter how small.

Thus, air density becomes just one more parameter to work with, another point to consider for any tanker really interested in obtaining all the performance that was designed into the system.

RANGE Meters	**APDS M392A2**		**HEAT M456A1**	**HEP M393A2**	
	Change in height meters	**Change in drift meters**	**Change in height meters**	**Change in height meters**	**Change in drift meters**
800	.0004	.0000	.0039	.0133	.0004
900	.0007	.0000	.0057	.0197	.0006
1000	.0010	.0000	.0082	.0281	.0009
1400	.0029	.0001	.0270	.0903	.0031
1500	.0035	.0001	.0348	.1155	.0039
2900	.0301	.0007	.5248	1.2068	.0640
3000	.0338	.0007	.6175	1.3475	.0744

Note 1. If density increases, height decreases and drift increases. If density decreases, height increases and drift decreases. Note 2. Since HEAT ammunition is fin-stabilized, there is no drift.

Figure 4. Effects of one percent change in density.

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 47)


①


②


③


④


⑤


⑥

Thunder In the Desert

by Major Charles R. Steiner, Jr.
Photos by the Author

"We'd really been fighting hard. It seemed like real war, the real thing. We had a private in our unit who killed three tanks yesterday by himself with his Dragon. War is hell and believe it! You've got to stay alert. To survive you have to be on top of everything. You got to take it serious...play the game to win. I know I do."

PV2 Cedric C. Mitchell, A Co, 4-54th Infantry.

If it is true that the battle of Waterloo was won on the playing fields of Eton, then the mechanized battles of the next war are being won today on the desert sands of the National Training Center (NTC), Fort Irwin, CA. To find out what a rotation through the NTC was like for the officers, NCO's and troops who experienced it, *ARMOR* visited the 194th Armored Brigade taking part in Operation DESERT THUNDER, a 22-day exercise in which elements of the brigade deployed to Fort Irwin, drew equipment, conducted 14 days of tactical exercises, including force-on-force maneuvers and live firing, and redeployed to Fort Knox, KY.

While the program is in its infancy and has some growing pains, the consensus among the participants is that a rotation through the NTC is the best training experience available, short of actual combat, for combined arms task forces. That opinion is based on the fact that the program exercises all elements of the combined arms team together and presents commanders and staffs with real-world problems of planning and coordination on a scale not available at other training locations and at an intensity guaranteed to be physically, mentally, and emotionally demanding.

Units are deployed to Fort Irwin in a brigade slice sufficient for two task forces. In the case of the 194th Armored Brigade, it included a mechanized infantry and armor battalion, the brigade artillery battalion (less one firing battery), most of the brigade's support battalion, a combat engineer company (minus one platoon), a *Vulcan* air defense artillery (ADA) battery, and chemical reconnaissance, decontamination, and smoke generator detachments as well as military intelligence and electronic warfare elements. The brigade was augmented by those assets not organic to it. Divisional units take organic attack helicopter and ADA assets as well.

Mission Scenario

The training program of the NTC is new but expanding. Units deploy by military or commercial air to Norton AFB, San Bernadino, CA, and are transported overland to the NTC. Equipment not drawn from the unit sets at the NTC is transported by rail from the home station to Yermo, CA, and convoyed to Fort Irwin. On the third day, the training begins with force-on force exercises for both battalion task forces. During this 4-day period, units have an opportunity to shakedown their equipment, acclimate themselves to the environment and familiarize themselves with the terrain and enemy. On D+7 one task force splits off to conduct 5 days of live fire exercises while the other continues force-on-force training. On D+12 the task forces switch roles. From D+16 on, units pull maintenance on their equipment, turn it in and redeploy to their home station. Eight such rotations are scheduled for FY 82, 10 for FY 83, and 21 for FY 84 (figure 1).

While all rotations follow the same general scenario, brigade commanders and staff and NTC teams begin coordinating and formulating the specifics of the scenario, based on the training needs of the units, 3 months before a scheduled rotation. To highlight the training experience, after-action reviews are conducted by NTC controller/observers at platoon, company, and task force level following each exercise on terrain overlooking the battle area. The reviews reveal the tactical strengths and weakness of each unit based on their adherence to doctrine. Interviews with unit commanders who participated in the reviews, reveal that they believe in the soundness of our doctrine and that defeating Warsaw Pact formations is achievable *when the doctrine is implemented properly.*

The success or failure of a unit in a force-on-force encounter is quite apparent after a battle. As both the friendly and OPFOR units are equipped with the multiple integrated laser engagement system (MILES), vehicle and weapon system kills are conspicuous.

On completion of the rotation, a complete package of data is provided for the brigade's review to enhance future training.

Terrain and Weather

Over 577,000 acres are available at the NTC for maneuver training areas, firing ranges, and impact areas. The terrain consists of high desert, composed of valleys surrounded by high peaks. Dry lake beds abound. Elevation ranges from 1,300 to 6,100 feet above sea level.

From the air, on maps, and as seen from the distance, much of the terrain appears featureless. Closer examination however reveals gullies, wadis, and other areas that will conceal armored vehicles. Rock formations near the mountains can severely impede vehicle travel. Distances are deceiving as well. Enemy formations could be observed as far as 15-20 kilometers away. Estimating distance and time required to traverse it became easier as troops became familiar with the desert environment.

While the climate is generally dry, it snowed and rained at times during DESERT THUNDER. In fact, the temperature is as deceiving as the terrain, averaging in in the mid-20's in December and January and climbing to 110° in July and August. Soldiers participating in DESERT THUNDER, who were not prepared for the cold, were extremely uncomfortable at night and during the early morning hours. While riding in open vehicles nuclear, biological, and chemical protective (MOPP) garments were worn as much for warmth as for protection. Time and again unit commanders emphasized the importance of being prepared for extremes of weather and temperature in the desert.

The Enemy

The opposing force (OPFOR) consists of the 1st Battalion, 73d Armor and the 6th Battalion, 31st Infantry configured to represent a Soviet motorized rifle regiment (MRR). Their mission is to provide rotation task forces the opportunity to maneuver against a live enemy force in realistic scenarios, against realistic force ratios, using Warsaw Pact combat formations and tactics. The OPFOR vehicles are *M551 Sheridans* modified to resemble the *T-72*, The BMP, the *ZSU-23-4*, and the *M-1974* 122-mm self propelled howitzer. Rounding out the line-up, *M880* trucks are configured to resemble BRDMs while real MTLBs may be seen in the formations as well. While each vehicle is distinctive in itself, the visual impact of hundreds of them maneuvering against you is best described as awesome.

Adding to the realism of the OPFOR are his aviation assets, and since he flys A-7 Corsair II fighter-bombers, (while friendly air flys *F-4s, A-10s,* and *F-15s),* it is easy to identify aircraft as friend or foe. While battles between the forces are intense and the good guys don't always win, the OPFOR regimental commander emphasizes that his mission is to present as realistic a scenario as possible and to adhere closely to Soviet Doctrine—whatever the outcome of an engagement.

DESERT THUNDER was the third rotation to employ the OPFOR MRR. The OPFOR quickly gained the respect of the rotation units. Friendly commanders remarked that the OPFOR was well trained, very aggressive, knew the terrain very well, used his combat multipliers to full advantage and would defeat you if you were not prepared

Deployment

While the major benefit of the rotation occurs during the exercises, the predeployment planning ensures that the process runs smoothly. The brigade staff makes most of its money during this phase.

Critical to the deployment is getting the right kinds and amounts of equipment to marry up with the operators and crew. The NTC has two sets of equipment for each task force. While one is being used the other is being maintained. The sets are not as yet complete, so the rotation unit must bring the difference between what

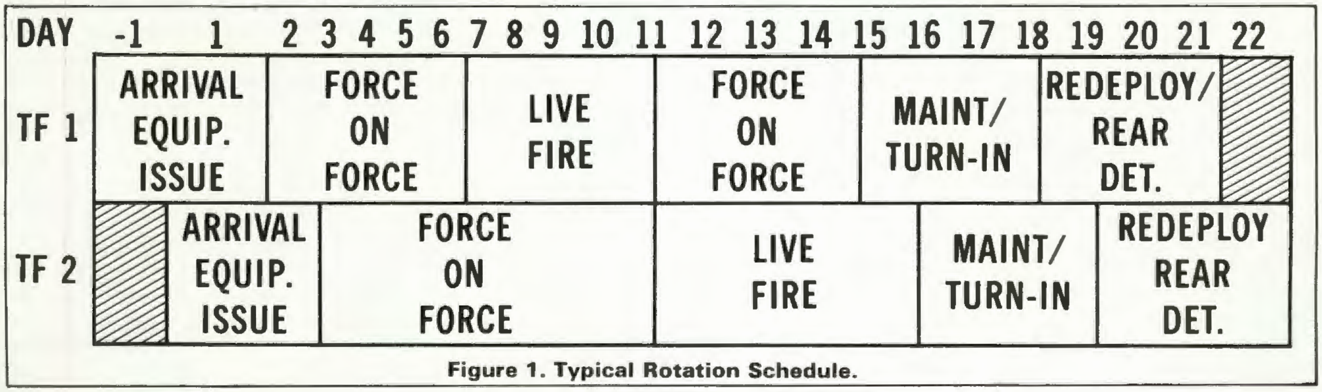


Figure 1. Typical Rotation Schedule.

the mission requirements are and what the NTC can provide. For example, units must bring their own TOW and *Vulcan* systems and direct support maintenance assets as the NTC is not yet fully stocked. As the NTC continues to fill the sets, the availability figures may change.

Not only must you know what equipment is available but also in which unit set it has been assigned so you can sort out which unit must ship what equipment. Consequently, close and continuous coordination is necessary between the NTC and the rotation unit. Since initial coordination takes place 3 months before deployment and the Military Traffic Management Command (MTMC) requires 60 days notice to order rail stock, it is necessary to be on top of the situation immediately. Rail transportation is an expensive undertaking and cost estimates may well dictate what equipment can go and what must be left behind. In order to program the cost more closely, the minimum number of railroad cars must be ordered as soon as possible. This will fix the freight rate. Additional cars can be added later at that rate. Otherwise, as freight rates fluctuate, the deploying unit will be unable to tie down the true cost of shipment. The brigade S-3 is heavily involved in this phase of the planning as it involves the configuration of the brigade slice. Later, the movement officer gets more involved and as the equipment list stabilizes, coordination with the post Transportation Division takes place to cram equipment into every available inch on to the cars. As always, changes take place up to the last minute because the maintenance status of vehicles designated for shipment changes or other problems occur.

No less attention should be given to the individual clothing and equipment each soldier will take with him. As only two duffle bags and an all-purpose, lightweight, individual carrying equipment pack may be taken aboard a plane, the equipment must be minimal but take into account that at certain seasons of the year the weather can be tricky. Rain suits, field pants, and parkas are not unusual requirements. A battalion commander even suggested that arctic sleeping bags were a good idea, and since the temperature changes drastically between sunup and sundown, wearing clothing in layers is the rule of thumb. Simply stated, the desert is a harsh environment and a comfortable stay requires meticulous planning for the individual as well as the unit.

Personnel

The brigade S1 must plan for real world contingencies such as medical evacuation of injured personnel, emergency leaves, mail delivery, and exercise contingencies such as casualties, and replacements. Morale support activities are few due to the limited facilities available, the short time on site, the simulated combat conditions, the intensity of the operations, and the field locations of units, which are miles from the cantonment area of Fort Irwin. Nevertheless, provision was made to provide a snack truck from time to time when the tactical situation allowed, or to show a movie in the brigade rear area occasionally.

The brigade replacement detachment and finance section were of significant value. In the first case, the replacement detachment acted as a collection and holding area for personnel going to and from sick call, stragglers, and returning medical evacuees. If a soldier was injured he was medically evacuated with what he was wearing and during his treatment he might have had boots or clothing cut off. The replacement detachment insured that the soldier returned to his unit with sufficient clothing and equipment to begin functioning immediately. Returning soldiers were consolidated in the holding area and dispatched in groups to their units, thereby alleviating the need for multiple replacement runs to distant locations.

The detachment also coordinated with the Red Cross and post transportation to insure the quick movement of soldiers going on emergency leave. The finance section cashed checks for soldiers in that situation, and visited field sites to cash personal checks. It did not cash government payroll checks, given the large sums involved and the fact that there was no way to spend or secure large amounts of cash.

Mail service was provided in a normal fashion by the postal service and no major problems were involved in getting mail to the troops.

Safety is a major concern for an exercise of this magnitude. Significantly, the brigade suffered no vehicle accidents during their stay but did experience numerous injuries from falling vehicle hatches and sprains and twisted ankles resulting from the rugged terrain. Therefore, safety awareness must be an integral part of all predeployment planning and must be continuously stressed during the exercises as soldiers get tired and forgetful.

Planning is necessary to handle simulated casualties or replacements during the play of the problems because one-for-one replacement of casualties takes place on completion of each exercise based on reports submitted by the player units. For example, personnel declared casualties may not resume play during an exercise until casualty reports complete their journey to division (played by an NTC control group) and the replacement message works its way back to battalion.

Medical support is provided by the 247 Medical Detachment (Helicopter Ambulance), Weed Army Community Hospital, and civilian hospitals in the area for special care.

Preparation and training of field medics is important because they really get to ply their trade in the desert. The medics, who might be taken for granted at home, take on the status of "field MD." They must be mentally prepared to actively seek out ill or injured troops. Since mess kits are necessary to prevent paper litter that attracts coyotes, birds, and enemy observation and fire, the medics must insure that field sanitation is practiced. Additionally, the air is dry; therefore chap sticks, and skin lotion must be available. Forced water consumption should be planned for. And in the heavy dust, outbreaks of upper respiratory infection can be devastating and eyes become constantly irritated. So dust masks, face cloths made from medical bandages, and goggles should be provided to as many soldiers as possible.

Training

The tactical success or failure of a unit will be determined by the training that takes place before the deployment. One thing becomes clear. If everyone knows their job and pulls their load the unit will succeed.

For individual soldiers, it means that they master the skills required for their MOS. Skills, which may seem mundane, such as vehicle driving, finding good defilade positions, driving into and out of positions, putting in range cards, and avoiding cresting hills, become crucial during the exercises. It was demonstrated time and again that individual errors often cost a unit heavy casualties. So, too, individual initiative often resulted in destruction of the enemy force. So, the mental preparation of the soldier toward the challenges he will face will reap dividends.

At the platoon level, leaders must master maneuvering their units without using radios. Because the threat of electronic warfare is always present and often used, platoon leaders must know how to keep track of their people and get them to do what is required quickly in the absence of radio communications.

Battle captains at the company level will have their work cut out for them. They will be employed with a full complement of cross attachments, including a fire support team (FIST), combat engineers, an infantry or armor platoon, and air defense assets. Consequently, the company commander must train as much as possible with those assets. The training should include terrain walks, tactical exercises without troops (TEWTs), terrain board and map exercises, as well as full scale maneuvers. Company commanders must be capable of integrating fire planning with the scheme of maneuver. Therefore, the company should habitually associate with the same FIST. Along with fire planning, the company commander must learn how to fit his unit to the terrain. That means that he must plan his positions carefully and teach his vehicle and tank commanders (TC) how to identify and put their vehicles into a good position. It was clear that the OPFOR was going to find and exploit weak spots in company positions or dead space not covered by fire so the company commander must become an expert in laying out mutually supporting positions.

At the battalion level, the most important preparation for tactical operations is combined training of all the elements that will compose the task force. Exercises using the combined arms tactical training simulator, computer assisted map maneuver system, *Pegasus* war game, etc., are useful in working out all leaders in the chain. Like the company commander, less sophisticated exercises such as terrain walks, TEWTs and map exercises are beneficial to the battalion commander. During these exercises, it is useful to cross-train leaders and key personnel in other duties and in other positions. Key people become casualties during play, or may be called away on emergency leave, leaving a gap in leadership. Therefore, the chain of command should be identified in depth and all leaders must be mentally and tactically prepared to assume other duties should unforeseen events require it. The same holds true for the ranks. There is no fat in the table of organization and equipment. Leaders and soldiers get tired from the pace over the 14 days and need rest. But, the operations go on 24-hours a day. So, there must be trained personnel ready to take up the slack for those who are resting.

All leaders are urged to read and *thoroughly understand* the concepts and doctrine in the "How To Fight" manuals. The need to do so becomes apparent after a few after-action reviews. In the words of a company commander, "You are either stubborn or an idiot if you don't take to heart the things they tell you in the after-action review, although it's pretty embarrassing sometimes. What is especially embarrassing is the fact that the men sitting around you listening to the critique

would all be dead in real combat because you as a leader either didn't understand or properly implement what was in the book."

Similarly all leaders should be intimately familiar with unit SOPs and report formats. Unit commanders emphasized that there was simply no time to wing it in the thick of battle...they had to pass information quickly and clearly.

Staff skills had to be honed. The intensity of the round-the-clock operations required that a smooth-running staff accomplish their tasks in the shortest time span to enable the small unit commanders the greatest time span for troop-leading procedures. If there was one universal complaint by small unit commanders, it was the lack of time to do all that was necessary to get their jobs done.

Staff preparation and training for the rotation must take into account that the two realities of the NTC, real time and "unreal" distances. Digging tank ditches and constructing barriers of all types take plenty of time. They go even more slowly than anticipated when tired troops must actually do the work. Movement takes longer because of the vast distances that magnify lags in decision making. To overcome this, staffs must train to anticipate requirements. Trains must be dispatched during daylight to reach their units after dark with sufficient time to resupply. Items such as spare parts and barrier material must be anticipated and pushed forward as the battle is monitored by the staff. Unit commanders will have their hands full dealing with the enemy at hand and may overlook those requirements.

Preparing the artillery to support the maneuver elements has some unusual challenges. Also, artillery training at the home station often takes place from static observation posts and familiar firing locations. Consequently, the transition to a mobile environment that requires batteries to leapfrog and FISTs to operate from vehicles suggests that a mobile FIST course be devised to prepare the teams to call for and accurately adjust indirect fire when moving from position to position. Also, map reading, terrain association, and distance estimation are key requirements for FISTs in the execution of fire missions in the expanse of the desert.

Throughout the experience, commanders and staffs cautioned against trying to "G2" NTC scenarios while at the home station because no two are exactly alike and you may find yourself preparing for the wrong battle. Nevertheless, playing map exercises on the Fort Irwin terrain is invaluable to gain familiarity with the terrain and distances involved.

Logistics

The S4 makes his money during the pre-planning stage by preparing the advanced party who will draw, inventory and prepare the unit sets of equipment prior to the arrival of the main body. The goal of the NTC is to issue equipment and move the units to the field within 4 hours of their arrival. Therefore, the advanced parties should have completed their work by the time the main body arrives. Depending on the state of equipment maintenance when it is initially drawn, the advanced party of TCs, mechanics, drivers, and supply specialists may have additional work to perform.

The S4 must train to monitor the battle closely. It may mean collocating with the S3 in the same track. In the heat of battle, it was discovered that while some administrative and logistical reports were useful, others were not, and some were untimely, in unusable format, or even forgotten. Therefore, administrative and logistical reporting must be thoroughly worked out beforehand. The S4 must *pull* information and *push* supplies. He must be ready to advise the commander and S3 on the logistics status of the units and recommend courses of action based on that information. He must *think* forward, *be* forward and *push* forward.

There was praise for the system the NTC devised for issuing equipment. Each company had a box car with on equipment/materiel (OEM) and tools and one individual, the supply sergeant, signed for it. Company mechanics made technical inspections of the vehicles. However, as in all unit moves, last minute equipment failures occurred and the inevitable unforeseen problems cropped up. Nevertheless, the 194th Armored Brigade's movement to the field occurred rapidly. During interviews, it was emphasized to bring sufficient prescribed load list (PLL) for your own equipment and for those items known to be in short supply. NTC issues PLL for the equipment they provide. From the experience gained during past rotations, the NTC is increasing the density of high demand items.

The brigade food service advisor indicated that feeding A rations should not commence until the evening meal of the fourth night because problems may occur in drawing supply vehicles, reefer vans, as well as the problems involved in feeding over 2,500 people who are in the midst of drawing equipment and moving to various field sites. It was stated that if in doubt about the availability of certain food service items of equipment, the rotation unit should bring their own item plus a 30-day supply of PLL.

Predeployment planning by the S4 must take into account the available transport. At the time of DESERT THUNDER, only 2½-ton trucks were available for transport. Given the reduced capacity and increased distances, the trucks received a good workout.

Operator maintenance became critical if the goods were to be delivered. It was said that the desert has no mercy and will reveal whether or not you have a good maintenance system. The quality of maintenance would make your stay memorable or miserable. Surprisingly, maintenance was not the problem it might have been because troops realized quickly that shoddy maintenance would have an immediate impact on their own welfare as well as that of their unit, and the mechanics got in there and did the job.

The S4 must train to monitor the battle closely. It may mean collocating with the S3 in the same track. In the heat of battle it was discovered that while some admin/log reports were useful, others were not while some were untimely in unusable formats or even forgotten. Therefore admin/reporting must be thoroughly worked out beforehand. The S4 must *pull* information and *push* supplies. He must be ready to advise the commander and S3 on the logistics status of the units and recommend courses of action based on it. He must think forward, be forward and push forward.

Intelligence

Pre-planning by the S2 was not overlooked. A thorough knowledge of OPFOR organization and tactics not only enabled the S2 to employ the many sources of intelligence available to him but also enabled him to template the enemy force. Through this technique, friendly commanders were able to anticipate enemy maneuvers and timetables and to bring effective indirect fire to bear on him and disrupt his plans.

Lessons Learned

"The enemy used our smoke screen against us. He breached our mines and wire and came through like a big wave. We killed a hell of a bunch of them but I didn't see them coming around my right flank. We got it from a BMP with a 73-mm gun. Usually when they hit us with arty you can kill only half as many of them, but this time they made a big mistake and didn't use their arty and we really fired them up".

Tank Commander

"When you see a couple hundred vehicles out there coming at you and they aren't even breaking for lunch, they're going to have you for lunch, it really impresses you."

Company Commander

What strikes the mind of a participant both during and after a battle is the extreme lethality of the modern battlefield. Knocked out vehicles litter the battlefield, the yellow rotating beacons of their MILES equipment signaling their destruction. Not only the numbers of casualties but the dispersion of the kills provides insight. In the distance, enemy vehicles hit by long range fire blink their lights. On the battle positions, however, the intensity of the close-in fight was also apparent. Enemy and friendly vehicles were all mixed up. Vehicles, which had been ambushed, sat dead in bunches. Encounters were violent and there wasn't a moment during the fighting when commanders or soldiers could take a respite. Commanders led from the front and were not immune to becoming casualties.

During the movements to contact and attacks the fighting took place on extended frontages to seize deep objectives. The fog of battle was visible. A pall of smoke from the smoke generator detachments hung along the ground. But, the fog was a mental effect as well, as tired troops executed their missions, often in the absence of specific orders. Up and down the line, leaders and soldiers got better at their jobs as the days and the after-action reviews went by—despite the fatigue.

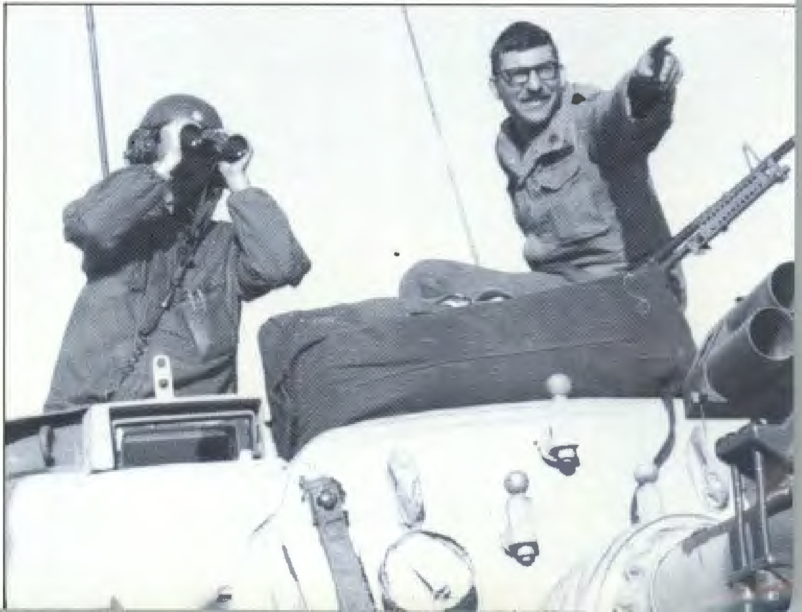
Platoon leaders learned to rely on their platoon sergeants and squad leaders to carry their loads and be accountable for their performance. As the days wore on, they discovered that the young NCOs in those positions, while inexperienced at the beginning, became efficient OPFOR killers.

Company commanders learned the value of meticulous planning and coordination among the various assets assigned to him. "I've got tanks, mech, *Vulcans*, engineers . . . they get attached to you 5-6 hours before an operation and you've really got to think about what you are going to do with it all. You've got to perform."

Leadership was tested as well as technical expertise. "They forget things. It's the first time that the soldiers have been pushed over a long period of time. You've got to kick them in the butt a little more. We started out with sleep plans but as time wore on and the demands became greater, they were more difficult to work."

Squad Leader

Despite the constant pushing, the soldiers adapted to the climate and terrain well, and in a very short time. They slept when they could, ate their C-rations without complaint, learned to take field baths, and learned the value of teamwork at all levels. "Immediately on receiving the fragmentary order I would gather the company commanders and S3 at a vantage point and issue my concept of the operation right there. The company commanders would use the available daylight to make their own reconnaissance and develop their plan. The S3 would be writing up the formal order for the commanders and staff. When I returned after dark I would firm up the plan with my people and get some rest. Meanwhile the executive officer (XO) would be moving



the logistics packs forward. I didn't have time to tell him to move them. He kept track of the battle and pushed it. When I awoke a couple of hours before jumping off, most everything was ready to go."

Battalion Commander

The live fire exercises challenged the command and control of leaders because there were few restrictions and the total spectrum of weapons, both indirect and direct (with the exception of ATGM's, which employed MILES) were orchestrated live together.

The offensive phase covered a maneuver area of over 35 kilometers. The offense not only exercised the FIST and maneuver elements but required the supporting batteries to shoot at maximum ranges and to displace to keep up with the maneuver forces. In the defensive exercises, successive bands of targets, (over 550 at the present time) simulating the advance of the Threat force appeared in a sequence timed to approximate the correct approach speed of an attacking Threat force.

Coupled with the ground targets, remotely piloted aerial targets provided the *Vulcan* gunners the opportunity to employ their weapons as part of a task force.

"In the live fire phase it doesn't seem like pop up targets. . .doesn't look like a range with red flags right and left although the safety considerations are real enough. We turned the (fire) units on and off all time with TACAIR, mortars, everything going. The scouts were out. . .we fired the registration behind them then pulled them back through." As the units gained experience, the expenditure of ammunition increased. The way to beat him is to outshoot him."

Company Commander

Contributing to the effectiveness of the artillery fire was the Position Azimuth Determining System (PADS), a jeep-mounted navigation computer that provided the artillery with position data within 1/10th meter of its location. The system, which is presently being fielded, was said to be absolutely essential for artillery units operating in desert terrain. It quickly plotted battery centers, mortar positions, and registration points.

Given the intensity of the operations, in both the force-on-force and the live-fire phases, what effect did stress have on leaders? The lower in the chain of command, the more "maxed out" were the leaders.

"There is a lot of pressure; some is self-induced because you want to do the best job you can and the necessity to make rapid real time decisions. You maneuver actual units so you have to figure travel time and how costly the operation will be on the men and equipment. . .are they the right moves. . .? If you don't make the right moves, OPFOR will eat you alive."

Platoon Leader

"It's the most stressful environment I've ever been in, including the war in Vietnam. The pace is tremendous. There is no time to stop and regroup or reorganize. You're always moving from one mission to another. It's frustrating. There is no way to assemble all your people and say, 'Look, we've got to get better.' You plan and you visualize how it will work and yet you can't get to that TC who skylines himself on a hill or the platoon that goes the wrong way. "I've been averaging maybe 3 hours sleep a night. First couple of nights, no problem. About the fourth night it started to have an effect on us. People falling asleep during an OPORD. You find people start cutting corners a little".

Battalion Commmander

"This is an opportunity to practice what you've learned on TEC tapes and chalk boards. But, sometimes the pressure is so great you forget—to call an FPL for example. That's why you need your NCOs to drive hard because there is only so much you can check on as an officer and little time."

FIST Chief

If it sounds like nothing new is being discovered at the NTC, in a sense that's true. It's proving that our doctrine is sound. It's proving that the modern battlefield is highly lethal. It's proving that the units which train together and implement doctrine correctly can win. It's proving that the American soldier has the same stamina, flexibility and intelligence that he has always had. Finally, it's proving that true grit and fighting spirit are not in short supply.

Pressure, stress, shooting, moving and, communicating. Even at Eton, Wellington never had the opportunity to train for the battle of Waterloo like our task forces are training at Fort Irwin. "What they were saying they were going to do at the NTC sounded fabulous, but I never thought that they'd be able to do it."

DESERT THUNDER proved that they did!

For an account of National Training Center operations as seen from the OPFOR side, see "Use of the Opposing Force at the NTC," by Captain John H. Perry in the January-March issue of Red Thrust Star published by the FORSCOM OPFOR Training Detachment, Fort Hood, TX. Ed

Do We Really Know How Good Our Tank Crews Are?

by Lieutenant Colonel (Retired) David C. Holliday

Over the many years that we have been training tank crews, we have sought to identify those crewmen who possess excellent skills that lead to success in tank battles. Of all those skills, perhaps none have had more attention than those pertaining to tank gunnery.

There are no secrets as to what those skills are. A good gunner is one who can react rapidly to the tank commander's fire command, index the right round of ammunition, acquire the target, alert the rest of the crew that he has done so, track the target with an accurate lay (if it is moving), make a proper lay (if it is stationary), announce his intention to fire by yelling "On the Way," make a correct sensing and observation, apply burst on target (BOT) (or other correction as appropriate), and while doing all this, insure that the proper switches such as main gun, turret power, etc., are set correctly. Of course, in some tanks, he may need to determine range as well. Additionally, he must be able to use battlesight techniques, properly boresight and zero the gun, employ the coax correctly, and know what to do with a misfire.

For years we have toiled to devise programs of instruction and produce training devices that will develop and sustain those skills in our tank gunners. In the past we relied primarily on subcaliber tables followed by main gun firing on ranges. We fired only in daylight, trained on stationary ranges, and used the coax as our subcaliber device. In the late fifties, a tank crew proficiency course (TCPC) was added in which the firing tank moved down a trail engaging targets as they appeared. This became Table VIII, and remains our primary measure of a gunner's effectiveness.

Subcaliber training has undergone major changes with the *M55* laser, the .22-caliber, the *Brewster*, and *Telfare* devices; second and third generation targets with variations in scale, and changes in the tables have also appeared. Combat training theatres (CTT) have been introduced in Europe where a second-generation device called the tank gunnery missile training simulator (TGMTS) is in use. The TGMTS has recently been tested for effectiveness in training in the institutional environment of basic armor training by the U.S. Army Armor and Engineer Board at Fort Knox. At about the same time, TRADOC's combined arms test activity (TCATA) at Fort Hood conducted the operational Test II of the unit conduct of fire trainer (U-COFT) designed for use in sustainment gunnery training in the tank battalion.

The cost of a single TGMTS in a production-quantity buy is around $70,000-80,000, and that is peanuts compared to the U-COFT. The estimates on U-COFT range from $700,000 to $1.4 million each.

Why buy something so expensive? The answer is simple. It costs too much to buy main gun ammunition to continue our present gunnery programs and no one has a great deal of faith that any of the present subcaliber programs develop good gunners. But how do you know whether to buy a TGMTS or a U-COFT? For that matter, how do we know if we should buy either one? How can we identify a good crew, and how do we precisely measure how much better one crew is than another?

Stated another way, how do we measure the quality of our tank gunnery training? For all the improvements made over the years in training, we still rely primarily on the same old measure of excellence—we *count holes in targets*. Granted, we adjust that score if the established time criteria is exceeded, but the single most important measure of a tank crew's skill with the main gun remains, "did the round hit the target?" As a measure of the crew's ability, counting holes in the target is like weighing yourself on an old bathroom scale that has a weak spring—it gives you an indication of the truth, but the accuracy is highly questionable. In fact, the old bathroom scale is probably a more accurate indicator of the truth than counting holes in targets, because the scale's inaccuracy will probably be consistent as to the direction away from the true value, while a crew's score based on holes in targets may give an inaccurate measure that could be better or worse than the truth.

Let us consider a single engagement from Table VIII. The fifth exercise listed on that table (page 66, FM 17-12-2) calls for the crew to engage an antitank target with HEP-TP-T (which, I believe, will soon be replaced with HEAT-TP-T) at a range between 1,400 and 1,800 meters. Page 2-11, FM 17-12-7, pictures an antitank target as being 4 feet by 4 feet, or approximately 1.22 meters by 1.22 meters in size. In such an engagement, even the best of tank crews needs a bit of luck to hit the target. One needs only to do a simple statistical exercise to find out just how much luck is involved. Using a range of 1,500 meters, a system dispersion of .4 mils, (which includes a nominal round-to-round dispersion of .3 mils) and the target size given, we can calculate the probability of a hit, given a perfect lay on the center of the target and a perfect range estimation. Given this perfect performance, 92 percent of the rounds will hit the target. But that means almost one out of ten engagements where the crew performs perfectly, will result in the round missing the target and the crew getting a zero score.

Of course, the error in the measurement can work for the crew in the opposite way. Suppose the gunner makes such a poor lay he is actually pointing at one of the outside corners of the target. With a perfect range estimation, the crew has a probability-of-hit (P_H) of .25. That is to say the chances are one in four that they'll get their 100 points on a single round and in two rounds it's just short of even money (P_H=.44) that they will get a hit. The measure looks even worse when we get compound laying errors and range estimation errors.

If in our example of a poor lay, the gunner had placed his crosshair on an upper corner and this error was compounded by a range estimation that was a little more than 100 meters short, the vertical errors would offset and the probability of a hit with a single round might be as high as .50, and with two such tries as high as .75.

As you can see, using hits-on-target as our measure of skill levels is at best very poor. You might think of it in these terms: How would you feel if, when you sat down in a classroom, the instructor was to say, "Your course grade depends totally on what you score on this exam. My assistant will grade the papers and, through experience, I have found that he scores about one-fourth of the answers incorrectly. After he grades your paper, he will throw it away so we cannot recheck it. Still, he is the best I've got, so—good luck." The odds are that you would be mad and mutter to yourself that it was about time to find a better way to grade the exam. The same is true of the way we measure tank gunnery. We need something better than *counting holes in targets*.

There is a simple explanation as to why we count holes in targets—we have not had anything better. Note that the statement is in the past tense. I believe a more accurate measurement of a crew's skill can be had at a relatively low cost. We cannot only assign a meaningful score to the combined efforts of the crew, we can discreetly measure the tank commander's and gunner's performance in terms of task accomplishment.

This is possible using an on-board, through-the-sight video recorder with a voice recorder connected to the intercom, a data reduction system called DARS, and a tank gunnery analysis model (TGAM) computer.

The on-board video and voice recorders tape what the gunner sees in his primary sight and what is said on the intercom. An observer on the firing tank can also "interject" comments on the crew's performance. Because the camera cannot be focused to give a clear view of the target and the gunner's reticle, a crosshair, boresighted with the reticle, is superimposed on the tape. Thus, the voice recorder captures the tank commander's fire commands, the gunner's and loader's announcements such as IDENTIFIED, UP, ON THE WAY, LOST, OVER, OR DROP ONE-HALF FORM. After the engagement, the instructor can use the voice recorder to note and record such errors as wrong ammunition indexed, main gun selector switch in wrong position, and incorrect range indexed into the computer.

The through-the-sight video device records the gunner's lay at the time of firing, his tracking, and the position of the round in relation to the target as it passes the target if the sight is not obscured. (It may be desirable to add a second camera on top of the turret for the latter function, using a split screen approach, but I doubt that this is required.) When the crew completes firing its table of engagements, the tape cassette is removed from the recorder, marked, and handed to the data reducer.

The data reducer, ideally skilled in both tank gunnery and the use of the DARS system, extracts the data from both the video and voice tapes. The data for each will include the following information in addition to those items previously mentioned.

- Target size (either previously known, or calculated during the data reduction process using WORM formula).
- The exact range (again, either previously known, or calculated) (one or both of these first two factors should be previously known).
- Horizontal and vertical gunner range errors, measured in meters and tenths of meters and expressed in cartesian coordinates.
- Whether the target was moving or stationary, and, if moving, the direction of movement.
- Time-to-fire location of the round as it passed the target, expressed in cartesian coordinates.

Ammunition costs make it imperative that we provide economical, but highly effective training for our gunners.

- Whether the round could be sensed or not.
- Correction method used for firing a subsequent round.

Within a few minutes after the tape is placed in the DARS, the data for each engagement could be placed on a single sheet of paper for later keypunching, or, as it is produced, the data reducer could enter it into a computer using a keyboard located within the DARS.

With the data collected and reduced, the next step is to analyze it in the TGAM model.

The first step in the TGAM program is to adjust and score the gunner's lay error in the horizontal plane. For a first round fired at a stationary target, no adjustment is required. If the target is moving, the proper lead, according to FM 17-12, is computed, and the lay offset is corrected by that amount. An example: The actual range to target is 1,500 meters and the target is moving from right to left. FM 17-12 prescribes that the gunner should lead the target by 2.5 mils from the target's center.

Using the good old WORM formula, the program computes that the offset should be 3.75 meters to the left. Thus, a perfect horizontal lay would have an X coordinate of -3.75. The program then would add 3.75 to the actual lay offset to obtain the adjusted lay error. (If the target had been moving left to right, 3.75 would have been subtracted.) Let us assume for purposes of illustration that the gunner had layed on a stationary target at 1,000 meters with his crosshair ½ mil left of the target's center-of-mass. If there were no such thing as round-to-round dispersion, the round would strike the target, assuming no vertical error, ½ meter to the left of its center-of-mass. But round-to-round dispersion does occur, and the model assumes a dispersion factor of .3 mils in both the horizontal and vertical planes. (We don't vary this for different rounds, because our objective is to obtain a measure of training effectiveness, not a true P_H even though our routine is somewhat similar to that of calculating a P_H.) The adjusted lay is next converted to an absolute value and then enters an algorithm that uses the target size, the standard deviation, and the horizontal point-of-aim to obtain a number that represents what percent of all rounds fired with these parameters would pass within the horizontal dimensions of the target. The number obtained is multiplied by 10 to provide a horizontal lay score (X-value or XV) between 0 and 10.

"Since the start point is somewhat dependent on the range facilities and layout, we'll merely say these will be determined and recorded."

The model next takes the vertical-lay offset and adjusts it, if battlesight was used, by adding to it a number equal to one-half the target height (remember that, when using battlesight, doctrine requires the gunner to lay on the bottom of the target). This result is then stated as an absolute value. Next, the actual and the estimated range are compared and any difference determined. The effect of that range error is computed using data extracted from the firing table, stated as an absolute value, and added to the adjusted-lay error. We then follow the same steps as in the horizontal-lay computation to assess what percentage of rounds would fall within the target-height parameters and multiply that by 10, so the result is a number between 0 and 10. We call this the Y value or YV score.

You should note that, in converting the vertical-lay error and the range-estimation error to their absolute values before adding them, we have intentionally eliminated any possibility of the crew gaining any benefit from offsetting errors. To those who would argue that this is not "real world," I will agree. I will repeat, however, that our purpose is not to compute a P_H, but to grade performance. Thus, the performance of each task is graded and each error degrades the crew's score.

"To those who would argue that this is not "real world," I would agree. I repeat, however, that our purpose is not to compute a hit probability, but to grade performance."

Having progressed this far into the model, we are now ready to compute a lay accuracy score, which we call "ZV", by multiplying XV times YV. We want the range of ZV score to fall between 0 and 100. In long-range versus small-target engagements, this will not happen. We solve this by having the computer compute the maximum ZV score possible and, if less than 100, an adjustment factor is computed. Let's go back to our example of the antitank target. The crew with a perfect range estimation and no lay error would have a single-round ZV score, before adjustment, of 68. The computed adjustment factor would be 1.47 and when multiplied by 68 gives the performance a score of 99.8, or near perfect. The crew with an accurate range, but a lay on the edge of the target gets a score of 37, and the one with both poor lay and a range error drops even lower.

By itself, the ZV score is a most useful tool in assessing the gunner's and tank commander's performance. *It, along with the data used to calculate it, would be on a printout to facilitate evaluation and critique.*

Since ZV is not a total score that treats all task accomplishments, our model continues into an assessment of the time factor. Most tankers agree that the time required to complete an engagement is an important measure. Time, however, is a double-edged sword. Certainly a crew that takes an excessive amount of time to get the round off should be penalized. By the same token, a crew that completes all of its tasks, and does them well, in less time than other crews normally require, merits some sort of a bonus. At the same time, firing fast, without taking a proper lay, or making a proper range estimation, should bring a penalty factor.

A necessary first step in measuring the crew's effectiveness in terms of time is determining a start and stop point. Since the start point is somewhat dependent on the range facilities and layout, we'll merely say these will be determined and recorded.

The reader might be interested in knowing the TGAM's predecessor, the institutional TGMTS analysis model (ITAM), where we limit ourselves to measuring only the *M60A1* gunner's proficiency, the start time is when the target appears on the TV screen. Since our TV picture is taken through the gunner's primary sight, we know that when we can see the target, the gunner can see the target.

The second, and perhaps the most difficult step in assessing the time factor, is setting a criterion, or standard, to be met. Our experience suggests that a good gunner takes a few seconds more at long ranges than he does at short ranges, and the lay can be a little less precise. Thus, separate time standards for short, medium, and long ranges can be accommodated in TGAM. The unit of measure is seconds and the criterion can be expressed either as a period of time, such as 10 to 12 seconds, or as a single number, such as 11 seconds.

Before we compute our time-measure evaluation effectiveness, we must establish criteria for what ZV scores represent excellent and acceptable lays. In ITAM, we are using different criteria for acceptable and excellent lays in each of the long-, medium-, and short-range intervals.

With these criteria, the model compares the time expended to the time standard. If they are the same, neither a penalty nor a bonus is involved. If the time is excessive, or if it is less than the criterion, *and* the ZV score was below the criterion for acceptability, the number of seconds difference between the time standard and time expended is raised to the second power and *subtracted* from the ZV score. When the time expended is less than the time standard, and ZV is in the acceptable category, the difference in time is raised to the second power and *added* to the ZV score; or, if the lay is in the excellent category, the difference is raised to the third power before adding to the ZV score.

There are still more tank gunnery tasks to be considered. Did the gunner make his proper announcements such as IDENTIFIED, LOST, ON THE WAY? Was the tank commander's fire command correct? Did the gunner index the proper round of ammunition; did he turn on the necessary switches, etc? Each of these tasks have been carefully considered to determine if they are independent or dependent tasks. All voice commands are considered independent, as is the gunner's indexing of the proper ammunition, and failure to perform an independent task results in a penalty that is subtracted from the ZV score. Such tasks as turning on switches are considered dependent and not treated separately, since they would already have had an effect on either the ZV score or the time penalty. An example: If the gunner fails to turn on the main gun selector switch at the outset, he won't be able to fire. The result would be a loss of time and, in turn, a penalty in the time measure of effectiveness.

Once the bonus and penalty points are added and subtracted, we have a final score for the single round. Keep in mind that, in addition to this score, we have on our printout the source of all the factors that entered into its determination. We have, in fact, a complete picture of what the crew did or failed to do.

Second-round scores require additional consideration. If the burst-on-target method is used, then the position of the first round in relation to the center of the target as it passes the target is recorded by the DARS data reducer. The initial correction for both horizontal- and vertical-lay error is made by adding the gunner's lay error to the corresponding first-round position values. Unless a change was made to the estimated range, the only further adjustment needed is to insure the X and Y lay errors are positive (absolute values). Remember, we record these X and Y offsets in cartesian coordinates. Thus, if the first round was sensed to be high and left, its X coordinate would be a negative value and its Y coordinate a positive one. Proper corrections would require moving the crosshair down and right an amount equal to the sensed error, and a perfect correction would result in the same X and Y values except with opposite signs. Thus, a perfect correction would have zero error when the two were added. This correction is made off-line by the DARS data reducer.

"There is no question that in the future, our tankers will have less and less opportunity to fire main gun ammunition."

For other types of correction, the DARS data reducer makes an appropriate off-line correction. From that point on, the model follows the same routine as for the first round and the same type of data is printed out.

It is, of course, desirable to have a single engagement score. If desired, the time standard may be for each round or for the entire engagement. Let us assume, for the moment, that we want time considered only for the total engagement.

Our first step in computing an engagement score is to use the lay accuracy (ZV) values for each round. No adjustments for penalties or bonus will have yet been made to these scores in an engagement computation. We'll call them ZV_1 and ZV_2. With these values, a raw engagement score (ES_R) is computed as follows:

$$ES_R = \left[\left(\frac{100 - ZV_1}{100}\right) \left(\frac{100-ZV_2}{100}\right)\right]$$

The result is a score between 0 and 100. As you can see, ES_R is never lower than the ZV score of the best round.

The ES_R is then adjusted for a final score (ES_A) by adding bonus points and subtracting penalty points.

The evaluator thus has the complete picture of the engagement presented to him in the printout, and the crewmembers have a score that is descriptive of both their individual and team performance—not one influenced by good or bad luck or by factors outside their control, such as a worn gun tube.

TGAM is important to us in three ways. Perhaps the greatest importance is that it will enable the tank unit leader to know his crews' weaknesses in tank gunnery so that he can tailor their training to what they need. Second, but of major importance, is the training developer's need to compare the effectiveness of various tank gunnery programs and training devices. If it provides valid means of comparing the relative effectiveness of such devices as the TGMTs and the more expensive U-COFT, TGAM will be a most significant development. (I am convinced that, given comparable data, it will do that successfully). Finally, TGAM, by providing an accurate measure of the crew's performance, will serve to improve unit morale. Soldiers can accept honest evaluations, even if those evaluations show them to be deficient. What they cannot abide is a score in which they are unfairly down graded. Even when luck runs for a soldier so that he qualifies, he knows he didn't earn his grade, and the taste is unpalatable.

One more point—TGAM is equally applicable to subcaliber scoring, although minor changes may be required.

The hardware required to implement this program is on hand or under development. One version of the on-board video/voice recorders is now being used by the Armor and Engineer Board for collecting test data. So is the DARS program. The tank-appended crew evaluation device now in being, is designed to lead to the fielding of voice/video recorders for tank units. The TGAM model is not yet in being, but its predecessor, the ITAM model, has been programmed and checked out with notional data. Directorate of Training Developments personnel at Fort Knox have been briefed on the model and are considering its potential use. The most difficult part of the TGAM development will be to set the criteria (standards) and penalties to be used in it.

There is no question that, in the future, our tankers will have less and less opportunity to fire main gun ammunition. The soaring prices of ammunition alone will dictate that limitation. It is therefore mandatory that we gain maximum value from both simulated (subcaliber) training and the limited main gun firing we will be able to do. Without a measurement tool that discriminates between skill and luck and which provides not only an overall effectiveness score, but discloses points of weakness that need concentrated practice to improve, we will never achieve that maximum value.

From the standpoint of testing, TGAM is also essential. In the near timeframe, we will have to make a decision to buy either the TGMTS or the U-COFT (at roughly 10 to 20 times the TGMTS cost). Such a decision needs not only comparative testing, but a set of measures of effectiveness that are truly discriminating. Counting holes in targets cannot provide those measures of effectiveness.

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Operation Badr: Crossing the Suez

by Captain Ray G. Roth

Although the Egyptian Army's attack against Israel in the October 1973 war failed, its crossing of the Suez Canal provides several lessons in the planning and execution of an attack across a water barrier. Egypt's preparation for the October 1973 war actually began immediately following the 1967 Six Day War when President Nasser sought military aid and advisers from Russia.[1] Both were forthcoming, and on 6 March 1969 Egypt launched the War of Attrition with artillery barrages on the Israeli-occupied east bank of the Canal. These barrages caused many casualties and the Israelis were forced to fortify the 35 to 40 outposts along the entire east bank. As a result, the Israeli concept for using their Bar-Lev line as an early warning system to trigger a mobile defense quickly evolved into one of a static, fortified defense line.[2].

By 20 July 1969, the War of Attrition had expanded to include Israeli Air Force (IAF) strikes to counter the massed Egyptian artillery fire and to attack targets deep inside Egypt. These strikes continued into 1970 and from January to April the IAF made its deepest penetrations to bomb airfields around Cairo. As the air war escalated, Egyptian pilots proved no match for the Israelis. Egypt lost 21 planes per 100 sorties compared to 3 per 1,000 for the Israelis. These losses prompted Nasser to request air defense missile systems from the Soviet Union, and he soon received the *SAM-6* surface-to-air missile systems that would be one of the keys to the success of the Suez crossing.

Meanwhile, enemy information essential to the planning and execution of the Suez crossing was being collected by commando raids into Israeli territory. During these raids, the commandos infiltrated between the Israeli fortifications and awaited the Israeli counterattacks. The Egyptians soon learned that the counterattacks were always made by one tank battalion of Colonel Amnon's armored brigade, and always along the same routes. Armed with this information, the Egyptian staff was able to accurately predict the reaction time, size, and direction of Israeli counter attacks.

Now, with the Israeli dispositions, capabilities, and probable courses of action established. the Egyptians began their buildup for a carefully phased attack across the Suez.

Egyptian buildup. Two infantry divisions, the 2d and the 16th, were established on the west bank of the canal between El Qantara and the Great Bitter Lake. (See map 1 and figure 1 for deployments and order of battle of Egyptian forces.) Each division was composed of 3 brigades and each brigade had a tank battalion with 31 tanks attached.An independent tank battalion of 31 tanks was under division command. Each division, therefore, had 124 tanks at its disposal. Augmented to each division for the initial assault was an armored brigade of 94 tanks, bringing each division's armor strength to 218 tanks.

The 21st Armored Division, positioned between the 2nd and 16th Infantry Divisions as part of the second echelon, had 220 tanks. However, it like other second echelon divisions was stripped of its antitank units, which were reorganized into antitank guided missile (ATGM) units and augmented to the first wave of assault troops.

OPLAN BADR. The Egyptian operation plan, titled *BADR,* consisted of three phases:[3] Crossing the Canal and establishing a 20-mile deep bridgehead; Using armor, seizing the Mitla, Giddi and Khatmia passes (map 1); destroying the Israelis in the Sinai.

The initial phase was to be an assault crossing of the Canal in four waves, with the first consisting of 8,000 ATGM troops armed with rocket-propelled grenade launchers (RPG-7) and *Sagger* missiles. These troops were to bypass Israeli strongpoints and establish a defensive antitank line about 2 miles into the Sinai. The second wave, consisting of infantry, was to seize the Israeli strong points and the third and fourth waves, consisting of heavy equipment and armor, were to consolidate and expand the bridgeheads.

In the second phase armor units were to sieze the three critical passes between 20 and 30 miles behind the Israeli defenses. These passes controlled access into and out of the Sinai and were the keys to the third phase—the destruction of the Israelis in the Sinai.

The major thrust of the second phase was to be in the south and was predicated upon the seizure of at least one pass, either Mitla or Giddi. The Egyptian 4th Armored Division and the 25th Armored Brigade were assigned this task. In the northern sector, the Egyptian 21st Armored Division and the armored brigade from the 23rd Mechanized Infantry Division were to thrust forward and capture the Katmai Pass (map 2).

With control of the passes, the Egyptians could proceed with phase three—the destruction of the Israelis between the passes and the Canal. Following this phase, they could strike into the heart of the Sinai.

Israeli Defenses. The Israeli Sinai defense plan was based on Operation Plan *SHOVACH YONIM* which called for the *Bar-Lev* outpost line along the

Artillery and Mortars	**2,300**
Tanks	**1,955**
JS-III	30
T-62	100
T-54/55	1650
T-34	100
PT-76	75
Anti-Aircraft Batteries	**150**
Aircraft	**568**
MiG-21 intercepter	220
Su-7 fighter bomber	120
MiG-15/17 fighter bomber	200
I1-28 light bomber	10
Tu-16 medium bomber	18
Personnel carriers BTR-40/-50P/-60/ 152 and OT-62	**2,000**
Infantry Divisions	**5**
Mechanized Divisions	**3**
Armored Divisions	**2**
Total Personnel Strength	**80,000**

Table 1: Egyptian Strength

Canal to be reinforced by armor in the event of an attack. The *SHOVACH YONIM* plan itself was based on a waterline-oriented static defense, with local armor counterattacks repulsing any breakthrough. Two Israeli tank battalions, each with 32 tanks, from Colonel Amnon's armored brigade were positioned almost directly across from the Egyptian 2d and 16th Infantry Division. Colonel Amnon's area of responsibility covered some 80 miles from El Qantara to Rus Sudrin the south. Another armored battalion was stationed in the center (Chinese Farm) sector and a fourth in the south. Total Egyptian tank strength in the first echelon divisions came to some 436, as opposed to a total of 64 Israeli tanks in the center and south sectors—a force ratio of 7 to 1, which would increase to 22 to 1 as the attacking ATGM troops reduced Israeli tank strength.[4]

Terrain Analysis. The immediate obstacle facing the Egyptians was the Canal itself and the 80-foot high rampart constructed on the east bank by the Israelis after the 7 August 1970 ceasefire in the War of Attrition. The Egyptians, in turn, constructed a 130-foot high embankment on the west bank. The embankments were to serve as impediments to amphibious vehicles.

Except for sand dunes, cover and concealment in the battle area was almost nonexistent. A few earth folds provided what little cover there was and the sand dunes provided more. The dunes, however, were natural obstacles for track vehicles. Cross-country traveling carried the risk of bogging down in soft spots, or of suddenly cresting on a dune with resultant exposure to observation and fire. The ground at the base of the dunes, however, was generally firm enough to support armor.

The Sinai road network in this area was limited. The Ismailia-El Tasa Road (map 1), was the only two-lane road in the area. Other east-west roads were single-lane. All roads were hard-surfaced. The Ismailia-El Tasa Road led directly to Katmai Pass. The junction of the Ismaili-El Tasa Road and Artillery Road (see map 1), was covered by sand dunes, and whoever occupied the dunes controlled the two roads.

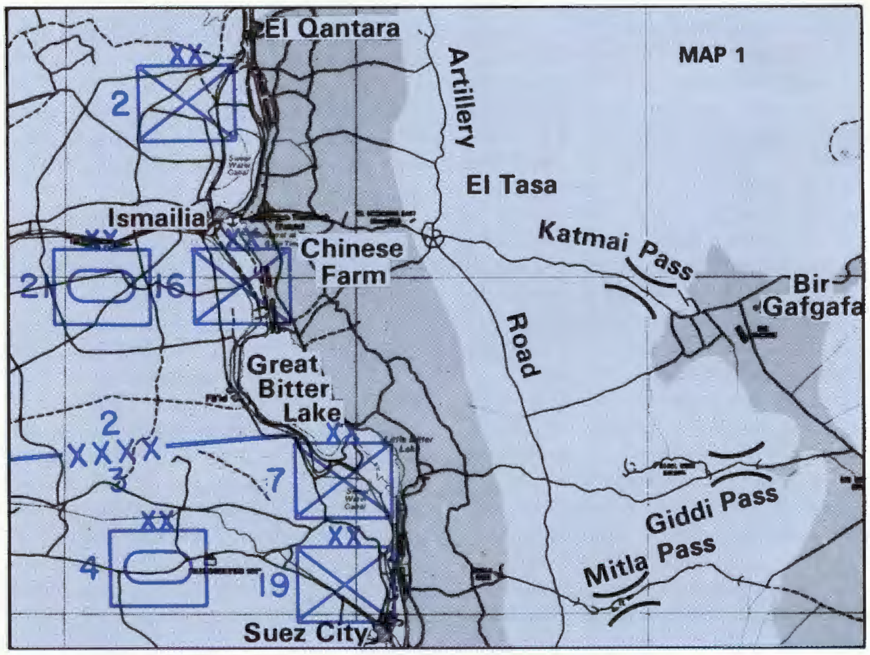
The Crossing. The Egyptians set the early part of October 1973 as the optimum time for their assault, a decision based on the predicted moonlight and the combination of highest tides and slowest current in the Canal. These conditions occurred on 6 October, and 1400 was set as H-hour. The afternoon time was selected for several reasons: the anticipated initital gains, the expectation of 3-4 hours to eliminate Israeli bank defenses, and nightfall which would preclude massing of Israeli armor. Darkness would also provide cover for bridge laying and armor crossing.

A massed artillery attack along the entire front served to confuse the defenders as to the actual crossing points. Over 10,500 rounds from more than 2,000 artillery pieces and mortars fell on the Israeli positions in the first minute. At the same time, General Hosni Mubarak, Egyptian Air Force commander, launched 300 sorties against Israeli communication centers and command posts.

Fifteen minutes after the opening barrage began, 8,000 Egyptians armed with *RPG-7s* and *Sagger* missiles crossed the Canal in 1,000 rubber boats and scaled the Israeli embankment, bypassed Israeli strongpoints, advanced 1-2 miles, and established an antitank defense line. In little more than 6 minutes the first Israeli tanks appeared.

The first *Bar-Lev* line fortress fell at 1500 and Egyptian engineers began using high-pressure water cannons to breach the 80-foot high embankment and, by 1930, 60 cuts had been made. By midnight, 10 PMP pontoon bridges and 15 ferries were operating at full capacity.[5] Total time for the initial assault and assembly and operation of the bridges was 10 hours — 38 hours less than the Israelis had expected.

By sunset 9 October, all bridgeheads were 6-7 miles deep. At this point, the Egyptian assault halted and assumed the defensive, with the mission of reducing the expected Israeli armored counterattacks before proceeding to capture the three vital passes. This pause continued until early morning of



14 October during which time the second phase of the Egyptian's operation was put into effect.

The second echelon divisions' tanks, trucks, and artillery were brought forward and emplaced. The 21st Armored Division in the north, along with the 4th Armored Division in the south, crossed to the east bank to spearhead the second phase of the offensive. The Israeli counterattack never fully developed during this lull since their primary effort was concentrated on the Syrian front. (They were fighting a two-front war.)

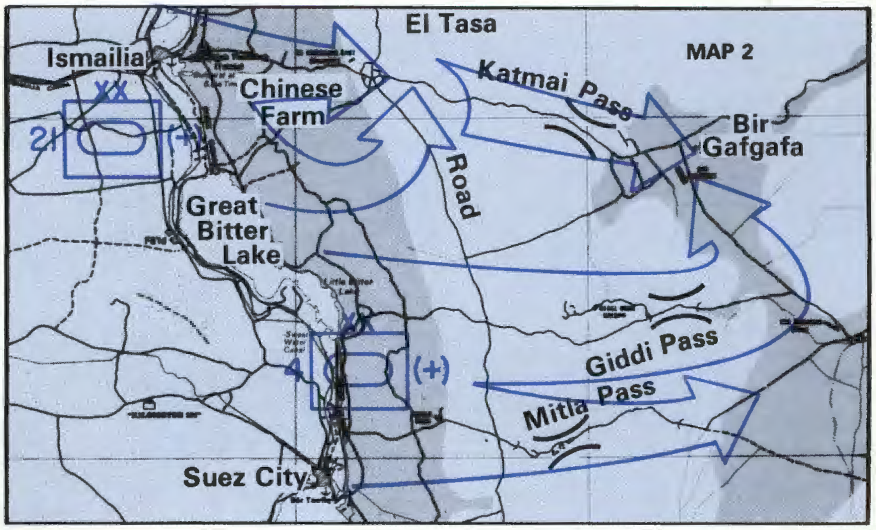
The 21st Armored Division launched its attack at 0600 on 14 October along the Ismailia-El Tasa Road with the mission of capturing the Israeli positions along Artillery Road, some 30 kilometers distant. The object was to prevent Israeli reserves deployed in that area from reacting to the eastward-moving Egyptian forces.

The primary Egyptian objective was to capture Refidim (Bir Gafgafa) (map 2), and thereby capture the three passes.

The 21st Armored Division, augmented by the armored brigade from the 23rd Mechanized Infantry Division, was to form the northern pincer and was to advance along the Tasa-Refidim Road, through Katmai Pass, with two brigades abreast. The 4th Armored Division, with the independent 25th Armored Brigade, was the southern pincer and was to advance, two brigades abreast, along the Um Mahza-Refidim Road through Giddi Pass (map 2).

However, the attacks were doomed because of their speed. They outran the range of their covering *SAM-6* anti-aircraft missiles and, without that protection, fell easy prey to Israeli tanks and aircraft. The battles saw the heaviest concentration of armored forces since the World War II Battle of Kursk, but the Egyptian advance was stopped 12-15 kilometers from the Canal crossings — short of the three vital passes. The fighting was intense and the 21st Armored Division alone lost 50 percent of its armor.

As the Egyptian attack faltered and ground to a halt,the Israeli Defense Forces (IDF) assumed the initiative and drove the invaders back across the Canal.



Conclusion. The October War did not present any tactical surprises to the IDF, for they had already encountered the ATGM on the Syrian Front, and the IAF had met the SAM-6 in the Canal Zone. What was crucial for the Egyptians in the opening stages was their employment of ATGMs in cohesive units that operated with a viable antitank doctrine. The IDF armor could not effectively counter this tactic. Also, the Egyptians were able to coordinate their anti-aircraft and antitank defenses into an effective air-ground defense net during the initial crossing. However, this defense net was unable to keep pace with the offense and the Egyptian armor outran its protection.

The 5-day lull not only permitted the IDF to marshal its combat forces, but allowed it also to seize the initiative at the decisive point in time and expel the Egyptians.

Footnotes

[1] Mohamed Heikal, *The Road to Ramadan,* (New York, 1975), pp. 48-55. It should be noted that President Nasser personally took major steps in restructuring the Egyptian officer corps following the Six Day War. Nasser appointed General Mohammed Fawzi as the new commander-in-chief. General Fawzi was a very strict disciplinarian although not strong as a stratigist. Nasser also appointed General Abdel Munim Riad as the new chief of staff. General Riad made up for the shortcomings of General Fawzi. Riad understood the strategy and tactics of modern warfare. He was trained in air defense missilery and later became an instructor in radar and anti-aircraft gunnery. Nasser also pressed for court martials, transfers, and reassignments of officers responsible for the Egyptian defeats in the Six Day War. Likewise he encouraged the promotion of officers who showed potential and promise.

[2] MG Chaim Herzog, *The War of Atonement: October, 1973,* (Boston 1975), pp. 4-6. The Bar-Lev line was named after Lieutenant General Chaim Bar-Lev, chief of staff of the Israeli Defense Forces. Between November, 1968 and March, 1969, Lieutenant General Bar-Lev tasked Major General Avraham Adan to propose a defensive system for the Sinai. Major General Yeshayahu Gavish, commanding general of the Southern Command, proposed to Major General Adan a series of strongpoints along the water line at probable crossing sites. These strongpoins were to serve as an early warning system of an Egyptian crossing. Reference is made to *The War of Atonement: October, 1973,* pp. 5-6 for Major General Gavish's reasoning for positioning the outposts at the water line and not in depth.

[3] *Ibid,* p. 33. BADR is named after the Prophet Mohammed who, in the year 624, began preparations for the battle of Badr which led to his entry into Mecca 6 years later and the start of the spread of Islam. It just so happened that the 6th of October was the tenth day of Ramadan — the beginning of Prophet Mohammed's preparation for the battle of Badr. This was more by coincidence than by design, because on 6 October the astro-meterological conditions were more conducive to water crossing operations on the Suez Canal than any other time that month.

[4] *Ibid,* p. 160. On 7 October, only 20 effective tanks remained in Colonel Amnon's brigade. The 436 Egyptian tanks of the 2d and 16th Infantry Divisions started crossing the canal in force around midnight of 6-7 October. Thus, by the end of 7 October, it can be fairly assumed that the Egyptians dominated in tank strength in the center sector, perhaps as much as 22:1.

[5] *Ibid,* pp. 156, 159-160. Three bridges were erected over the canal in the Ismailia-Great Bitter Lake area.

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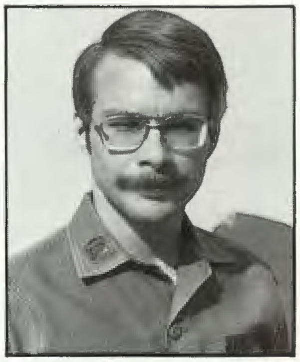


The Bradly Versu

By Captain Ger

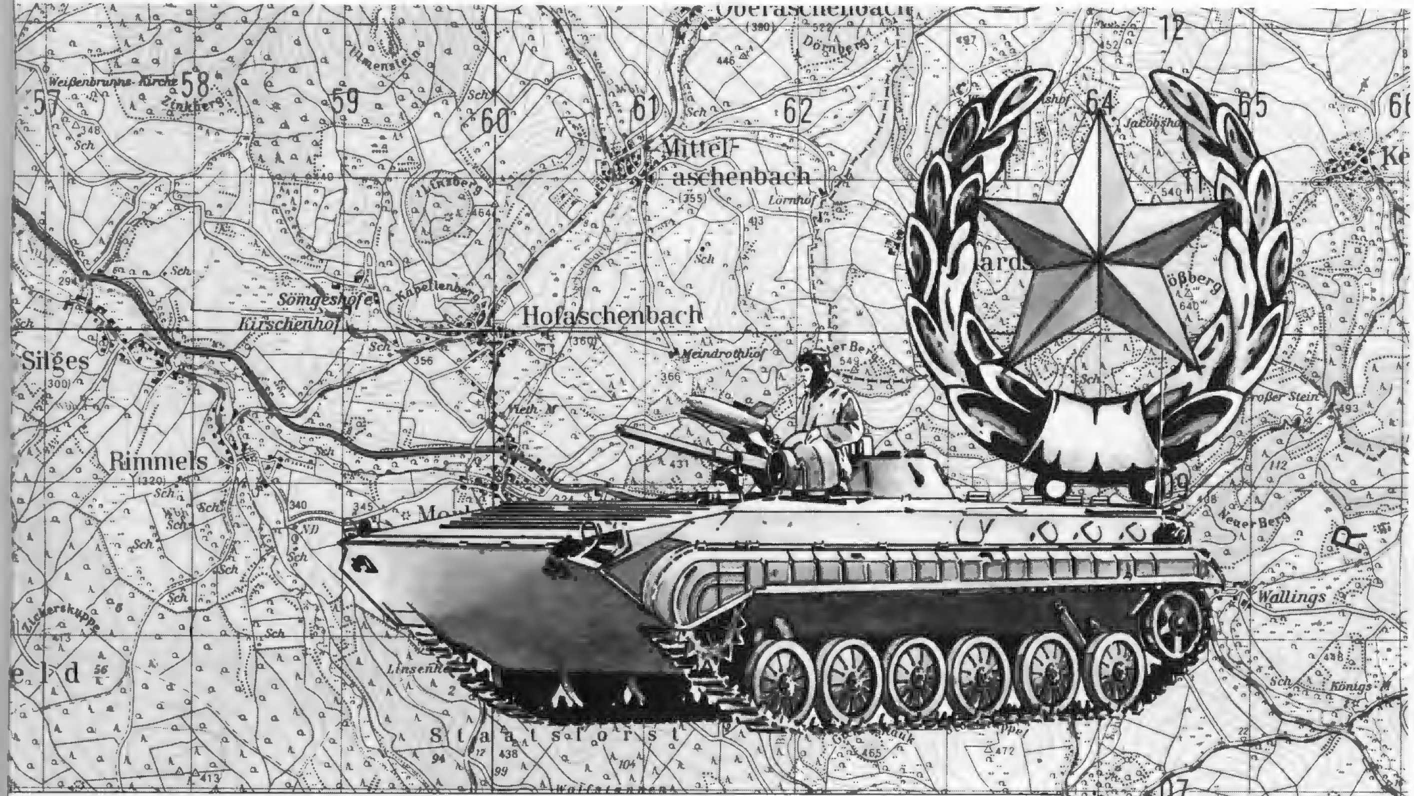
Letters to ARMOR Magazine, such as the one by Staff Sergeant Peter L. Bunce in the November-December 1979 issue, indicate that some individuals in armor cannot understand why the U.S. adopted a large scout vehicle when the Soviets produce small reconnaissance vehicles such as the BMD. Sergeant Bunce was particularly upset that ARMOR published a profile on cavalry fighting vehicles (CFV) in an issue in which Major General George S. Patton, Jr. said, "We should keep cavalry as light as possible."

In the past, the Army *has* designed several small cavalry vehicles. But when the decision was made to use a common hull, suspension, power plant, power train, turret, and cannon for the infantry and cavalry fighting vehicles, the cavalry had to accept a vehicle that is less than ideal for the cavalry role.[1] However, the CFV is smaller than one "cavalry" vehicle that it replaces—the M60A1 tank. On the other hand it is larger than the M551 *Sheridan* and the M113 armored personnel carrier now used in some of the roles that the M3 CFV will assume. The CFV's 2.946-meter height includes the 1.956-meter hull, .610-meter turret, and .381-meter sight head. The 1.956-meter hull is required for the .45-meter ground clearance and 1.499-meters are needed to accommodate a sitting 95th percentile American soldier (6 ft, 1 in to 6 ft, 2 in).[2]

In spite of this height, the CFV offers one distinct advantage. It lowers the distinct cavalry unit signature because it so closely resembles the *M2* infantry fighting vehicle (IFV) counterpart, thereby denying enemy reconnaissance units information regarding the composition of forces occupying defensive positions.

When comparing the U.S. CFV/IFV to equivalent Warsaw Pact (WP) vehicles, the question arises as to which WP vehicle to choose as there are at least seven similar vehicles in WP forces. The WP vehicles chosen for comparison here are the BMP, BMD and the *BTR-60.*

The BMP is the primary IFV used by



s the Opposition

ald A. Halbert

motorized rifle units in tank divisions.[3] It also equips one motorized rifle regiment (MRR) in each motorized rifle division (MRD). The remaining two MRRs in an MRD are equipped with *BTR-60s*.[4] The BMD is used as an IFV in airborne divisions.[5] Other tracked APCs are in evidence, but they are obsolete or have limited use.

There are several variants to the basic BMP and one recently seen is the BMP *M-1976*, sometimes known as the BMP-R. This is a reconnaissance variant that has a two-man turret set further back than the regular BMP. It probably does not mount an antitank guided missile (ATGM).[6]

Both the *M-2* IFV and the *M-3* CFV carry ATGM.[7] While their internal configurations differ, they seem similar from the outside.[8]

The BMD is an IFV used by Soviet airborne units.[9] It carries five passengers and a two-man crew.[10] Photographs show six paratroopers in the vehicle to the rear of the turret.[11] If six men were carried inside, plus the two-man crew, they would be very cramped because the BMD carries ammunition and armament in addition to the engine, fuel, and the hydrojet propulsion unit. It is well suited for raid-type operations behind enemy lines where security forces would normally have only light antitank weapons. The BMP and *BTR-60* are closer to the IFV/CFV in size. The BMP is lighter than the CFV, but is less tactically flexible. For example, the BMP main gun can be depressed only 4 degrees,[12] compared to the CFV's main gun depression angle of 10 degrees.[13] Thus, in many instances, the BMP cannot take up defensive positions usable by the CFV. The BMP carries 40 main gun rounds in its basic load.[14] The CFV carries 1,500 main gun rounds,[15] 37.5 times as much main gun ammunition as the BMP. If the CFV uses 3-5 round bursts, it can engage several hundred targets compared to the BMP's capability to engage 40 main gun targets. Both vehicles are equipped with ATGM. The BMP carries a first-generation *T-3 Sagger* that requires a

Table 1. Armor Thickness of Soviet APC/IFV/Reconnaissance Vehicles (Expressed in MM of Rolled Homogeneous Armor (RHA)

Hull	BMP	BTR-60PB	BTR-50PK	BRDM-2
Front, Upper	40.3	160.3 (Note 2)	65.6	28.8
Lower	34.9	13.2	16.6	9.9
Side, Upper	16.5	8.5	10.0	7.4
Lower	18.0	7.0	9.0	7.0
Rear, Upper	16.9	11.8	7.0	7.0
Lower	16.9	7.0	8.1	7.0
Top	6.0	100.3 (Note 2)	100.3 (Note 2)	7.0
Belly, Front	5.0	6.0	6.0	2.0
Rear	7.0	6.0	6.0	3.0
Turret				
Front	30.9	9.6	N/A	9.6
Sides	23.5	8.7	N/A	8.7
Rear	13.8	8.7	N/A	8.7
Top	6.0	7.0	N/A	7.0
Mantlet	26-33	N/A	N/A	N/A

1. Above thickness expressed in terms of RHA basis equivalent where the actual thickness of the armor is divided by the cosine of the armor obliquity to determine the distance a projectile traveling horizontally to the ground has to penetrate.
2. Very small area, high obliquity causes misleading impression. Actual thickness is 7 mm, obliquity is 86 degrees.
3. U.S. data not available.

Sources

Appendix B, DIA AFV Guide, as modified by using formula on page 83, Ogorkiewicz (footnote 31)

Table 2. Penetration of U.S. and Warsaw Pact Anti-Armor Projectiles (Millimeter of Rolled Homogenous Armor at Zero Degrees Obliquity)

	Range (Meters)								
Projectile	0	200	400	500	800	1200	1600	2000	2400
7.62-mm *M80* Ball	9.0	6.1	4.0	—	1.5	0.8	0.6	0.4	0.3
12.7-mm *M8* API	29.4	23.9	21.3	—	15.1	10.5	6.9	4.8	3.9
14.5-mm API	—	—	—	32.0	20.0 (1000 M)				
25-mm APDS	—	64.4	61.5	—	55.8	50.4	40.3	35.3	31.2
40-mm HEDP	63.5 at all ranges (HEAT Warheads)								
66-mm LAW	330.2 at all ranges								
73-mm *PG-9*	300 at all ranges								
80-mm *PG-7*	335.6 at all ranges								
Sagger	381-431.8 at all ranges								
TOW	500 at all ranges								
Dragon	500 at all ranges								

Data for 25-mm APDS is from the original specifications, not actual measured performance.

Sources

1. Data for 14.5-mm extracted from p. 1, Technical Intelligence Bulletin 77-14, "The Soviet 14.5-mm KPV Heavy Machine Gun and ZPU-1, 2 & 4 Weapons System," Company D, 519th MI Battalion and p. 3-75, DIA AFV Guide.
2. Data for 40-mm from p. 8, "MK 19: Automatic Grenade Launcher Will Make Its Mark in Marine Weaponery," *HQMC Hotline,* February 1981.
3. Data for 66-mm, 80-mm and *Sagger* from p. 1, TRADOC Bulletin 1.
4. Data for 73-mm is for 73-mm *SPG-9* and BMP main gun, as both weapons use the same projectile. Extracted from p. 14, Unclassified DIA Publication "Projectile Fragment Identification Guide-Foreign (U)" and p. 4-4, HB 550-2.
5. Data for TOW and Dragon extracted from p. 20, Joseph E. Backofen, "Shaped Charges versus Armor-Part II," *ARMOR,* September-October 1980.

highly skilled gunner to successfully operate.[16] The TOW carried by the CFV requires much less skill to achieve a higher hit probability.[17] The BMP can carry only four *Saggers*.[18] The CFV carries 12 TOW.[19] In addition, when prepared for firing, the *Sagger* is outside the armor envelope.[20] The TOW is under armor when ready to fire.[21]

The BMP carries 2,000 rounds of 7.62-mm ammunition for the coaxial machine gun as secondary armament.[22] The CFV has 4,400 rounds of 7.62-mm ammunition for its coaxial machine gun.[23] The CFV's fully-stabilized main gun gives the crew a true fire-on-the-move capability.[24] The BMP's main gun is auto-loaded but is not stabilized, and the BMP must halt to accurately fire its main gun.[25] Also, the low velocity and fin stabilization of the BMP's 73-mm main gun round makes it relatively inaccurate beyond 800 meters (874 yards).[26] The CFV should be able to hit a BMP at ranges of 1-2,000 meters.[27] However, a main gun hit by a BMP can destroy a *M-60A1* series tank.[28] The 25-mm main gun of the CFV is not very effective against frontal armor of tanks. It should penetrate rear or bottom plates at close range. Table 1 shows that the armor protection of the BMP is very good. However, Table 2 shows that the 25-mm CFV main gun should penetrate the glacis plate out to 1-2,000 meters. Armor protection on the CFV is classified, but it is reported to be able to defeat 91 percent of the weapons of a motorized rifle division.[29] Most BMP armor should be penetrated by the CFV main gun out to 2,000+ meters (2,187+ yards).

When viewed in the European context, the basic main gun loads and gun depression angles of the CFV and the BMP are important. The U.S. will fight a defensive war in Europe and greater main gun depression angles equate to more defensive positions in hull defilade.

Soviet strategy envisions using the BMP in mass attacks and every CFV can expect to face at least two to three enemy vehicles at any one time. Thus, the basic load ratio of 3 to 1 in ATGM, and 27.5 to 1 in main gun ammunition, allows the CFV to fight longer than the BMP. It is expected that for each 13 BMPs there will probably be four tanks as well.[30] Therefore, a U.S. troop of 10 CFVs could expect to see 30 BMPs and 12 tanks to engage.

Table 3 demonstrates that the CFV and the BMP are fairly evenly matched in mobility, although the CFV has better cross-country mobility. The BMP's maximum speed is higher, but the CFV should have a higher cross-country

Table 3. Vehicle Comparison Chart (All Figures are Metric).

General	CFV	IFV	BMP	BMD	BTR-60PB
Crew (Incl Cdr)	3	3	3	3	3
Passengers	2	6	8	4	8
Weight (tons)	21.8	22.05	13.9	7.5?	10.3
Ground Pressure (Kg/Cm2)	0.52	0.53	0.33	0.61	N/A
Length (meters)	6.453	6.453	6.74	5.3	7.56
Width (meters)	3.2	3.2	2.94	2.65	2.825
Height (meters)	2.972	2.972	1.92	1.85	2.31
Max Step (meters)	0.91	0.91	0.8	0.6	0.4
Trench Cross (meters)	2.54	2.54	2.0	2.0	2.0
Volume (cubic meters)	61.4	61.4	38	26	49.3
Volume, Less Ground Clearance (cubic meters)	50	50	30.3	20.	39.2
Radios	AN/VRC-12 AN/PRC-77 AN/GRC-160 AN/VRC-46		R-123	R-123	R-123
Night Vision					
Type	Thermal	Thermal II		II	None
Range (meters)	2000 +	2000 +	900	900	N/A
Ground Clearance (meters)	0.457	0.457	0.39	100-450 (Variable)	0.475
Engine					
Type	V-8	V-8	V-6	V-6	2 In-line 6
Horsepower	506	506	300	240	180 (total)
Transmission					
Type	Auto	Auto	Manual	Manual	Manual
Gears (F/R)	4/2	4/2	5/1	5/1	4/1
HP/ton Ratio	23:1	23:1	21.6:1	32:1	17.5:1
Speed (Km/hr)					
Road	66	66	80	66 +	80
Water	7.2	7.2	7.8	10	6.5
Fuel Capacity (1)	662	662	460	?	290
Armament					
Main Gun					
Size (mm)	25	25	73	73	14.5
Basic Load	1500	900	40	30	500
Coaxial MG					
Size (mm)	7.62	7.62	7.62	7.62	7.62
Basic Load	7,140	4,400	2,000	3,000?	2,000
Hull MG	N/A	N/A	N/A	2 ×7.62	N/A
ATGM					
Designation	TOW	TOW	AT-3	AT-3	None
Basic Load	12	2+ 5 TOW/Dragon	4	3	0
Max Range (meters)	3,750	3,750	3,000	3,000	N/A
Passenger Weapons					
Firing Ports (pp)	0	6	9	3	6
FP Weapons	0	6 5.56	2 PK 7 AK	3 AK	6 AK
Squad Weapons	3 LAW 1 *M60* 5 *M16*	3 LAW 1 *M60* 9 *M16*	1 RPG 2 PKM 5 AK	1 RPG 1 RPKS 3 AKMS	1 RPG 1 RPK 8 AK

Sources

1. CFV/IFV: p. 1-13, FVS Book.
2. BMP: p. 3-4 to 3-9, DIA AFV Guide; BMP Operators Manual.
3. BMD: p. 3-10 to 3-14, DIA AFV Guide; p. 12-13, Yu. Burtsev, "The Airborne Combat Vehicle," *ZNAMENOSETS,* No. 9, September 1980.
4. BRT-60PB: p. 3-72 to 3-75, DIA AFV Guide.

speed due to different suspension design.[31] Also, the CFV has a superior gross power-to-weight ratio, but the mechanical transmission of the BMP has a lower power loss than the CFV's hydromechanical transmission.[32] On the other hand, the CFV's automatic transmission makes for easier handling and requires less maintenance than the BMPs mechanical transmission.[33]

The BMP's lower bulk is an advantage over the CFV. The CFV has an overall volume of 59.2 cubic meters and the BMP's volume is 38 cubic meters. The CFV is 1.052 meters higher than the BMP because of its greater ground clearance, the greater main gun depression angle (requiring a higher turret), and the placement of the thermal imaging system on the roof.[34]

The fact that the CFV commander is in the turret, rather than in the hull, as in the BMP, also adds to the CFV's height.[35] The larger size of the troop compartment in the CFV allows for longer operational periods with less fatigue than the BMP hull.[36] The thermal imaging system can see farther than 2,000 meters (2,187 yards) in the dark or in haze or smoke.[37] The BMP image intensifier can see only 900 meters (1,143 yards) and is not capable of seeing in haze or smoke. The CFV's night sight is an order-of-magnitude better than the BMP's night sight.[38]

It is expected that the Threat forces will use heavy artillery fire to disrupt supply operations, which would limit our capability to rearm.[39]

The BMD offers even less room to the crew/passengers than does the BMP. The volume of the BMD is 26 cubic meters, compared to the CFV's 59.2 cubic meters. The BMD is not suited for long battles. It can be argued that cavalry units should not fight long battles, the fact remains that they may have to.

The last WP vehicle examined is the *BTR-60PB,* an eight-wheeled armored personnel carrier. While the *BTR-60PB* has excellent mobility and a good main gun, it offers the least armor protection of any WP vehicle discussed and has provisions for only six of the 14 passengers to fire from cover. The main gun is not stabilized and it does not have long-range night vision equipment.[40] In fact, the armor of the CFV is optimized against the 14.5-mm main gun of the *BTR-60PB,*[41] while the *BTR-60PB* and the BMP can be penetrated anywhere by the CFV's main gun. This has been confirmed in firing tests. The CFV has better armor protection than the *M113, Marder,* BMP and the *AMX-10.*[42] The *BTR-60PB* does not mount an ATGM.[43] In addition, its cross-country mobility is inferior to the CFV's.

It is easy to make one-on-one comparisons, but these can be misleading. Rarely will one-on-one engagements occur. Admittedly, cavalry vehicles will more likely fight one-on-one engagements than will other types of armor, but normally CFVs will be in units that will have a mix of organic and attached weapons. These attached weapons will be fighting with the CFV, thereby giving it a greater staying capability.

Another factor to consider is people. Vehicles made by any nation are optimized for that nation's people. The BMP is sized to carry the average-sized Russian who is considerablly smaller than the average-sized American.[45] Anyone who has been in a BMP can testify to its cramped space, and a BMD is even smaller.

What conclusion can be drawn about the relative worth of the CFV/IFV and the opposition?

First, the CFV and IFV are more suited to defensive fighting. They can use more hull-down positions and fight longer without resupply than can the BMP. Second, the stabilized gun and thermal sight allow the CFV/IFV to conduct offensive operations beyond the maximum effective range of the BMP, especially in conditions of low visibility. Third, the CFV/IFV carry an ATGM with a higher hit probability than does the BMP. This is due to the higher skill degree required of the BMP gunner than of the CFV/IFV gunner with his semi-automatic TOW.[46] Finally, the CFV has mobility equal or better than that of the BMP. The only real advantage the BMP has is its lower silhouette.

And, even though the CFV crew would have to fight wearing CBR gear in a buttoned-up mode while the BMP crew does not have to wear protective CBR gear, what happens if the BMP crew has to debark? If they are not wearing CBR gear while inside their vehicle, they cannot very well debark into a CBR environment. When they open their hatch they lose their CBR protection.[47] And anyone acquainted with tracked vehicles knows the frequency of dismounting.

While the CFV may not be the best in theory, it is probably the best available, and its balance of offensive/defensive capabilities are unmatched in the world.

Footnotes

[1] Hearings on Military Posture and HR 10929. "DOD Authorization for Appropriations for Fiscal Year 1979 before the HASC, 95th Congress, Second Session, Part 2 of 7 Parts, Procurment of Aircraft, Missiles, Tracked Combat Vehicles, Torpedoes and other weapons — Title I," p. 210-211. (Hereafter cited as HASC 95-2).

[2] HASC 95-2, p. 157.

[3] Unclassified Handbook 550-2, *Organization and Equipment of the Soviet Army,* Combined Arms Combat Development Activity, Ft. Leavenworth, KS, 15 July 1980, p. 2-11. (Hereafter cited as HB 550-2).

[4] HB 550-2, p. 2-1.

[5] HB 550-2, p. 2-15.

[6] Unclassified DIA Report, *Warsaw Pact Ground Forces Equipment Handbook:* Armored Fighting Vehicles, DDB-1100-241-80, April 1980, p. 3-4. (Hereafter cited as DIA AFV Guide).

[7] Unclassified brochure, *Fighting Vehicle Systems*, published by the Program Manager, Fighting Vehicle Systems, 28 February 1978, p. 1. (Note: Pages in this brochure are not numbered. The first page cited is the first page of text after turning the cover, but not including the letter on the inside front cover. All pages numbered one-up from the first page). (Hereafter cited as FVS Book).

[8] FVS Book, p. 9.

[9] DIA AFV Guide, p. 3-12.

[10] Col Yu. Burtsev, "The Airborne Combat Vehicle," ZNAMENOSETS, No. September 1980, p. 12-13.

[11] DIA AFV Guide, p. 3-10.

[12] DIA AFV Guide, p. 3-9.

[13] FVS Book, p. 13.

[14] DIA AFV Guide, p. 3-9.

[15] FVS Book, p. 13.

[16] DIA AFV Guide, p. 3-9, & HB 550-2, p. 5-27.

[17] FVS Book, p. 13.

[18] DIA AFV Guide, p. 3-9.

[19] FVS Book, p. 13.

[20] DIA AFV Guide, p. 3-5. (Vulnerability to artillery fire inferred by remaining drawing on page 3-5).

[21] FVS Book, p. 3.

[22] DIA AFV Guide, p. 3-9.

[23] FVS Book, p. 13.

[24] FVS Book, p. 6.

[25] Unclassified TRADOC Bulletin 7, "The BMP: Capabilities and limitation," 30 June 1977, p. 7-8. (Hereafter cited as TRADOC Bulletin 7.

[26] TRADOC Bulletin 7, pp. 6 & 10.

[27] FVS Book, p. 6.

[28] TRADOC Bulletin 7, p. 6. (Conclusion based on statement that, as of 1977, "BMP main gun will defeat any known armor").

[29] FVS Book, p. 5.

[30] Unclassified DIA Report, *The Soviet Motorized Rifle Battalion,* DDB-1100-197-78, September 1978, p. 72. (Tank company attached to battalion illustrated). Tank company size on page 3, Unclassified DIA Report, *Soviet Tank Battalion Tactics,* DDI-1120-10-77, August 1977. (Tank company size of MR regiment tank battalion is 13 tanks, three platoons of four tanks). Also page 1, TRADOC Bulletin 7.

[31] FVS Book for CFV evaluation, p. 4. (BMP comments based on personal examination of BMP). Also R.M. Ogorkiewicz, *Design and Development of Fighting Vehicles,* Doubleday & Company Inc., Garden City, NY, 1968, p. 99. (Hereafter cited as Ogorkiewicz, *Design of Fighting Vehicles).* Also see p. 175, HASC, p. 5-2.

[32] Comments comparing BMP and CFV are based on data in Table 3, sources of which are noted in Table 3. Statement on relative effectiveness of transmissions based on Ogorkiewicz, *Design of Fighting Vehicles*, p. 96.

[33] FVS Book, p. 12 and Ogorkiewicz, *Design of Fighting Vehicles,* p. 96.

[34] Comments on imaging system and ground clearance are self explanatory, comment on gun depression extracted from Ogorkiewicz, *Design of Fighting Vehicles,* p. 74.

[35] Conclusion based on location of commander in hull as shown in TRADOC Bulletin 7, p. 16 and Ogorkiewicz, *Design of Fighting Vehicles,* p. 77-78.

[36] Conclusion based on personnal observation of BMP and CFV.

[37] "Sighting the TOW," *Military Review,* December 1979, p. 82.

[38] Unclassified Operators Manual, BMP: Armored Infantry Combat Vehicle, D Company, 519th MI Battalion, pp. 1-16 an 3-24. Also see HASC 95-2, p. 176.

[39] Conclusions based on discussions with personnel in the Directorate of Combat Developments, USAARMC, Fort Knox.

[40] DIA AFV Guide, pp. 3-71 to 3-75.

[41] David G. Holmes, "The U.S. Army's Infantry and Cavalry Fighting Vehicles," *International Defense Review* (IDR), 7/1980, p. 1079. (Hereafter cited as Holmes, IDR 7/1980). Also see HASC 95-2, pp. 156, 161, 172 & 176.

[42] p. 1077-1078, Holmes, IDR 7/1980. Also see p. 190, HASC 95-2.

[43] DIA AFV Guide, pp. 3-71 to 3-75.

[44] Conclusion based on personal observations of BTR-60 and CFV and comparison of relative mobility.

[45] Conclusion inferred from data concerning Soviet Soldiers in "Details of the Soviet T-72 Battle Tank," IDR 6/1977, p. 36 as reprinted in IDR Special Series Number 11, Armored Vehicles, 1980.

[46] *Sagger* is not a semi-automatic, command-of-line-of-sight (SACLOS) missile. Hit probability varies from 25 to 85 percent at various ranges. TRADOC Bulletin 1, "Range and Lethality of U.S. and Soviet Anti-Armor Weapons," 30 September 1975, p. 11). TOW is a SACLOS ATGM and requires less operator training to ensure a high probability of kill. Enrico Po, "The TOW System,"*PARABELLUM*, No. 2, 1978, pp. 80-81. TOW hit probabilities averaged 96 percent hits during firing of 1,000 TOWs during acceptance trials. Christopher F. Foss, "Anti-Tank Guided Weapons, A Defence Survey," *DEFENCE*, Volume 10, Number 2, December 1979, p. 931.

[47] There is no mention of CBR protection in the FVS Book. BMP CBR protection is discussed in TRADOC Bulletin 7, p. 20.

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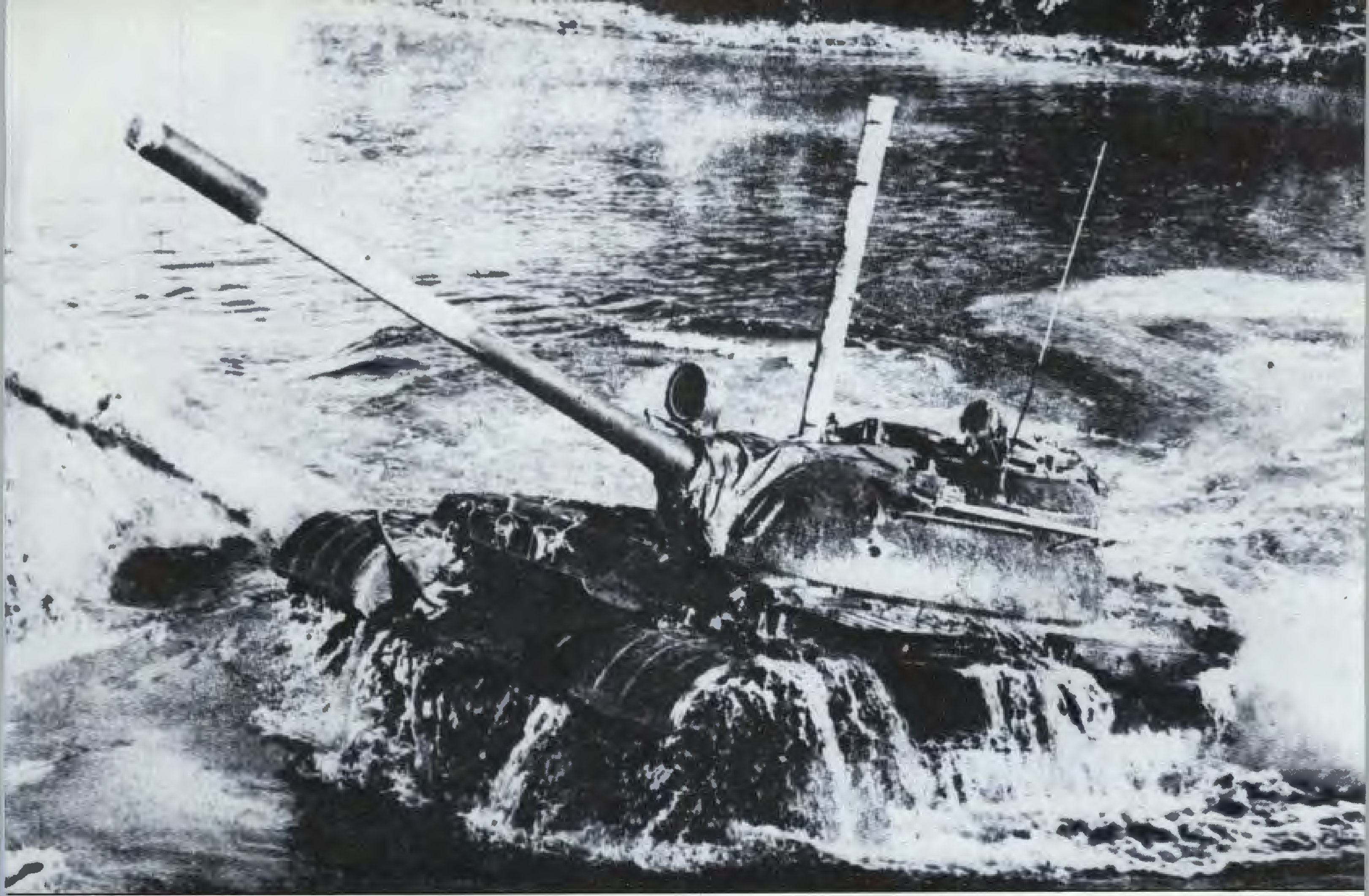

Ivan Has Training Problems

by Arthur W. McMaster, III

There is a serious gap in Soviet ground force capabilities owing to training weaknesses, and especially to systemic problems in the Soviet political-military system. This gap lies stalwartly between what their ground force probably could do in real combat (in Europe), and what their leviathan of top-notch weaponry and their doctrine and attendant norms of performance dictate they should be able to do. These problems seem particularly acute in Soviet armor. This may be because armor is so important to the Soviet doctrine of high speed shock operations. Nevertheless, they have many of the same problems as does any large, modern army.[1]

Senior Soviet military readers constantly write about training problems. Nonetheless, they do not seem to have much profited from past infirmities, and seem to have resolutely embraced a bogus cure. Allegedly skilled in scientific application of history, they seem unwilling or unable to debug the military from its political bugbear.[2]

The most common "fix" to such training woes as lack of training time—be it for the development of simple or complex skills—is to intensify "political counselling." In fact, the worse the performance, unit or individual, the more the local unit *Komsomol* or (CPSU) organization is the eternal font of training panaceas.[3] It all seems remarkably akin to medieval blood-letting to treat the weakened man.

But all this serves to explain only part of the malady, and may suggest a poor prognosis. The objective here is to expose some of the manifestations of Soviet training problems, and especially as they impact on their combined arms performance.

The Program: Orthodoxy, Repetition, and Rewards. The overall training direction and annual training objectives are established by the Ministry of Defense which issues documents that assure that political subjects, and an unalterable master program, are followed. These are issued by the *Main Training Directorate of the Ground Forces* and the *Organizational Methodological Directive,* which specifies the number of hours that must be alloted to each training subcourse, such as chemical defense.[4] Working within stiff guidelines, regimental commanders and subunit commanders are allowed to tailor training, at least with regard to emphasis. However not much can be done about interrupted training periods.

The winter training period runs from early December through mid-April, and the summer period runs from mid-May through late October. There is a 1 month basic training period for draftees before each period. Each is further divided into cycles to progressively cover, squad-, platoon-, company-, and battalion-level training. "Large unit exercises can be conducted at any time in the period as required,"[5] or as ordered.

But there are built-in difficulties. The training program is written and promulgated to cover an entire year, but the training year itself is split into two parts, winter and summer. This split accommodates the twice-yearly draft calls. Each new group of draftees must receive *identical* training, and the entire unit must repeat elementary training whenever the new draftees show up.

If we were to place the training program on a continuum, we'd find that if assigned the task of progressing in skills—such as tank gunnery, or combined arms live fire—from level "A" to "Z" in a given year, we would have to return to "A" 6 months along the way.

It is probably rare that any unit progresses to more complex, coordinated training subjects.

Given that training is supposed to occur in building-block fashion, the mid-year restart has a special impact on larger-unit combat training. For example East German articles indicate that up to 75 percent of a training period may be dedicated to platoon or lower training, while about 14 percent of the period goes to company, about 11 percent to battalion-level activities. Based on a review of the Soviet military press, it appears that a similar breakdown is used by the Soviet Army.[6]

Troops can expect to go to the field for regimental-size exercises at least once per year, and probably twice when their division participates.[7] But these exercises are not always what they seem, and there is a definite tendency to "showcase." This is especially true when a dignitary is present, or "socialist competition" is in question. Goldhamer, when discussing this matter refers to Soviet writings in *Krasnaya Zvezda* (KZ) *Red Star:* that state, "It is not surprising . . . that commanders take precautions to omit from exercises those officers and men they think may bring down the score. A battalion commander left a new officer out of an important exercise because the commander was uncertain what he would do and 'the exercise will be (our) final mark for the year'."[8]

Training mistakes are treated severely. Political browbeating is one remedy, but Soviet military training techniques are not different from any other professional training. Soviet military training is Soviet nit-picking on a grand scale. The political overtones of all learning experiences are constant and oppressive. In her superb, if informal, treatise on Soviet society, *Russian Journal,* Andrea Lee notes, "Soviet educational techniques seem based on rigid discipline, on the humiliation of slow students and praise for the obedient."[9] It is interesting that the author does not talk of the bright, or talented, as compared to "slow students," but rather "obedient." She has a point. And that speaks to the enormous political bent of Soviet "education." There are many talented people, but they are not all obedient.

Uniformity and correctness of performance are institutionalized in officer and NCO education and training. Obedience is expected to follow. In an article for *Voyennyy Vestnik* (VV), *Military Herald,* the then Commander-in-Chief of Group Soviet Forces in Germany (GSFG), Army General Ye. F. Ivanovskiy, wrote in 1979, "The forces of political education being used in the *chast'* (units of regimental size) or *podrazdeleniye* (sub-units) ensure a continuous increase in officers' knowledge and in their successful mastery of Marxism-Leninism as an ideology and methodology. . ."[10]

Methodology is an important idea or tenet in Soviet training, for he adds, "An inalienable part of officers' professional training is their ability to train and indoctrinate personnel competently and achieve highest effectiveness in the training process. We constantly arm our officers with knowledge of military pedagogics and psychology and persistently improve their methods expertise."[11]

To what extent this heavy-handed approach to training succeeds is supposed to be proven in interunit competition—in "socialist competition." Socialist competition offers the chance to be rated *outstanding,* and also offers awards and gifts for the troops such as inscribed wristwatches, cameras, and special favors.[12] But the profession literature tells us much more.

The Problems. Soviet junior officers, and some not so junior, have gone on record with some of their problems that result from this system. For example a GSFG tank company commander wrote in April, 1981 for *Red Star,* "The men of our company assumed lofty obligations for this training year. . . But even now, on the first days of the final lessons for the winter period, we note with alarm that matters in accomplishing what has been planned are not proceeding as we would like. The tankers are committing errors . . . in firing and driving. Can it be that the obligations which were assumed are unrealistic? No. We have opportunities. . . The reason is that many lessons called for by the schedule are not conducted."[13]

The author goes on to blame "administration," and complains that it has cost him entire training days. Mostly he complains about unrealistic planning—lost time! He continues with these specifics, "Shortcomings in the work of our training center also hinder the normal course of training. Let us say that previously it was established that beginning on Monday, we tankers will accomplish firing exercises on the tank moving target gunnery range. We arrive . . . and they inform us . . . (the) gunnery range is closed. ". . . the next day, this was repeated (again closed). ". . . the tankers returned to their regimental area downcast, they did not accomplish the firing exercise, they lost (again) an entire day. . ."[14]

A GSFG Lt. Colonel, writing at about the same time for *Red Star* writes about his findings in a motorized rifle unit, "Last year, the regiment did not attain the goals planned in the competition. The inspectors found especially many shortcomings in the tactical and weapon training of the motorized riflemen." He continues: ". . . last year, an authoritative commission which worked here drew the conclusion: the shortcomings of the motorized riflemen in tactical and weapons training were caused to a great extent by the low level of the methodological skill of some of the commanders and by indulgences and simplifications in the training process." But by March, 1981 he had found no improvement.[15] Such articles and letters to professional journals are common.

"Eventually the battalion commander did the only thing he could: He ordered the crews to get out and wade or swim . . ."

A superb collection of relatively recent, open source, bleatings was assembled by Nathan Leites, for RAND Corporation, in May, 1978, in *What Soviet Commanders Fear Most From Their Troops.* It seems that these fears include inefficiency, especially wasting time, absorption in self, inactivity (sluggishness), and instability. This literature abounds with complaints that march training (scheduled vehicle movements) is not what it should be.

Lt. General Pikalov is quoted briefly on this matter. ". . . the columns at times stretch out to an excessive degree, unplanned halts . . . and individual vehicles fall behind. . .as a result of poor orientation. . ."[16]

Combined arms, or, integrated, training and capabilities have been especially difficult. As long ago as 1968, General of the Army I. Pavlovskii wrote for the *Military Herald* this highly critical comment. "Approaching a water barrier, the unit of (one officer) overcame it only with great difficulty. But at the same time nearby means for crossing were lying idle, as the sappers had not received the mission of securing the crossing. . . More than that, (this officer) did not know what artillery support he had. In one word, the cooperation between infantry, tanks, artillery, engineer and other units had not been organized. . ."[17]

However, the most telling, and most humorous example of unit bungling, reflecting training problems, was reported in a London newspaper. Information provided in October, 1981, indicates that fundamental deficiencies cannot always be alleviated, even under the most contrived and loaded circumstances. "Showcasing" goes awry too.

The Observer reported the following Soviet tank company commander's description of a major river-crossing exercise that was conducted for members of the Army General Staff and some Politburo members.

"The exercise turned out to be like so many military exercises the world over . . . one big snafu . . ."

We had been given a new tank—the *T-64*. Before, tracks had had to be changed every 1,400 kilometers (870 miles); now they could stand 7,000 (4,350 miles). The only trouble was they kept falling off. . . The exercise was to commemorate the 50th Anniversary of the October Revolution. What made it a farce was that, to ensure a good display, the units taking part were to be composed entirely of officers who were ordered to remove rank badges and wear troopers' overalls. To build up one show division, 10,000 officers were needed. They had to be called from four key military districts that in the war would be army groups.[18]

The scheme for the exercise was that the *T-64s* would cross the river submerged, the tanks taking air through snorkel devices. But, as all troops know, crossing a wide river under water requires luck and great care. The reduced gravity of the vehicles means that just a light touch on the steering controls can swing them round violently.

It is possible for an inexpert crew to drive them round—helplessly in circles.

To make sure that this part went well, thousands of troops were employed to pave the river bed with steel matting and build concrete furrows to keep the tanks running in a straight line, an operation that would be out of the question in war.

The entire armada of 5,187 tanks had to cross to the other bank of the Dnieper River in a strictly limited time, before the eyes of the Politburo itself, not to mention distinguished foreign guests. There were 100 furrows, completely invisible from the spectators. Building them had taken months.[19]

The exercise turned out to be like so many military exercises the world over. . .one big "snafu." A motor battalion (motorized rifle?) was to move up to the river, covered by artillery and air bombardment. It would then secure a bridgehead into which the tank battalion would be the first to cross.

Two artillery brigades, plus eight artillery regiments, cleared the way. The infantry's armored personnel carriers plunged into the water and swarmed toward the enemy bank, which was wrapped in the smoke of exploding shells. Shell fragments rained down endlessly, some reaching the middle of the river. According to the opera-

tion plan, when the infantry were halfway across, the guns should have switched to firing in depth. But the artillery showed no sign of letting up. On the contrary, the rate increased.

This was either because the artillery observers had missed the right moment, or because the battalion had started crossing too early. In any case, it was impossible for the armored carriers to continue, and they started to circle in the water, crashing into one another in the current.

All this was in front of the distinguished guests. Eventually the defense minister shouted into a microphone, and the guns stopped—all but one battery which went on firing and stopped bashfully a few minutes later.

Meanwhile the armored carriers continued pirouetting in the water, because the battalion commander dared not give the order to advance.

When finally the artillery, slowly and reluctantly started to fire in depth, the battalion moved towards the bank. But not one carrier managed to get out . . . because the guns had cut the opposite bank to pieces. Eventually the battalion commander did the only thing he could: He ordered the crews to get out and wade or swim. .[20]

Clearly this is not "socialist competition" on a good day, and the absurdities in this account are not to be considered routine. We all know that the Soviet military machine is due respect. But it must not be held in awe. Even such a rigged-up operation as this one contains the seeds of failure. And the system which spawned it should give us something to reflect upon.

It may be that there is something fundamentally at odds with optimum performance. Herbert Goldhamer provides a weighty clue. "Commanders are responsible for organizing socialist competition in their units, but it appears from much Soviet military literature that the political officer, the unit Party bureau, and Komsomol, serve as active initiators. . . They furnish 'assistance' to the commanders, an assistance that in many instances amounts to a shove. . . Several officers (in one situation) openly expressed doubts about the feasibility of attaining these goals. However, the senior political worker and a member of the . . . Party bureau as well . . . maintained that all this was possible'."[21]

The Soviet military training system above all rewards political enthusiasm and conformity. It is not all unlike other major components of the society. It may also be unable to effectively and legitimately treat the nagging, day-to-day infirmities within its ranks. The problem of training to properly conduct complex battle drills and use highly sophisticated weaponry and equipment—within the officially sanctioned norms of performance—remains a problem. If fact, it may be worsening.

We have noted the most obvious shortfalls, those we are lucky or privileged enough to find exposed, and those that for one reason or another are exposed to us. We must not only ponder the true depth of these disorders—which surface from time to time by way of such people as the tank company commander—but we are challenged by this knowledge.

There is a place for this understanding of potential enemy problems in U.S. and friendly Western military planning.

Footnotes

[1] Herbert Goldhamer in his landmark volume, *The Soviet Soldier*, Crane, Russak, and Co., and RAND Corp., 1975, states that he feels that while military training implies many disciplines, we deal here with only the narrow sense on training in basic combat skills. The acquisition of these skills took a severe blow in 1967 with the Law of Universal Military Service, which replaced a single, annual period of induction with two periods. The twice-yearly call-ups, along with the reduction from three years service to two, has drastically cut training effectiveness, and especially so at the unit level. In his article "The Militarization of Soviet Society" *(Problems of Communism*, Sep 76), William Odom suggests that the displaced year was largely re-couped in society's pre-military training.

[2] Roman Kolkowicz, in *The Soviet Military and the Communist Party*, Princeton, 1967, p 341, states: "It might seem to be a rational policy for the Party to avoid any gratuitous injury to the military's effectiveness, its morale, and good will. But the Party does not behave in an entirely rational way, its distrust of the military being almost instinctive . . ." One result of this he points out, is "an elaborate and cumbersome indoctrination and control machinery (that) permeates the Soviet military establishment."

[3] Political sections, of the Main Political Administration, create and direct Communist Youth League *(Komsomol)* organizations at battalion-level, and sometimes at company. The *Komsomol* is to bind the Party and the military's young men.

[4] Defense Intelligence Agency (DIA) unclassified report; DDB-1100-200-78; "The Soviet Ground Forces Training Program," Summary, & pp 8-9.

[5] Ibid, p 5.

[6] DIA, op cit., p. 9

[7] DIA, op cit., pp. 11-12.

[8] Goldhamer, op cit., pp 116-124, "Socialist Competition and the Grading System."

[9] Lee, Andrea. *Russian Journal*, Random House, 1981. p. 129.

[10] Army Gen. Ye. F. Ivanovskiy, VV, *Officers' Professional Training*, 1979, No. 8. p. 10.

[11] Ibid, p. 13.

[12] DIA, op cit., p. 17.

[13] Capt. V. Fedyukov, KZ, 18 April, 1981, p. 2.

[14] Ibid, p. 2.

[15] Lt. Col. Bogdanovskiy, KZ, 31 March, 1981, p. 2.

[16] Lt. General V. Pikalov, KZ, March, 1975, pp. 104-105.

[17] General of the Army I. Oavlovskii, VV, July, 1968, p. 9.

[18] Soviet tank company commander, defector, not further identified. Attributed to *The Observer*, London, 4 October, 1981. Reprinted in USMC, MCDEC Newsletter, *The Threat*, 3-81.

[19] Ibid, inclusive.

[20] *The Observer*, op cit., inclusive.

[21] Goldhamer, op cit., p 119; with further reference to *Kommunist Vooruzhennykh Sil* (KVS) *(Communist of the Armed Forces)*, inclusive.

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Fighting the Threat Advance Guard

by Major Richard Armstrong

No combat leader of even the smallest fighting unit wants to be surprised in battle by the enemy. Knowing your enemy is an eternal truth in battle. Therefore, the leader must ask himself, do I truly understand how the Threat will march to contact and fight the meeting engagement?

In highly-mobile, conventional battles, or in partially-devastated, nuclear environments, the Threat considers that opposing columns rapidly advancing toward each other will be the most common combat scenario, resulting in meeting engagements. During the meeting engagement, emphasis will be on seizing the initiative and securing favorable conditions for the deployment of the main forces. Threat preparation for the meeting engagement includes a practiced battle drill designed to minimize the decision-making time and to capitalize on the confusion and indecisiveness of the opposing force. The cutting edge of a regiment in a march to contact is the advance guard using battle drill to execute a meeting engagement.

A complete understanding of the doctrinal composition and deployment of the advance guard is vital for a fighting force commander if he is to counter this disciplined battle drill A countering force must be prepared to conduct operations that anticipate Threat initiatives and complicate his decision-making cycle.

A reinforced battalion located 20-30 kilometers ahead of the regimental main body is the most likely advance guard unit on a regimental avenue of approach. It is normally a tailored force, approximately one-third of the regiment's strength, and has ample firepower to enable it to deal quickly with minor opposition.

The missions of the advance guard are to assure unhindered movement, to prevent enemy reconnaissance, to warn of surprise attack, and to secure suitable conditions for commitment of the regimental main body to battle.

Composition. The advance guard battalion will be reinforced, based on the regimental and battalion commanders' determination of areas of possible contact and the concept of operation. The size and composition of the reinforced units will vary, but the basic organization of the advance guard will remain constant. It consists of a reconnaissance patrol, lead march security detachment, flank security elements, main body, and rear security element.

Depending upon the type of regiment involved the advance guard will be one of three types of reinforced battalions. The first type is a reinforced tank battalion (figure 1) from a tank regiment in either a tank or motorized division.

The second type is a reinforced motorized rifle battalion (figure 2) of a motorized rifle regiment of a motorized rifle division. It has wheeled personnel carriers, usually *BTR 60's*. It also contains an antitank section consisting of *RPG-7's*, *Sagger* teams, and 73-mm *SPG-9* recoilless rifles teams.

The third type of reinforced battalion is the mechanized battalion from a mechanized regiment in either a tank or motorized rifle division (figure 3). Since the *BMP* has the *Sagger* and 73-mm gun, the mechanized battalion does not have an antitank section. For the purpose of this article, the mechanized battalion will be used for examples.

The first element within the advance guard battalion is the *combat reconaissance patrol* (figure 3,a) moving usually 1-2 kilometers, and at times up to 10 kilometers, in front of the next element of the advance guard. This patrol can contain up to a mechanized platoon reinforced by chemical and engineer reconnaissance personnel and vehicles.

The mission of the reconnaissance patrol in the advance guard is to collect timely data on the enemy's approach; to establish enemy strength, composition, to determine trafficability of road routes, and to detect radiation and chemical contamination along the route and in the areas of contact with the enemy.

The mechanized platoon in the reconnaissance patrol is a part of the next unit in the advance guard, the *lead march security detachment*. Just as the reconnaissance patrol is allocated from the lead march security detachment, the lead march security detachment is allocated from forces in the battalion.

The lead march security detachment (figure 3, c) can be as small as a reinforced platoon, but usually is a reinforced company. It is composed of a mechanized rifle company, tank platoon, and chemical, and combat engineer personnel. The lead march security detachment may also contain an artillery battery and mobile air defense assets, such as *ZSU-23-4s* or *SA9s*.

For protection of the advance guard, the lead march security detachment and flank security elements may preceed the advance guard main body by 5-10 kilometers (figure 3, b). Security during the march is organized to prevent surprise enemy attack.

The lead march security detachment, has the capability to neutralize or fix an opposing force in the opening moments of an engagement. This allows it to seize the initiative.

The main body of the advance guard follows the march security detachment waiting for the opposition to reveal its strength and course of action upon contact. The tank company that is attached to the mechanized battalion (minus the tank platoon in the lead march security detachment) usually moves at the head of the main body column (figure 3, e). This placement permits the tanks to move ahead quickly upon approaching an area of contact. The tanks may either cover the deployment of the advance guard main body, inflict a surprise attack on the enemy, or maneuver with the main body.

a. Combat reconnaissance patrol

b. Patrol vehicle

c. Lead march security detachment comprised of tank company, mechanized squad, artillery battery, sapper squad, and bridge layer

d. Patrol vehicle

e. Flank security (up to 1 platoon)

f. Battalion commander and headquarters, engineer platoon (minus 1 squad), air defense battery, and chemical reconnaissance

g. Tank company (minus 1 platoon for flank security) with mechanized squad

h. Tank company with mechanized squad

i. Artillery battalion (minus 1 battery)

j. Rear services

k. Patrol vehicle

Figure 1. Tank battalion.

a. Combat reconnaissance patrol, up to a motorized rifle platoon, with chemical and engineer elements

b. Flank security, up to a company on a vulnerable side, usually a platoon or less

c. Lead march security detachment motorized rifle company, tank platoon, 120-mm mortar battery, engineer squad

d. Patrol vehicle

e. Artillery battalion, towed artillery at the head of main body for quicker deployment

f. Tank company (minus 1 platoon)

g. Headquarters motorized rifle battalion, artillery battalion, signal platoon, and engineer platoon

h. Antitank platoon

i. Antiaircraft battery

j. Motorized rifle company (minus 1 platoon)

k. Motorized rifle company

l. Rear services

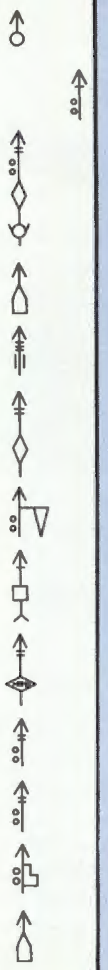


Figure 2. Motorized rifle battalion.

The battalion commander (figure 3, f) is usually located at the head of the main body to maintain control and to establish the order of march. Since radio transmissions are forbidden, radios are maintained in a receive mode for notification and target designation signals during the march. Control of the column on the march is usually exercised by using flares and messengers. Radio transmissions from the lead march and flank security detachment commanders are permitted at critical times or if flares or messengers would be detected. When there is a surprise air or ground attack, radio communications can be used without restrictions.

Air defense assets in the advance guard are organized for the purpose of detecting the air threat, offering timely warning, and destroying ground attack aircraft and helicopters. During the course of movement, all-round watch for hostile aircraft is continuously conducted.

Using intelligence received from regimental and higher headquarters and from the reconnaissance patrol leading the advance guard, the advance guard attempts to maintain continuous movement without stopping for obstructions and impasses. Rapid movement depends upon the combat engineers' ability to conduct route reconnaissance, eliminate route damage quickly, or establish bypasses around obstacles or breaches in barriers.

In anticipation of the extensive obstacles and barriers created by nuclear weapons employment, all combat arms elements are expected to be capable of independently crossing poor route segments.

At the rear of the advance guard column, behind the last mechanized company is the rear services support element whose mission is to provide ammunition, equipment repair, food service, clothing issue and the battalion aid station.

Deployment. As mentioned above,

a. Combat reconnaissance patrol, usually a mechanized rifle platoon reinforced with chemical and engineer reconnaissance elements

b. Patrol vehicle

c. Lead march security detachment, usually mechanized rifle company, tank platoon, artillery battery, combat engineer squad and chemical reconnaissance personnel

d. Flank security detach

e. Tank company (minus 1 platoon)

f. Battalion commander and staff with air defense battery and 120-mm mortar battery

g. Artillery battalion (minus 1 battery)

h. Mechanized rifle company (minus 1 platoon for flank security)

i. Mechanized rifle company (minus 1 platoon for rear security)

j. Rear services

k. Rear security

Figure 3. Mechanized battalion.

the Threat considers the most common combat to be the meeting engagement. It is a very dynamic situation in which time is critical. It is important to beat the enemy to the punch in gaining fire superiority, deploying the main force, and transitioning to the attack. The outcome is determined in minutes—even seconds. Consequently, the Threat considers the advance guard to be the answer to this need. It will be the first to deploy and attack, using fire and maneuver, to preempt the opposing force's coordinated fires and to hinder its preparation of a hasty defense.

The advance guard march formation is organized to insure the rapid deployment of its subordinate elements into combat. While attempting to maneuver to the enemy's flank and rear, the advance guard also attempts to bring to bear the preponderence of its firepower in the initial assault. The idea is to use shock action, overwhelm the enemy and paralyze his will to react or resist.

By his organization of the march, the commander has already made some of his decisions for the advance guard action in the meeting engagement. Based on his organization and allocation of forces to the lead march security detachment, and the march order of the main body, the advance guard commander establishes his priorities for how strong a force he wants his subordinate commanders to fight.

The success of the advance guard's meeting engagement will depend to a considerable degree on the decisiveness and effectiveness of the lead march security detachment.

The march security detachment commander has two basic options in a meeting engagement. The lead march security detachment, upon encountering enemy reconnaissance or small elements, can quickly move to destroy them and continue the advance. Or, upon meeting a superior force, the lead march security detachment can occupy a suitable defensive position with good fields of fire to inflict maximum damage on the enemy. The main body can then maneuver to strike the enemy's flank or rear.

Upon initiation of the engagement by the lead march security detachment, the advance guard commander may move forward for a quick estimate of the situation. With information received from the lead march security detachment, the commander will assign a fire mission to the artillery to support the march security detachment. Those artillery pieces that accompany the lead march security detachment may employ direct fire to augment the detachment's firepower.

Against opposition, (figure 4) the march security detachment may establish a base of fire, allowing the main body to maneuver on the advance guard commander's orders. Having made his decision, the commander assigns missions to subordinate commanders by means of short combat instructions issued personally, or by radio. The missions are usually given to the units as the battalion deploys into combat formations. The battalion commander, or the staff, reports the situation and action taken to the senior commander.

At this point, the mounted assault begins using the standard, well-rehearsed battle drills for movement from the line of march into the assault (figure 5).

Depending on the situation and terrain, the advance guard can deploy directly from the line of march into battle formations.

The avenue of approach selected by the advance guard commander should allow rapid deployment, provide covered and concealed approaches, allow movement to the flanks of the base of fire provided by the march security detachment, allow for attack from the upwind side, and ensure air defense coverage of the main body's attack. An additional consideration is to deploy as close as possible to the enemy to reduce his opportunity to use tactical nuclear weapons.

While the advance guard is organized to have maximum combat forward in the initial strike, the commander may keep a reserve of one or two platoons to influence the battle at a critical point.

If the attack is favorable and the enemy is forced to defend, the advance guard will prevent occupation of suitable defensive positions, break up enemy combat formations, and defeat them in detail.

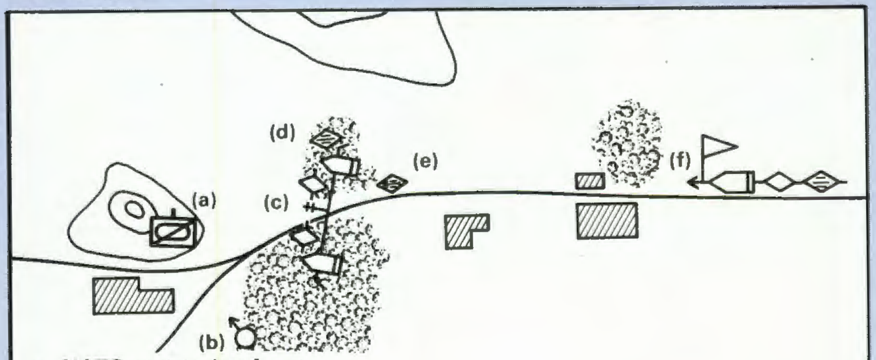
If the enemy begins to withdraw under pressure the advance guard will pursue, destroying any screening force, then attack the main force.

If, on the other hand, the opposition has prevented the advance guard's deployment, the reinforced battalion fires the opposition on a broad front, using all available weapons, thereby allowing the deployment of the approaching regiment.

Tactical lessons. A successful defense requires beating the attack of the advance guard. Fighting it to a standstill forces the premature deployment of the regiment. Coordination with adjacent and higher level units at this point will expand the fight and continue to force the premature deviation from the coordinated plan. Adjacent units hasten those deviations by threatening the flanks of the advance guard.

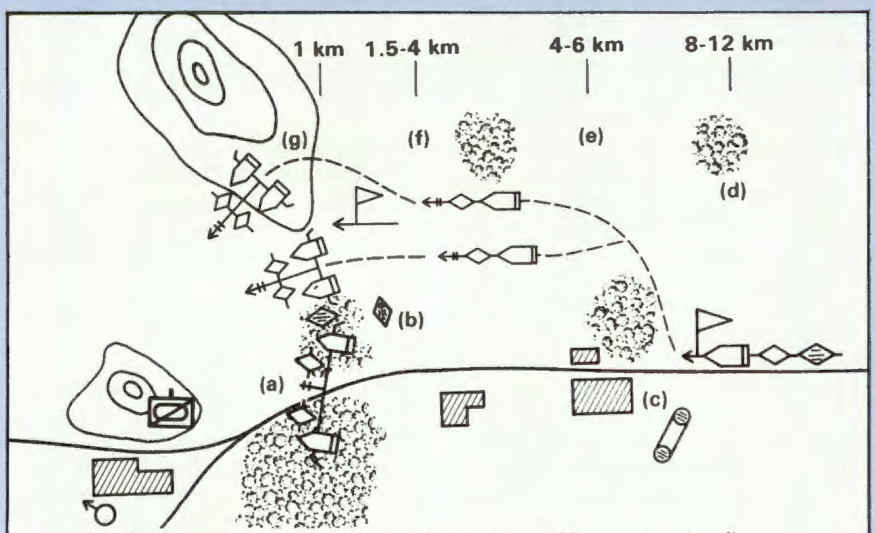
Initially, it is essential to observe the equipment composition of the lead march security detachment and the course of action it selects. Identifying the course of action is the first step to gaining insight to the Threat commander's perception of the situation. If the lead march security detachment attacks, the march security commander believes that the defending force can be defeated. If the march security detachment lays down a base of fire, the leadership has decided to maneuver the advance guard main body. The ability to anticipate subsequent events enables the friendly commander to wrest the initiative from the threat commander during a meeting engagement.

Additionally, by identifying the equipment composition one can identify the advance guard battalion as tank, mechanized, or motorized; thereby giving the unit's range of capabilities and equipment density. For example, a lead march security detachment consisting of a tank company



a. NATO countering force
b. Advance guard reconnaissance
c. Lead march security detach preparing to provide a base of fire
d. Artillery battery with march security provides direct fire support
e. Air defense asset with march security
f. Advance guard mainbody

Figure 4.



a. Lead march security detach continues to provide suppressive fire
b. Air defense assets accompanying the march security moved to cover main body approach
c. Artillery battalion deploys (minus 1 battery)
d. Advance guard main body begins to deploy
e. Battalion in column breaks down to companies in columns
f. Companies in columns move to platoons in columns
g. At 1 km or less the companies form battle lines for assault

Figure 5.

reinforced with BMPs is most likely to be from an advance guard tank battalion of a tank regiment. Conversely, a motorized rifle company with a tank platoon attached will generally indicate a motorized rifle battalion of a motorized rifle regiment. Identification of *BTR-60s* or BMPs will give some indication to the density of *Saggers* and 73-mm guns on the BMPs versus the density and type of antitank weapons of a motorized battalion.

Based on the march security detachment's activity and on understanding its options, the friendly unit commander must choose the right course of action. Timing becomes critical. If the friendly force prematurely pulls out of the battle, the Threat march security detachment will pursue immediately, attempting to bypass or follow the friendly force back to its main body.

A defensive force should not wait too long to press the attack if the opposing march security detachment has laid down a base of fire. This action should raise the friendly commander's expectation that the main body of the Threat advance guard will attack from the flank or rear, attempting to clear the way for the regiment's approach. Awareness of the advance guard's options allows the friendly force to anticipate events and force the Threat to deviate from his battledrills.

After determining the lead march security detachment's actions and composition, one can presume that the main body of the advance guard is about 10 kilometers behind. A quick terrain analysis, using the factors previously mentioned, should provide some clue to the main body's avenue of approach and eliminate the element of surprise.

Additional clues the friendly force commander should look for to determine the advance guard's avenue of approach would be: placement of the air defense assets by the march security detachment to cover the main body deployment, and the use of smoke on the upwind side to screen final battle formations and to mask target acquisition. Only by anticipating actions and exercising options can one begin to confidently fight the advance guard.

Despite the Threat's growing emphasis on initiative and creativity, their training for meeting engagements has remained a stylized battle drill that preempts the need for freethinking on behalf of small unit leaders. This battle drill results in a predictability that is confirmed by the composition and the organization of the advance guard.

Although flexibility is significantly enhanced for the advance guard through reinforcement, its response is limited by the small battalion staff—only five officers, counting the commander and a signal platoon leader. In a fast moving situation, these officers could be quickly overwhelmed by the requirements for action, information and decision making forced on them by an agressive opponent well-versed in their organization and tactics, particularly when surprised. In these situations, deviations from their plan would be disconcerting to the Threat commander.

In the case of the BMP-equipped advance guard (figure 3), approximately 53 percent of the vehicles are armored; i.e., tanks, self-propelled howitzers, and BMP, while the remainder (47 percent) are thin-skinned vehicles. Stalling the advance guard by an agressive attack, forcing its commander to await orders or prematurely choose an avenue of approach, exposes the armored vehicles to attack by armed helicopters and close air support, and the many thin-skinned vehicles to attack by artillery.

It is critical to recognize and to understand the advance guard. A countering force, if it is to stall the initial breakthrough, must disrupt the sequential deployment and forward motion of the advance guard, and its subsequent escalation into a regimental or divisional hasty attack. By effectively dealing with the advance guard's meeting engagement battle drill, the whole plan for a continuous attack can be stymied. This will force the Threat leadership to deviate from the original coordinated concept of operations, and allow the initiative to pass to the countering force.

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Armor Technology

by Joseph E. Backofen, Jr.

This is the eighth in a series of articles on tanks and the technologies of armor penetration, armor, and survivability.

It was not very long ago that the tank was proclaimed as "dead" in the face of modern antitank weapons.[1] However, since the mid-seventies, the talk has turned to that of the tank's supremacy on the battlefield.[1,2] This turnabout has been principally attributed to the development of Chobham armor and special armors which make all but extremely large shaped charges ineffective.[3] These armors are supposedly so effective that when Austrian Defense Minister, O. Roesch, raised the subject of antitank guided missiles, which are forbidden by the 1955 Austrian State Treaty, he was told in Moscow that they would be of little use against the coming generation of tanks.[4] Recently it has been suggested that these armors should also be used on infantry combat vehicles and armored personnel carriers[5] which generally have thinner armor than the main battle tanks that they accompany.[6,7] Thus it appears appropriate to review the technologies and trends of armor.

Initially, thin armor plate of 10- to 25-mm thickness was applied to tracked and wheeled vehicles in order to keep out shell fragments and infantry weapon projectiles so as to attain some measure of battlefield mobility for the weapons and crews.[8] This armor was applied completely around early tanks (some of these such as the German *A7V* might today be considered more of an infantry combat vehicle).[9] Later, as the threat from antitank guns and other tanks grew in importance, thicker armor was used over the forward arc in which the majority of weapon hits were anticipated on the basis of battlefield operations research data. However, photographs published in various popular books do show destroyed tanks with turrets facing to angles of 3 o'clock and 7 o'clock. These photographs do not necessarily deny the battlefield statistics; but they do show that these particular vehicles had been engaged from the direction of their weaknesses.

One of the reasons for the shift of heavier armor to only the front was that the vehicles would be too heavy with all-around protection.[8,9] This weight limitation also led to the use of thin top and bottom armor. Still it was recognized as early as pre-World War II that the top armor could not be made too thin because it would have to stand up to air attack. Thus, in general, the top armor for most armored vehicles was kept at about 20-mm[9] However, the Soviets used from 30- to 35-mm on the top of their heavy tanks during World War II and later generally settled on about 30-mm for both medium and heavy tanks.[10] This emphasis on top deck protection may have been a result of their pioneering of armored vehicle attack by armored aircraft.[11,12]

More recently, advanced armors have been applied to the frontal arcs of modern tank turrets and hulls.[13] The previous articles of this series have reviewed the historical development of antiarmor threats from kinetic-energy penetrators, shaped charges, and mines. These are important; but other weapons developments, such as nuclear weapons, fuel-air explosives, improved conventional munitions, and ground attack aircraft weapons, should also be reviewed because they too affect the development and usage of armor technologies.[14]

It has been well recognized that armored vehicles provided significant protection from many of the effects of nuclear weapons such as light flash, air shock (if the vehicle profile were streamlined and the hatches were closed), residual radiation (fallout), and some forms of initial radiation.[15,17] This is important in recent times both because the U.S. has indicated that it might be forced to escalate to the use of nuclear weapons for the defense of NATO (although it might not do so) and because the Soviet Union might use them on a first strike basis in order to achieve surprise and a breakthrough (although it might not need to).[18-26] Unfortunately, steel tank armor does not provide protection against all forms of radiation and in particular neutron radiation. This was the rationale for the U.S. development of enhanced radiation weapons (neutron bomb), which were loudly decried by the Soviet Union.[27-30] Furthermore, it can be considered characteristic that if enhanced radiation nuclear weapons are used, they will be fired as airbursts so as to penetrate through the lightly armored top, sides, and rear. Thus it is quite reasonable to worry about the effects of friendly as well as enemy use of enhanced radiation nuclear airbursts.

Like the air blast of an airburst nuclear weapon, the blast from a fuel-air explosion is not too hazardous to a closed-up armored vehicle.[17,31,32] However, it is possible that lightly constructed equipment and material such as antennas, lights, and tool boxes might be stripped away or crushed. It is even possible that the impulsive loading might seriously deform plate-like portions of light armor that have large lateral dimensions in comparison to their thickness.[33-35] Still, the proper use of materials, attention to structural design, and closure of hatches in combat should provide protection from the blast effects of fuel-air explosions and nuclear weapons.

Protection from radiation effects is generally considered to be of recent concern. However, it has been noted that the Soviet *T-55A* has had a radiation/spall liner for quite some time.[36,37] It is also apparent that at least the hatches of the *T-72* have been fitted with some kind of radiation/spall liner,[38] although it has even been suggested that the interior of the turret has been lined with lead impregnated polyurethane.[39] The reasons for using such liners have been suggested since the development of nuclear weapons.[13,40-42] Still it should be possible to further adapt reactor shielding techniques and materials toward providing improved radiation protection for the crew and the material.[43-49] These could be applied not only to the top armor to protect against initial radiation but also to the entire vehicle so as to better protect the crew from residual radiation.

The weakness of battle tank top armor was responsible for the development of improved conventional munitions (bomblets) during WWII and the last two decades.[3,50] More recently, the trend in these weapons has been to increase their probability of hitting their targets by making individual submunitions guided "smart" bomblets.[51-54] Further top attack weapons will probably also include self-guiding and laser-designated mortar rounds such as the West German *Buzzard*.[55] This should be anticipated, as the guidance could be adapted for this relatively soft launch weapon from other munitions such as the artillery-delivered SADARM and *Copperhead*. Furthermore, the rate of fire of such a threat, carrying a shaped charge warhead, could be about four times that of a 155-mm howitzer firing *Copperhead*;[56] and the attack could be more directly downward through the top deck.

Since WWII bomblets could pierce 30-130-mm armor,[57] there is really very little to question about whether top armor can be perforated by the jets from newer shaped-charge weapons or the high velocity slugs from mass focus devices. At present the only remaining doubts are about the amount of damage that will occur on the inside of the target and the effect of radiation/spall liners on limiting this damage. Undoubtedly, the effectiveness of these weapons and their impending deployment mean that future armor and armored vehicle research must counter them in some way.

Aircraft can deliver bomblets; but they can also attack with guns, rockets, and guided missiles.[58] Thus it is appropriate to consider these weapons as they can be carried and historically have been carried by Soviet armored ground attack aircraft and helicopters.[59]

The most famous ground attack aircraft of WWII was the Soviet *IL-2 Sturmovik*.[12] This armored aircraft was originally fitted with 23-mm cannon and fragmentation rockets for the role of flying ground attack missions against tanks and other armored and unarmored vehicles. During 1942, the *IL-2m3* version was fielded with two 37-mm

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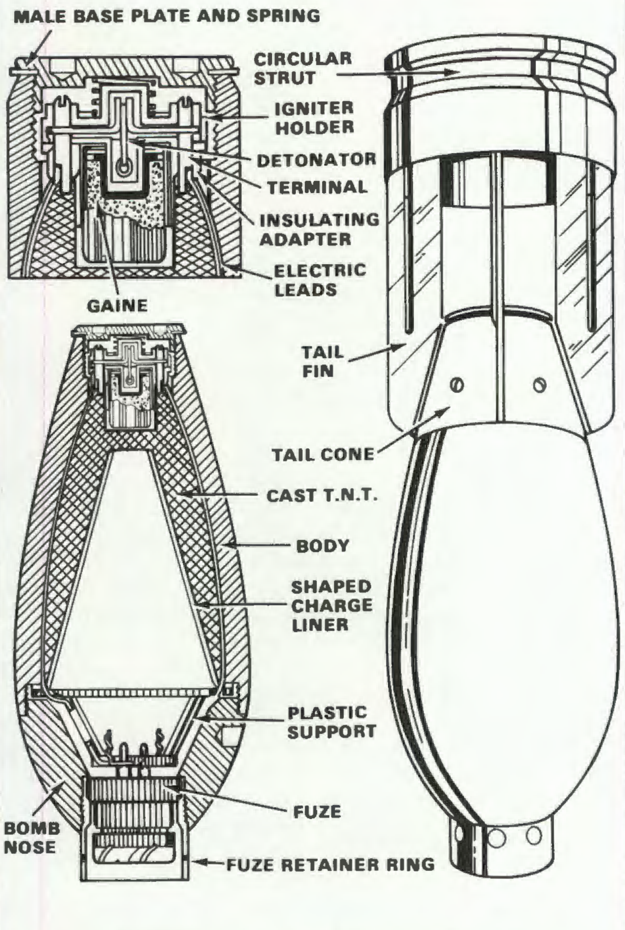

German SD 4 HL Bomblet of World War II

Nudelmann-Suranov *NS-37* cannon which was more than capable of penetrating top deck armor.[60,61] Later in the war, the more heavily armored *IL-10* was introduced for the same mission.

In the West, the WWII exploits of Hans Ulrich Rudel are widely responsible for the recognition of the ground attack capabilities of the *JU-87 Stuka* fitted with two 37-mm *BK (Flak 18)* cannon, each of which fired six tungsten carbide-cored projectiles capable of penetrating 120-mm armor at 100m with an impact angle of 60°.[11,62-64] But it would also be noted that a heavier hitting German aircraft appeared in the form of the Henschel *HS 129B* fitted with a 75-mm *BK-7.5* antitank cannon which consisted of a 75-mm PAK40 fitted with an efficient muzzle brake and a 12-shot automatic loader.[65,66] These modified aircraft were capable of piercing 175-mm armor at 0′ obliquity at 100m whereas the 30-mm guns originally fitted for the ground attack role could only pierce 80-mm armor with tungsten carbide-cored projectiles.[58,66]

During WWII, U.S. aircraft generally relied upon .50-cal. machineguns and bombs for ground attack.[11] However, experiments were conducted with 75-mm cannon mounted on *B-25* aircraft;[11,67] but there was some difficulty with the design of the muzzle device to reduce the gun's recoil without too severe an airblast loading on the airframe.[68] More recently, the U.S. has developed the *A-10* aircraft with the seven-barrel *GAU8/A* 30-mm Gatling gun that carries up to 1,350 rounds and the GEPOD-30 for use with such aircraft as the *A-7*, F-4, F-5, F-16, and F-18.[65-73] The depleted uranium-cored, armor-piercing projectile has been shown to be capable of penetrating 76-mm armor at a 1,200m slant range[72,73] and to be deadly against Soviet *T-62* tanks.[74] Interest also arose during the 1970's in fitting the U.S. *Enforcer* aircraft with the GEPOD or 106-mm recoilless rifles firing shaped-charge projectiles.[75] The investigations of the use of recoilless rifles on aircraft go back in time to the original invention of the Davis gun and were also tried during WWII.[65] However, the experiments have generally led to the use of free-flight rockets instead of a recoilless gun.

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Although Soviet interest in development of an aircraft similar to the U.S. *A-10* is announced periodically,[59,61] it should be remembered that the Soviet Air Force has always been heavily oriented toward ground attack.[60,76-78] This has been especially evidenced in the armament of such aircraft as the *MIG-17, MIG-19, MIG-21 C/E, SU-7, SU-17/20*, and *Yak-28* consisting of 30-mm or 37-mm cannons and rocket pods containing 57-mm *S-5K* shaped-charge antitank rockets capable of penetrating 200-mm armour.[61,77-79] It has recently been further emphasized by the development and deployment of the *HIND-D* helicopter, which not only carries pods of antitank rockets but also antitank guided missiles.[12,79]

Recent weapons research in the West has resulted in the development of high-velocity recoilless rifle kinetic-energy projectiles[80,81] and hypervelocity kinetic-energy penetrator rockets that can also be fitted with guidance so as to act as a guided kinetic-energy round.[52,82] It can be anticipated that these new weapons could be mounted on aircraft, helicopters, and light ground vehicles as similar weapons were likewise mounted in the past. Still, the aircraft or helicopter-mounted antitank guided missile, which uses a shaped-charge warhead, can be considered the more significant threat to armored vehicles because of the size of the warhead and the ability to attack from any azimuth.[52,83] This has stimulated not only the development of the missiles themselves, but also various attack and antiarmor helicopters.[84-86]

The response to top attack can be an increase in top deck armor thickness, rearrangement of the vehicle's configuration, or a counter of the top attack threat. During WWII it was noted that ground attack aircraft were stifled by either fighter aircraft or heavy air defenses.[11,58] This was rediscovered during the 1973 Arab-Israeli War but could have been anticipated from either the WWII ground base data or the trends in naval warfare. In naval warfare the WWII response to topside attack resulted in both the fighter air umbrella launched from aircraft carriers and the development of special antiaircraft ships.[87-89] More recently, sophisticated *F-14* and *E-2C* aircraft have been deployed with the U.S. Navy to supplement shipborne guided missile systems in order to protect ships from aircraft attack. Thus, it could be anticipated that the ground forces might find their umbrella being formed in the future from a combination of fighter aircraft, antiaircraft helicopters, and ground-vehicle-mounted guns and air defense missile systems.[90] However, even though the weight of increased top deck armor might seriously impede mobility, it might still have to be considered in light of newer standoff weapons such as *Assault Breaker* and advanced indirect weapons such as *Buzzard* and *Tank Breaker*, which probably can not be countered by air defense systems.

Since an armored vehicle's "sillhouette" from the "air" is larger than that seen from the ground, its armor array deserves as much, if not more, attention than that used to protect the vehicle from attack from any other direction. In the past, however, top armor has been greatly overmatched by the various threats such as kinetic-energy penetrators and shaped charges. In the future, protection from these and nuclear weapons effects should and probably could be provided by the judicious use of armor materials and the arrangement of the vehicle's equipment and other material.

This article has begun the discussion on vehicle armor with an examination of topside armor threats, technologies, and trends. The discussion will continue with an examination of the historical development and usage of armor materials.

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Technology's Effect On Warfare

"Give us the tools," said Winston Churchill in 1941, "and we shall finish the job." Those tools, of course, were the instruments of war which science and technology had rapidly put in the hands of the soldiers at the end of the 19th century and the first half of the 20th.

Indeed, it is time that we added to the so-called principles of war the maxim: "Thou shalt keep abreast of the technological developments of thy day."

A historical truism begets the fact that only rarely does a new weapon retain its decisiveness for very long. An excellent example is the American military and its undying faith in the capacity of technological innovation to determine outcomes on the battlefield. In particular, it is evident in the ongoing infatuation with antitank weapons. It is the belief that such weapons, if simply deployed in sufficient numbers, can neutralize, if not defeat, the powerful tank armies of the Warsaw Pact. In our embrace of these new laser and wire-guided antitank weapons, the Army has, with characteristic abandon, pursued a technological "fix" for a problem essentially structural in nature. It is more the lack of mobility and less a deficiency in firepower that will cripple our NATO forces in the face of an advancing tank force.

By probing the historical record, one can develop a healthy respect for the difficulties of translating technological advances into battlefield success. New technologies are virtually worthless if unaccompanied by appropriate changes in force structure and tactics, and such changes are usually long in coming. Some 500 years separated the invention of gun powder and its full exploitation in war. The tragedy of World War I was to a large extent the product of a deadly combination of 20th Century weapons and 19th Century tactics. The machinegun was one of those lethal considerations. With the early application of the machinegun, the British were able to win many of the colonial wars of the late 19th century. However, the disconcerting truths learned during the battles of the American Civil War and the Japanese siege of Port Arthur in 1905-05 were lost to the strategists. The great loss of life suffered from a steady fusillade from breech-loading artillery, coupled with barbed wire and entrenchments on attacking massed infantry was largely ignored.

Again as in the past, the decisive importance of the machinegun had disappeared when its employment by both sides led to the no-win situation on the Western Front.

Consequently, another technological solution was sought to break the stalemate in the trenches, and the tank was developed to crush the barbed wire and provide cover to the infantry from the machineguns as they rushed through the gaps. The tank retained its dominance into World War II when used with air supremacy and so is a decisive weapon system even today, but only when supported by a myriad of technological and electronic equipment.

Finally, it should be noted that even profound technological superiority is no guarantee of success in combat; that history is littered with battles and wars—the Little Big Horn, Isandhlwana, Aduwa, the Chinese Civil War, Vietnam—in which the loser possessed vast technological advantage.

- True grit and not the Welsh longbow destroyed the French Feudal Army at Crecy.
- Low Russian morale and not superior Japanese gunnery proved decisive in the great naval engagement off Tsushima in 1905.
- France in 1940 had more and better tanks than the Germans.
- Russian manpower and not the superior quality of Allied arms defeated the Third Reich.
- Hand-to-hand fighting on Iwo Jima and Okinawa rather than the atomic bomb sealed the fate of Japan in 1945.

But one item you cannot overlook is the human factor in technological warfare. General George C. Marshall said of this very issue, "The only effective defense a nation can now maintain is the power of attack, and that power cannot be in machinery alone. There must be men to man the machines, and these must be men to come to close grips with the enemy and tear his operating bases and his productive establishment away from him before the war can end."

The ends that may be attained by war, and the machinery of war have changed throughout the centuries. The deterrent policies of modern times may keep a potential aggressor from the paths trod by the Hapsburgs in 1914 and by Hitler in 1939. But while total warfare has receded into the background, other forms of violence still attract elements that seek to press their advantages.

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Combat Readiness: Fifty Percent

As a commander, I am concerned that, given present deficiencies in training and equipment, we as an armored force are maintaining an average of 50 percent combat readiness. That won't win battles!

A great number of things are checked out in periodic operational readiness inspections (ORIs), but, based on personal observations of the Israeli Defense Force (IDF), I feel that several vitally important matters have either been overlooked or deliberately ignored. Compliance with these matters would substantially improve our ORI reports—and our combat readiness.

I recently had the opportunity to visit an armor brigade of the IDF and was impressed by their crew drills, tank load plan, medical evacuation drills and issue of NOMEX fire-retardant clothing.

The IDF conducts crew drills that acquaint every crewman with every position, enabling them to react to any interior condition, whether it be "fire in the crew compartment", or "round in the engine." Crew reactions are unified, and this training is carried out in day and night conditions. One IDF brigade commander stated that if he could see a decrease in minor cuts and grease stains on his crewmen, he felt the drills were showing results. Israeli tank crews' familiarity with their crew compartments is believed to be second to none.

A further standardization practice equating to greater combat readiness is the fact that IDF tank load plans are identical for a specific tank model. This load pattern covers *everything* inside the tank from main gun ammunition to individual water bottles and first aid kits—"a place for everything and everything it its place" is especially apt within the confines of a tank. It makes for greater neatness, always a problem in an operating tank where improperly stowed and unsecured gear can come adrift, detracting from the concentration required to fight the tank.

The IDF, drawing upon invaluable combat experience, has also added medical evacuation (medevac) drills to crew training. A damaged tank may well be returned to action within a short period if dead and wounded crew members are quickly evacuated, minimal repairs made and a new crew (already thoroughly familiar with the interior arrangements and stowage) installed. Medevac, therefore, is an important IDF tank crew drill. It is important that crew members be instructed in "buddy" first aid by assigned medical personnel.

The need for medevac drill was seen during an exercise in USAREUR when the identification, location, and evacuation of 24 casualties per day was set as a training goal. In practice, only two to four men were evacuated daily. This resulted from the inability of medical personnel to correctly read a map and inadequate evacuation means for the number of casualties generated in the exercise. Armored warfare statistics indicate that a battalion-size unit in action can expect more than 24 casualties per day.

Closely related with medevac and casualty-prevention is NOMEX fire-retardant clothing. In the IDF, nearly every crewman and rear echelon soldier wears NOMEX. Such is not the case in U.S. armor units. NOMEX clothing is available and should be issued, regardless of administrative hangups—for nothing equates to the horror of a burning tank. Even assuming the general use of NOMEX, the number of burn casualties generated in modern tank warfare can quickly overburden unit medical capabilities. Current Soviet doctrine guarantees both frontline and rear echelon soldiers will be involved in the fighting, therefore they all should wear NOMEX clothing.

Other lessons learned from the IDF and related to medevac include the inadvisability of marking medevac vehicles with the Red Cross and the fact that such vehicles should be armed. Also, it was noted upon return to my parent unit, that very few of the items considered essential by the IDF to these vehicles was present. Such inadequacies include: electrically-driven, on-board suction; adequate medical lighting; extended medical/surgical capabilities including intravenous solutions and up-to-date splinting and litter capability.

I was particularly impressed by the IDFs tactical operations centers (TOCs). Although they use the *M113* armored personnel carrier (APC) for command functions, their brigade-level command posts (CPs) are normally no larger than U.S. company-level CPs. If war comes to Europe, present U.S. TOCs in USAREUR will be entirely too large, with regard to mobility and camouflage.

Additionally, I was adversely impressed by the continual sight of U.S. commanders in jeeps and helicopters, using them in addition to the *M577*-equipped TOC. Such vehicles imply command presence and their users would become prime targets. Commanders at any level in the IDF rarely used any vehicle other than their own tank or APC. These common battlefield vehicles served both to hide the commander's rank and his duty. The Israelis have also adapted the M113 cargo hatch as a map board, enabling the commander and the S3 to use the same map while advising subordinates by radio. Also, the communications-electronics (C-E) and the fire support officers were in the TOC vehicles, and while it would seem that to have so many important officers concentrated in so few vehicles would invite disaster, that has not been the case because these vehicles are highly mobile and, because of their similarity to other combat vehicles, do not draw undue attention in battle.

Lessons learned by the IDF in combat are there for us to use. We should not ignore them, for complete combat readiness is dependent upon quality training and equipment adaption based on combat experience. We are not being fair to ourselves, our crewmen, or our country if we do not do all in our power to raise our present state of combat readiness to the highest possible level. Say, 100 percent?

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Horse Sense and Grit: The Spirit of Cavalry Leadership

We, as cavalry leaders and trainers, must convince our troops that the absolute first priority (in spite of strength problems, equipment status, volumes of written guidance, and "the way we've always done it") is definitely to *fight* and *win* using whatever we have, however we can. A cavalry unit has to be functional down to the last breathing body — be he the "first-shirt" or last cook.

The modern cavalry leader has to understand that winning is a combination of optimum use of all resources — even when there doesn't seem to be any resources. It is a matter of "horse sense and grit." He has to realize that he's never going to be able to control all the variables and that the unexpected should be the expected. Cavalry leaders have got to think fast and address each new twist as it appears. They must be constantly anticipating and asking themselves: What can I do? How can I do it? What are the alternatives? Which one am I going to use? At every echelon cavalry leaders have got to understand that established tactics and procedures are tools—usually good tools, but only tools—not binding laws. They must be prepared to design and modify tactics as they go and have the courage to act and skill to do it right. Success in war is not in how the game is played, but in results—who wins. It is our responsibility as cavalrymen to collectively recognize the importance of mental mobility and do everything in our power to foster it.

Implementing and fostering "horse sense and grit" into day-to-day training can be an almost impossible challenge for the small unit leader, especially when faced with the inevitable administrative and bureaucratic problems that continually plague the peacetime soldier. There are, however, many things we can and should do in our daily training that will help us realize our goal.

The National Guard cavalry troop that I commanded for 2 years was not atypical of other small armor/cavalry units I have seen or heard about throughout the U.S. Army. My unit strength hovered around 70 percent; I suffered "terminal tankers' trauma" (never-ending maintenance); Most of my people were excellent—some weren't; and I never went to the field with 100 percent of anything—except 0-6 observers.

In order to lend realism to my training and teach my troops to think and act, I would start every field training problem with an operations order and situation update that usually put us in the second day or phase of the particular operation. At the point we would have incurred losses, etc., bringing us to whatever our training strength and equipment status actually was on that given day. It was the responsibility of each subordinate leader to task organize at each level to best do the assigned job—to win.

I would allow nothing to be simulated. If we did not have maps of a particular area we did not pretend to have them. We never simulated weapons or vehicles. If radios or tracks developed mechanical problems during play of an exercise, we worked around the problems as we would in combat. I emphasized dealing with the "here" and "now" as things were actually happening.

I stressed extensive cross-training. My cooks and mechanics became familiar with and fired the *M60* tanks. Every man in the unit could drive a track vehicle and every soldier was drilled in the basic combat skills. Regardless of his assignment in the unit, each trooper could use a map and a compass and cross-check his calculations with vehicle odometers, wristwatches or whatever was available.

As a result, in addition to teaching my people basic skills they needed, I was able to make them *think* and instill in them a feeling that they really could *fight* and *win*.

The degree to which we are able to rapidly adapt and respond is the degree to which we can expect to survive and win. Again, its a matter of horse sense and grit.

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M60 Pre-Operation Checks

The current preventive maintenance checks and services, (PMCS), in TM 9-2350-257-10-1, April, 1980, are an improvement over past inspection systems. However, the authors of the manual have failed to put the before-operations checks into a logical and organized sequence. The manual also fails to indicate which crew member should inspect which item. Since many tanks have only three-man crews, the loader tasks shown on the charts should be divided among the three crewmen.

The organization of inspection tasks as presented in the accompanying charts, allows many checks to be conducted simultaneously by the crewmen. The driver conducts his checks in the driver's compartment. The loader completes all checks that must be accomplished at ground level. The gunner inspects all turret systems. The tank commander (TC), in addition to insuring that all other checks are performed, is also responsible for the back deck and the tank's exterior.

The before-operation checks are broken down into four phases. Each subsequent phase is dependent on the completion of the preceding phase. The phases are: prepower checks; prestart checks; individual system checks, and crew systems checks. PMCS for the night vision devices are not specifically included in any of these phases because they should be done only during darkness. Selective during-operation checks, such as gauge readings, have been included as part of the before-operation checks.

Each check in the chart has a number. The numbers correspond to the sequence numbers for the inspection given in the TM. All checks should be accomplished on a daily/mission basis.

Phase 1, prepower checks, (chart 1) are accomplished by the crew before the driver turns on the master battery switch. Each crew member checks his own area. The gunner completes his inspection of the interior left side of the turret before taking his seat. When each crew member completes his checks he says, "Phase one checks complete." If a crew member finds a fault he announces the fault to the tank commander, who verifies it. If the fault can not be crew-corrected, the tank commander records it on DA Form 2404. When all phase one checks have been completed or recorded on DA Form 2404, the crew proceeds to phase two.

Phase 2, (chart 2), prestart checks, are done with the master battery switch on, but with the gun tube in travel lock. The TC has the responsibility for the air induction system. The TC also checks for the proper amount of oil in the engine and transmission before the engine is started. Additionally,

Tank Commander

1. Commanders hatch (3,4)
2. *M119* periscope mount (205-206)
3. Grenade launchers, covers and stowage boxes L/R (259-206)

Gunner

1. Loaders hatch (3,4)
2. Portable fire extinguisher (255-257)
3. Nylon personnel ballistic shield (268-269)
4. Main gun breech operating group (159-163)
5. Replenisher assembly, recoil mechanism (167-170)
6. *M37* periscope and stowage box (265-267)
7. Gunners seat (60,61)

Loader

1. Fire extinguisher handle external (2)
2. Torsion bars for roadwheels 1-6 (1)
3. Torsion bars for roadwheels 2-5 (131)
4. Track drive sprockets (132)
5. Rear grill doors (81-83)

Driver

1. Drivers hatch (8)
2. Drivers seat adjustment (9)
3. Drivers seat dumping (10,11)
4. Drivers escape hatch (12-14)
5. Fire extinguisher system (15-18)
6. Hydraulic brake system (19-20)

Chart 1. Prepower Checks for *M60A1*

Tank Commander

1. Air cleaner housings and doors (22-29)
2. Restriction indicator R/L side (38-40)
3. Top deck grill doors (30-31)
4. Engine and transmission oil coolers (32-33)
5. Air cleaner hoses, elbows and clamps (34-36)
6. Mantlet cover and mounting hardware (270-273)
7. Cradle cover (274-275)
8. Rangefinder lenses, periscope windows and telescope lens (78)
9. Commanders seat (60,61)
10. Cupola azimuth control and elevation control (63-65)
11. *M36* daylight body and light source control (207-209)
12. Grenade launcher power box (258)

Loader

1. Blackout markers and infrared headlights (119-123)
2. Taillights (124-130)

Gunner

1. *M118* periscope mount (184-186)
2. *M32* periscope daylight and infinity sight (187-189)
3. *M105D* telescope, light source control, *M114* telescope mount, instrument light (199-204)
4. Fire control (elevation) *M13A3* quadrant, and light source control (66-69)
5. Ballistic computer (177-183)
6. Azimuth indicator (70-71)

Driver

1. Master battery indicator, power plant warning light (21)
2. Blackout markers and infrared headlights (119-123)
3. Taillights (124-130)
4. Bilge pump (116-117)
5. Personnel heater (76-77)
6. Hull-turret inflatable seal (264)

Chart 2. Prestart Checks for *M60A1*

Tank Commander

1. Restriction indicator (41)
2. Air Cleaner elbows (37)
3. .50 caliber machinegun and interrupter (217-223)
4. *M17A1* rangefinder (171-176)
5. Stabilization circuit emergency shutoff and ventillating blower (146-153)
6. Ballistic Drive (197-198)

Gunner

1. Manual traverse, manual elevation and turret lock (5-7)
2. Hydraulic power supply (154)
3. Turret power traverse main gun power elevation, depression, hydraulic power (72-75)
4. Stablization circuits, emergency shutoff and ventillating blower (146-153)
5. Ballistic drive (197-198)

Driver

1. Power plant warning light (44)
2. Battery-generator (45)
3. Engine oil pressure (46)
4. Transmission oil pressure (48)
5. Engine oil temperature (47)
6. Transmission oil temperature (49)
7. Steering controls (50-51)
8. Shifting controls (52-53)
9. Engine idle speed and acceleration control (42-43)
10. Hydraulic brake system (54)
11. Manual engine fuel shutoff handle (118)

Loader

1. Track hammer-ring test (133-135)
2. Track tension (136)
3. Ammunition stowage racks and ready racks (57-59)
4. Batteries (110-115)

Chart 3. Individual Systems Checks

Tank Commander

1. Intercom (62)
2. Gas particulate system (142-145)
3. 7.62-mm machinegun (224-233)
4. Main gun firing circuit test (164-166)
5. Boresight (234-237)

Driver

1. Intercom (62)
2. Gas particulate system (142-145)

Loader

1. Intercom (62)
2. Gas particulate system (142-145)
3. 7.62-mm machinegun (224-233)
4. Main gun firing circuit test (164-166)
5. Boresight (234-237)

Gunner

1. Intercom (62)
2. Gas particulate system (142-145)
3. 7.62-mm machinegun (224-233)
4. Main gun firing circuit test (164-166)
5. Boresight (234-237)

Chart 4. Crew Systems Checks

the TC should verify that the turret seal has been completely deflated. This will help avoid problems in the next phase. The loader works with the driver during this phase to insure that all exterior lighting systems are functional. As each crew member completes his checks, or discovers a problem, he reports it to the TC.

During phase 3, (chart 3), individual systems checks, the tank's engine is started for the first time. The loader ground-guides the vehicle to a location where the turret can be traversed 360 degrees. He then completes his suspension checks and boards the vehicle. The TC takes the gun out of travel lock and conducts an operational check of the induction system before returning to the cupola. He also checks the searchlight, if it is mounted. However, he must consult the necessary technical manual and he must insure that the driver does not shut the engine off until the searchlight check is completed and the light turned off. During the stabilization checks, the TC and the gunner insure that all crew members are clear of the turret and the gun tube.

The crew-systems checks are the final phase in the before-operation inspection (chart 4), and the radios and CVC helmets are inspected according to the appropriate technical manuals.

If the tank has successfully completed all checks according to the readiness criterion in the technical manual, it is ready to go. If the tank is not ready, organizational maintenance must be notified.

In summary, this improved system of before-operation checks provides the tank crew with a rapid, well-organized, inspection procedure. The more practice the crew has in using this system the more proficient they will become. This system should become standardized and used in armor units world-wide as is in keeping with the current army emphasis on standardization. It is hoped that in the future the technical manuals will be revised to reflect this "crew" approach to tank before-operation checks, and perhaps the searchlight and communications systems can also be incorporated into a single tank manual.

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Training For CP Radio Operators

While much attention and priority is given to the training and evaluation of combat elements, little attention or emphasis is given to the individual and crew training of the personnel assigned to the command post (CP). Too often the radio teletype (RATT) operators are used as clerk typists, and the radio operators are used for other details. In this era of soldier's manual and skill qualification test training we cannot afford to allow this practice to continue. When units deploy for field training, suddenly all nets and operators are required to be up and functioning at 100 percent. This cannot and will not happen without a sound, effective, training and evaluation program.

What I propose is a method of diagnostic evaluation to determine levels of proficiency for the radio and RATT operators assigned to M577 CP vehicles. This method is also adaptable to other types of units. This is not a cure-all, but a technique that will improve training and add some interest to otherwise dull, boring, crew and operator drills.

The basic idea is to evaluate individual job skills, crew proficiency and crew interactions. It could and should be a basis for future training. This program can be as simple or as complicated as time, equipment, and terrain permits.

The course should be run in combat uniform, with weapon optional. The course consists of a movement phase and stationary testing or evaluation areas. A night, or period of limited visibility, phase could also be incorporated.

Suggested stationary evaluation situations for a course for battalion or squadron CP personnel follows:

Stations	**Supported/Administered by**
Vehicle Pre-Ops Maintenance	Maintenance Section
Camouflage Vehicle and Equipment	S2/S3 Section
Installation of CE Equipment	CE Officer/Section
Posting Maps and Map Graphic Symbols	S2/S3 Section
Stowage of BII	Maintenance Section
Field Sanitation	Medical Officer

The moving phase should use as varied terrain and be as long as time, terrain, and course design permits.

The moving or driving phase would incorporate, but not be limited, to the following:

Stations	**Supported/Administered by**
Start, drive, stop *M577*	Maintenance Section
Stop, erect, strike and stow tentage on *M577*	S2/S3 Section
Stop, unload, operate and reload, generator on *M577*	S2/S3 Section
Stop, erect, use, and stow *RC/292* antenna	Communication Section
Send and receive messages	
2 — Command Net	S3 Section
2 — Intelligence Net	S2 Section
2 — Administrative/Logistic Net	S1/S4 Section
Use CEOI extract correctly, encode, and decode message	Communication Section
React to nuclear, biological, and chemical contamination	NBC Officer/NCO
Evacuate wounded from inside vehicle	Medical Section
Use hand and arm signals	Maintenance Section
Drive obstacle course with and without ground guide	S2/S3/Mainentance Section

This course can be adopted with a minimum of trouble to those units that are not equipped with M577s.

CHARLES D. WILLIAMSON
Captain, Armor
OHARNG

Recognition Quiz Answers

1. ***TAM* (Argentina)**—This medium tank was designed in West Germany. It weighs 33 tons (30,500 kilograms), has a crew of 4, and a maximum range of 297 miles (550 kilometers), which is extended to 485 miles (900 kilometers) with auxiliary tanks. Its power-to-weight ratio is 23.27 bhp/ton.

2. ***VCTP-ICV* (Argentina)**—This infantry fighting vehicle was designed in West Germany. It has a two-man turret mounting a 20-mm cannon and a 7.65-mm machinegun. There are three gun ports on each side. It can carry 12 men, including the crew, at a maximum road speed of 38.8 mph (72 kmph). It weighs 29 tons (27,000 kilograms) combat loaded, and has a maximum range of 470 miles (870 kilometers) with additional fuel drums.

3. ***LVTP***—This armored amphibious vehicle is used by the U.S., Argentina, South Korea, Italy, and other countries. It has a 3 man crew and carries 25 men. It weights 25 tons (22,838 kilograms) and has a maximum road speed of 35 mph (64 kph) and a miximum water speed of 7 mph (13.5 kmph) with water jets. Its maximum land range is 260 miles (482 kilometers) at 22 mph (40 kmph). The main armament is a 12.7-mm machinegun.

4. ***BTR-152/Vulcan* (Yemen)**—This self-propelled antiaircraft weapons system is made up of a Russian-made BTR-152 and an American-made, radar-controlled Vulcan antiaircraft gun.

5. ***YPR-765* (Netherlandes)**—This American-made armored personnel carrier is also known as an armored infantry fighting vehicle (AIFV). It mounts a 12.7-mm machinegun, has a 3-man crew, and carries 7 passengers. It weighs 14 tons (13,470 kilograms), has a maximum road range of 265 miles (490 kilometers) at a maximum speed of 33 mph (61 kph), and its maximum water speed is 3.4 mph (613 kmph).

6. ***Centurion Mk5/2* (UK)**—This tank is armed with a 105-mm main gun and two 7.62-mm machineguns. It has a 4-man crew and weighs 55 tons (50,728 kilograms). It has a maximum road speed of 18.6 mph (34.6 kmph) and a maximum range of 55 miles (102 kilometers). It can ford 4.75 feet (1.45 meters) of water.

FORGING THE THUNDERBOLT

Specialty 51: Combat Developments/Operational Testing

This article discusses what Combat Developments and Operational Testing is about, how you can contribute, and how you can become qualified in Specialty 51 (Research and Development).

Specialty 51 includes service in the TRADOC arena of Combat Developments, *the user*; or in the DARCOM arena of Research and Development, *the developer* or at HQ DA (ODCSRDA or ODCSOPS) or DOD. Both DARCOM and TRADOC also utilize Specialty 51 officers in the area of testing. Within TRADOC, the majority of the assignments are at the respective Branch Centers in an organization known as the Directorate of Combat Developments (DCD). Within DARCOM, the majority of the assignments are in the Project Manager Offices, the Research and Development (R&D) Commands such as Armaments Research and Development Command (ARADCOM) and DARCOM Laboratories. The Test and Evaluation Command (TECOM) of DARCOM conducts *developmental* tests to verify that the contractor delivered what he said he would.

The systems acquisitions process through which material is developed and tested by the R & D officer follows a logical sequence. The *user* establishes and defends the requirements. The *developer* manages the money and produces the prototype by civilian contracting or inhouse. The *tester* conducts developmental and then operational tests .The *user* then makes the *go, no-go* or *fix-it* decision. And, finally , HQ DA approves or disapproves the *user* decision. DOD will also review the Army's decision on major systems. This process is applicable to all materiel; whether it be a new crewman's helmet or main battle tank.

The DCD, U.S. Army Armor Center (USAARMC) (figure 1) is authorized some 44 officers (captains to colonels), 12 Department of Army civilians (GS 9-13) and 7 senior NCOs. Short TDY trips, tight suspense actions, and a crisis environment mark the daily routine. Seventy percent of the activity deals with the other TRADOC Centers and DARCOM commands with the remainder dealing with higher headquarters, including DA and DOD. DCD is organized into three divisions: The Studies Division functions include concept development and doctrine, wargaming, organizational TOE , high-risk technology, and Threat and operational research and analysis; the Materiel Division is concerned with tank systems and ammunition, cavalry systems, and armor support systems, and the Test and Evaluation Office which includes operational (equipment) and force development (structure, doctrine, tactics) suboffices.

It is the combat developer's responsibility to establish new or product improvement materiel requirements and to formulate the Armor Center's position or decision on all Armor materiel and organizational issues. Restated, they define for the Commanding General of the Armor Center where Armor should be in current, near-term, and far-term time frames. The *M1* tank, *M3* cavalry fighting vehicle, armored crewman's uniform, and Division 86 Armor structure were a few of the activities initiated in the 1970s to move the Armor Force into the 1980's. Actions concerning the Armor Force for the 1990's and beyond the year 2000 have already begun through such processes as the Armor Development Plan (to be replaced by the TRADOC Battlefield Development Plan), DARCOM's Combat Vehicle Base Science and Technology Plan and the Armored Combat Vehicle Technology Program (test bed vehicles).

Not stated, but inherent within CDC's responsibility, is the moral charge to say no, when necessary, to the DARCOM *developer*, force the contractor to understand the armored crewman, keep the *tester* honest, educate other TRADOC Centers on Armor's combat support and combat service support needs and constantly push Mobile Warfare. None of the above is an easy task. It requires pushing bureaucracy, sinking pet projects, encroaching on other Branch Centers' turf and surfacing problems, thereby forcing action on other Centers and Major Commands.

The U.S. Army Armor and Engineer Board (USAARENBD) (figure 2) is another major employer of Specialty 51 officers, with its Armor and Engineer Test Divisions being staffed by about 16 officers. Most of these officers are test project officers who play a major role in accomplishing USAARENBD's primary mission of conducting operational and force development tests to determine how well systems and materiel perform in the hands of the average soldier.

The test project officer operates in an unusual time cycle and in an environment saturated by "experts." His cycle involves 4 to 6 months planning, 1 to 3 months field execution, and 1 to 3 months compiling the test report. One test per year is the average workload. His sources of advice are unlimited. The *user* wants the system to do all things, which sometimes leads to unrealistic test issues. The contractor wants only those things of the system tested which he is sure will do well. The trainer wants more crew train-up time which, if given, reduces the availability of field test time. The troop support unit desires a short test with minimum troop involvement which, of course, would detract from the test validity and credibility. Higher headquarters wants all "what if" drills covered by some contingency. The *developer*

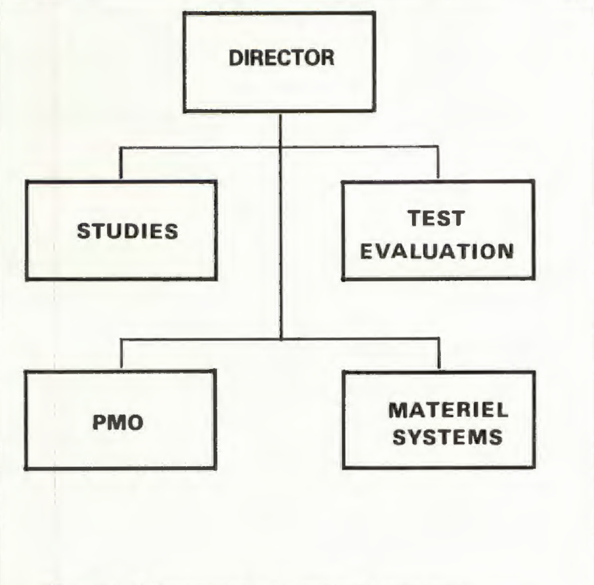

Figure 1. Directorate of Combat Developments.

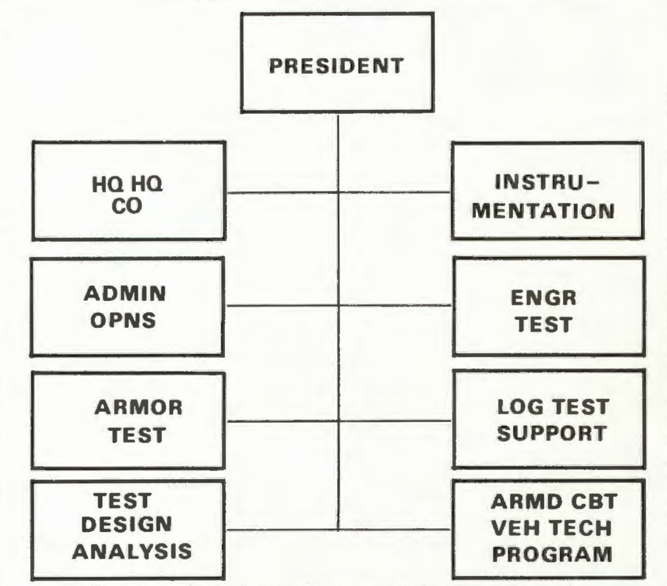

Figure 2. U.S. Army Armor and Engineer Board.

wants a success story regardless of the problems encountered, so he attempts to be a trade-off politician. It is exciting, and it becomes more so when the test report is briefed and published.

At the conclusion of the test, the test project officer, by nature of what he has done, is the Army's "green suit" expert on that system. However, since he discovers both good and bad, his fame is short lived. The contractor blames the problems on the trainer (inadequate training), the trainer blames the manuals, the *user* blames the test design, the *developer* blames the requirement document (not specific enough), the tactician (whoever he may be) blames the test scenario, the supplier of support troops doesn't blame anyone, he just wants his troops back, the test crews blame the maintenance/logistics support package, higher headquarters stays aloof, and the *tester* is initially lost in the shuffle. However, the *tester* is not off the hook yet. His most trying challenge is about to occur: the "expert" (DA or DOD staff officer, congressional staffer or media reporter) who visited the test site for only 4 hours at one time during the entire 3-month test is about to enter the net with his profound evaluation of the issues. The patience, poise, courtesy, and integrity of the test project officer will be well challenged. But, in the end, the test project officer remains the expert and his test conclusions must be addressed by the decision makers; the *user*, and *developer*, as well as the trainer and the logistician.

Who is the key to his DCD and USAARENBD process? He is the USAARENBD project officer or DCD action officer; the captain and the major, who has just completed company command or S-3 duty and decided to see what Specialty 51 is about. He is an officer who feels that it is now the time in his career to contribute to the progressive development of his branch and, equally important, have a say in what the Armor Force will look like when he later commands a battalion and brigade. Remember, from concept (requirement established) to production involves about 7 to 10 years.

Officers, who are the real combat developers and testers, are not necessarily technicians with a master's or doctoral degree in electrical or mechanical engineering. An advance degree is helpful for those seeking an assignment in Specialty 51 but one is not always necessary. More important is a firm background and performance in Armor, troop experience, and a sincere belief in mobile warfare. For captains, company command experience, and advanced course completion is desirable (but not always necessary), along with the ability to articulate your Armor expertise. For majors, similar accomplishments at battalion or brigade level and graduation from Command and General Staff College are desirable, but not always necessary, for acceptance. All other expertise and experience is a bonus.

DCD and USAARENBD are the training grounds for Specialty 51. You do not arrive trained by the civilian or military schools system. Rather, the technical knowledge required is gained during the combat developments or testing assignment with one exception. Those interested in pursuing the analytical studies side of combat developments, or test design and test report analysis, of USAARENBD, require an advanced degree in Operational Research and Systems Analysis (ORSA), Specialty 49. Armor officers most in demand are ORSA specialists who have served in Specialty 51. No better advice could be given to a young captain who is heavy on mathematics, has completed his branch advanced course and command, than to pursue the Specialty 12A49 with a utilization tour in the Specialty 51 field.

Seize the initiative and take a hard look at Specialty 51 for your additional specialty. Do not depend on MILPERCEN to forecast your potential. Seek a Specialty 51 assignment through MILPERCEN and by contacting the Director of Combat Developments AUTOVON 464-1555, or Commercial (502) 624-1555; or the President of the Armor Engineer Board (Testing), AUTOVON 464-7850, or Commercial (502) 624-7850 at the Armor Center.

If you want to influence your Armored Force in the near and far-term, DCD is where it all "begins." USAARENBD is where "what began" is checked, verified, and accepted, or rejected. Your home of Armor and Cavalry invite you to help shape the future.

JIMMY L. PIGG
Colonel, Armor, USAARMC
Former Director, DCD
Former President, USAARENBD

OPMS-EPMS

Do You Have M1 Experience?

Armor Branch is actively working to identify officers who have detailed knowledge of M1 tank operation. Officers who have successfully completed the M1 Course at the Armor School are awarded ASI 3M. These officers are easily identified by Branch, because the ASI is on the MILPERCEN computer. However, there is no quick way to identify those officers who have had extensive M1 experience if they have not been awarded ASI 3M. With the increasing number of assignments for M1 qualified officers, Armor Branch needs to know who has M1 experience in order to better match qualified people with the Army's needs. If you have had detailed experience with the M1, (e.g., platoon leader, executive officer, company commander), please send a short, hand-written note to:

HODA MILPERCEN
ATTN: DAPC-OPE-R
200 Stovall Street
Alexandria, VA 22332

Reserve Officers Career Status

An interim change to AR 135-215, 15 Oct 1979 affects Army Reserve and Army National Guard officers who desire to remain on active duty in a career status.

This interim change indicates a policy change which establishes 2 years as the minimum period of active federal commissioned service before an officer is eligible to apply for a voluntary indefinite extension of active duty. Also included is a change to permit commissioned and warrant officers of the basic branches to apply for short-term extensions for a minimum period of 90 days to a maximum of 36 months. These changes have been made to improve the management of requests for extended active duty.

AR 135-215 is changed as follows: Paragraph 2-2a is superseded to read: Obligated reserve officers serving on active duty who desire to remain on active duty in a career status may apply for a voluntary indefinite extension upon completion of 2 years active federal commissioned service. When approved, and before being accepted into a career status, they must remain on active duty 1 year from the expiration of their current service agreement. This 1-year active duty service obligation will be served in a competitive voluntary indefinite (CVI) status. Officers will be notified of their selection, or non-selection, for retention on active duty through the eighth month of CVI status. Officers in the basic branches may apply for the short-term extensions for a minimum period of 90 days to a maximum of 36 months when they:

- Have been ordered to an initial active duty tour.
- Desire to extend their initial service agreement without entering voluntary indefinite status.
- Desire to extend their active duty for initial flight training (AR 611-110) and the resulting active duty service obligation.

Applications for additional short-term extension will be considered on a one-time basis provided the total of all such extensions does not exceed 36 months.

Short term extensions are a voluntary active duty service obligation and may be waived by HQDA to permit early separation on an individual basis and only in cases of extreme compassionate circumstances or when such action is deemed to be in the best interest of the officer and the US Army.

Officers should understand that they are required to be in a CVI or career status prior to being selected for attendance at the advanced course.

Assignment Officers/Assistants

LTC Norman E. Beatty	Branch Chief
MAJ James E. Quinlan Ms. Gloria R. Johnson	LTC
MAJ Israel P. Anderson Ms. Janice P. Boyce	MAJ
CPT Craig B. Whelden Mrs. Laurie J. Bennett	CPT
CPT Joseph G. Pallone	CPT
CPT William T. McAlpin Mrs. Diana D. Lueker	LT

Telephone Numbers
Autovon 221-6340/6341/9698/9658
Commercial (202) 325-

MILPERCEN Location

Officers desiring to visit Armor Branch at MILPERCEN should follow Interstate 495 (The Capital Beltway) toward Alexandria, VA, and take Exit 2 north to Telegraph Road. Hoffman Buildings I and II are on the immediate right after exiting the Beltway, and are located adjacent to the Holiday Inn. Visitors should only park near the METRO station overpass in spaces marked in red, and register POVs with the security personnel in the lobby of Hoffman Building 1. Officers should then report to Room 4S33 in Hoffman Building II for interviews with Armor Branch.

Officers who want to see their Official Military Personnel File (OMPF) should call AUTOVON 221-9618 (or commercially, 202-325-9618) at least 48 hours in advance for an appointment. Although a copy of the OMPF is maintained in the Branch File (CMIF), officers are encouraged to review their official records when they come to MILPERCEN.

news notes

Air Force Tests A Tracked F16

The USAF Flight Dynamics Laboratory is testing a light, wrap-around track that envelopes the landing gear tires on the F16. The "tracked F16" has improved soft soil performance, lower ground pressure, and protection from debris and rubble on bomb-damaged runways.

Ex-Trooper Reagan Rejoins Horse Cavalry

President Reagan, a pre-WW II reserve cavalry officer, has joined the U.S. Horse Cavalry Association as a charter member and will serve as the organization's honorary chairman.

The President was commissioned a second lieutenant of the cavalry after graduation from Eureka College and was assigned to a reserve unit of the 14th U.S. Cavalry Regiment at Ft. Des Moines, Iowa. He was later ordered to active duty and transferred to the Army Air Corps and served as adjutant at the San Francisco Port of Embarkation.

The USHCA sponsors the U.S. Cavalry Museum at Ft. Riley, KS. Membership is open to all who support the cavalry tradition and non-troopers are welcome. The address is: Box 6253 Ft. Bliss, TX 77906.

Seek Information

The 7th Armored Division Association is preparing to publish a commemorative history of the Division covering the period 1942-1982. Wanted are personal biographies (150 words or less) of members and ex-members; recent photos, historic photos. Write to: Seventh Armored Division History Book P.O. Box 36488, Dallas, TX, 75235.

Vulnerability Technology

Research personnel at Aberdeen Proving Ground are engaged in obtaining realistic battlefield damage results by determining the vulnerability of many different targets.

Data obtained have played a role in NATO weapons development and have increased survivorability in major U.S. tank and aircraft weapon systems.

Reunions

Spearhead Division

The Third Armored Division Association will hold a reunion July 21-24 at Twin Towers Hotel, Orlando, FL. Contact Mr. Matthew Hickey, Florida Chapter President, 4384 78th Ave., N.O., Pinellas,FL 33565.

1st Cavalry Division

The 35th annual 1st Cavalry Division Reunion will be held August 19-22 at the Twin Bridges Mariott, Washington, D.C. Reservations with Lieutenant Colonel Joseph Whithorne, 1st Cavalry Division Association, George Casey Chapter, Box 1262, Springfield, VA, 22151.

508th Association

The 508th Parachute Infantry Regiment Association will hold a 40th anniversary at Ft. Bragg, N.C. in October, 1982. Those persons who served with the unit during 1942-1945 and who are not now association members are requested to contact: R.E. Chisholm, P.O. Box 212, Santa Teresa, N.M., 88008.

Big Red One

The Society of the First Division will hold its 64th reunion at Lake Placid, NY on July 7-11. Members should contact Arthur L. Chaitt, Executive Director, Society of the First Division, 5 Montgomery Ave., Philadelphia, PA, 19118.

Liberators

The 14th Armored Division will hold its 18th annual reunion at the Atkinson Hotel, Indianapolis, IN. Contact Merrill Vance, 813 Lone Oak Road, Anderson, IN, 46011.

503d Parachute Infantry

The 503d Parachute Infantry will celebrate its 40th anniversary with a reunion at Canaan Valley, WV, July 15-18. Contact Secretary, Colonel John Davis, P.O. Box 53962, Fayetteville, NC 28305. Phone (919) 485-1550.

Thunderbolts

The 11th Armored Division Association will hold a reunion August 12-15 at The Pointe, Phoenix, AZ. Contact Alfred Pfeiffer, Secretary-Treasurer, 2328 Admiral St., Aliquippa, PA, 15001. Phone: (412) 375-6295.

Super Sixers

The Sixth Armored Division Association will hold its 35th annual reunion in Louisville, KY from July 28 to August 1, 1982. Highlight of the affair will be a river cruise on the *Belle of Louisville* paddlewheel river steamer. Passenger limit is 800. Write to: Sixth Armored Division Association, P.O. Box 5011, Louisville, KY 40205.

Old Hickory

Veterans of the 30th Infantry Division (Old Hickory) will hold their 36th annual reunion from July 6-9 at the Hyatt House, Winston-Salem, N.C. Write to: Saul Solow, Executive Secretary-Treasurer, 13645 Whippet Way East, Delray Beach, FL 33445

BOOKS

HISTORICAL STUDY, RUSSIAN COMBAT METHODS IN WORLD WAR II, Department of the Army pamphlet 20-230. Department of the Army. 1950. Reprinted by GPO, 1978. 115 pages with maps.

This paperbound work is one of several which comprise what is referred to as the German Report Series and was written by former German officers, all of whom had experience on the Russian Front during World War II. It is divided into six parts. Part one is a brief introduction and part six the conclusion. Part two, "The Russian Soldier and Russian Conduct of Battle," contains six chapters covering the Russian soldier, Russian army leadership, role of the political commissar, primary combat arms of the Red Army, Russian battle techniques, and Russia as a theater of operations. Part three, "Peculiarities of Russian Tactics," has seven chapters covering the offense, the defense, reconnaissance and security, retreat and delay, combat under unusual conditions, and camouflage, deception and propaganda. Part four is a short discussion of the Red Air Force and Part five concludes that the Soviet partisan movement had little influence on the overall operations in the East.

The Germans were the last army to fight the Soviets in a large-scale conventional war. We can learn much that is of use by studying not only what the Soviets did, but also what the Germans did. This pamphlet is well worth looking into.

JAMES GEBHARDT
Captain, Armor
HHC, 1st Bd, 8th Inf. Div.

THE DEVIL'S VIRTUOSOS: GERMAN GENERALS AT WAR 1940-5, by David Downing. St. Martin's Press, New York, NY, 10010. 1977. $10.95. 256 pages, 22 maps, 12 photos.

David Downing has done a study of the Second World War which examines nine major European compaigns as seen by the German generals who exercised the greatest influence on their planning, direction and outcome.

Foremost among the generals mentioned is Heinz Guderian, the man who forged the *panzer* forces and led them through Poland, France and Russia. Rommel, the former commander of Hitler's bodyguard, later won laurels in North Africa and ended his career trying to defeat the Allies in Normandy.

These generals, and others, are seen fighting several battles at once: the battle against the slow, relentless Soviet tide; the battle against the overwhelming weight of British and American airpower and resources in the West, and the battle against their own leader, Hitler.

The study shows that the general's strengths became their weaknesses. *The Devil's Virtuosos* may be considered a concise, worthwhile contribution to the subject of the German viewpoint of World War II.

WILLIAM BROOKS
NCARNG
Wilmington, NC

U.S POLICY AND LOW-INTENSITY CONFLICT, edited by Sam C. Sarkesian and William L. Scully, Transaction Books, Rutgers—The State University. New Brunswick, NJ. 1981 221 pages.

This book is a compendium of papers, in 7 chapters, which were presented at a Loyola University workshop in November, 1979. The essays are informative, well-written, and cover many subjects: political-military considerations, constraints and limitations in the employment of force, US capabilities for military intervention, lessons of modern history, and the Soviet and U.S. responses to low-intensity conflict.

Although a number of issues can provoke debate and disagreement, the importance of this book lies in the fact that the U.S. must be prepared to respond to such conflicts. This is a timely book for policymakers, the military professional and the serious student of national security.

JAMES B. MOTLEY
Colonel, Infantry
Washington, D.C.

ON THE BANKS OF THE SUEZ by Avraham Adan. Presidio Press, Novata, CA. 980. $16.95.

Avraham (Bren) Adan begins this account of the Yom Kippur War by describing the urgent telephone call summoning him to war. Yet, his perspective as a veteran of Israel's five wars, as the general officer commanding the Armored Corps until October 1973, and as the commander of a reserve armored division that participated in the most famous engagements in the Sinai, give this book a unique and valuable place among the many volumes of books to emerge from the Yom Kippur War.

On the Banks of the Suez is a fast-paced account of a division commander's operational view of the war, as well as an informative glimpse into the workings of the Israeli Defense Forces (IDF).

General Adan's stated purpose is to illustrate the success of Israeli soldiers despite the strategic surprise which they suffered at the hands of the Syrians and Egyptians.

The chronological, first-person, format effectively places the reader right in Adan's command Zelda (the Israeli name for M113 APCs) monitoring radio communications, or looking over his shoulder as he participates in crucial commander's conferences. Adan uses radio message records, unit war logs, after-action reports, IDF historical studies, and even captured Egyptian documents to substantiate his writing. Adan makes critical, subjective judgments of other leaders of the IDF including Generals Ariel Sharon, Shmuel Gonen, Israel Tal, and the late Moshe Dayan who was Defense Minister at the time of the war.

Adan's accounts of engagements in the Sinai are specific reference sources for students of the 1973 War, as well as for students of mobile warfare and tactics. He details the 8 October battle during which his advance met determined Egyptian resistance and devastating *Sagger* fire. At the end of the day, his division barely held a forty kilometer line against three Egyptian infantry divisions. This engagement was the first large-scale demonstration of the effectiveness of Egyptian infantry armed with antitank guided missiles. It is also considered one of the most grievous defeats suffered by the IDF Armored Corps.

Adan's division rebuilt its strength, adapted its tactics, and tenaciously fought on until 17 October when it performed one of the most spectacular feats of modern armored warfare. Adan describes the Um Kishuf "war council in the dunes" where the final decision was made for him to exploit the crossing of the Suez later that evening. At 1445 hours, the division conducted a highly successful ambush of an Egyptian armored brigade in what Trevor N. Dupuy has termed a "modern Lake Trasimene." After breaking off the pursuit of the few survivors, Adan's division executed a partial replenishment and rapidly displaced to cross the Suez under the cover of darkness.

The lessons of the Yom Kippur War, and their implications for military doctrine, are of widely recognized importance. Avraham Adan's book affords yet another opportunity to identify and analyze those lessons.

ALLEN GOSHI
Lieutenant, Armor
Fort Knox, KY

PATTON'S GAP, by Maj. Gen. Richard Rohmer. Beaufort Books, N.Y. 1981. 240 pages. $14.95.

The author served as a fighter-recce pilot with the RCAF in World War II. As such, he flew numerous missions over "Patton's Gap," the Falaise Gap, through which some 250 thousand Germans escaped following the Normandy landings. This escape has been judged by allied and enemy analyists as the one single factor that prolonged the war in Europe as much as a year.

Purpose of the book is to lay out the key elements that caused the Allies to leave the gap open and to assign the responsibility for leaving it open when it was apparent that it could have been closed.

The book is easy reading.

PHILIP C. GUTZMAN
Major, Armor
Fort Hood, TX

STEEL ON TARGET

The theme of the 1982 Armor Conference, "The Armor Force — Teamwork in Action," calls to mind the vital role that esprit de corps and cohesion plays in winning any contest, especially on the battlefield. A camaraderie based on shared values and a common purpose is the basic ingredient around which a winning team is always formed.

The United States Armor Association, founded 97 years ago by a concerned group of Cavalry officers was dedicated to promoting not only improvements in the technical and tactical applications of mobile warfare, but also to fostering the spirit and dedication needed to win on the battlefield.

Unfortunately, not all of the players on the Armor Team participate in their association. Current statistics show that only 37 percent of the 5,798 members are active Armor officers. Those officers comprise only 35 percent of the active Armor officer strength. While membership is open to, and encouraged for enlisted men and noncommissioned officers, only 141 Armor NCOs enjoy the benefits of membership. In short, the "controlling stock" of the association is held by reservists, veterans, and members of other branches and services. Yet, the active Armor professional should obtain the most value from membership.

The value of membership in a professional association is shown by the emphasis it receives in the medical, legal, and educational professions. Membership in these associations is considered career-enhancing through the continuing education derived from reading the associations' professional journals and through the intellectual stimulation derived from the free exchange of professional thoughts at local chapter seminars and other activities, as well as attendance at the associations' annual conventions.

Similarly, the United States Armor Association offers Armor professionals the opportunity to enhance their professional knowledge through a personal subscription to Armor Magazine, and to derive intellectual stimulation through participation in the professional activities of local chapters. The Association's annual meeting held in conjunction with the Armor Conference at Fort Knox, Kentucky, provides members the opportunity to exchange professional thought, on an informal basis, with those members who are making decisions affecting the future of the Armor Force.

Individual membership, participation in local chapter activities, and attendance at the Armor Conference and Annual Meeting provide the Armor professional a broader perspective on esprit de corps and cohesion, for each of these forums brings together the total Armor Team, active, reserve, and retired. Through the efforts of each, and the exchange of professional thoughts, the future of the Armor Force is assured.

Good Shooting!

6th Armored Cavalry

(The Fighting Sixth)

Lineage and Honors

Constituted 5 May 1861 in the Regular Army as 3d Cavalry. Organized 18 June 1861 at Pittsburgh, Pennsylvania. Redesignated 3 August 1861 as 6th Cavalry. Assigned to 3d Cavalry Division 15 August 1927—1 December 1939. Reorganized and redesignated 21 July 1942 as 6th Cavalry, Mechanized.

Regiment broken up 1 January 1944 and elements reorganized and redesignated as Headquarters and Headquarters Troop, 6th Cavalry Group, Mechanized, and 6th and 28th Cavalry Reconnaissance Squadrons, Mechanized. These units converted and redesignated 1 May 1946 as Headquarters and Headquarters Troop, 6th Constabulary Regiment, and 6th and 28th Constabulary Squadrons, respectively. These units converted and redesignated by elements 20 December 1948 as elements of the 6th Armored Cavalry (Headquarters and Headquarters and Service Troop, 6th Constabulary Regiment, as Headquarters and Headquarters Company, 6th Armored Cavalry). (Battalions and companies redesignated 24 June 1960 as squadrons and troops.)

Inactivated 24 October 1963 at Fort Knox, Kentucky. Activated 23 March 1967 at Fort George G. Meade, Maryland.

Campaign Participation Credit

Civil War
- Peninsula
- Antietam
- Fredericksburg
- Chancellorsville
- Gettysburg
- Wilderness
- Spotsylvania
- Cold Harbor
- Petersburg
- Shenandoah
- Appomattox
- Virginia 1862
- Virginia 1863
- Virginia 1864
- Virginia 1865
- Maryland 1863

Indian Wars
- Comanches
- Apaches
- Pine Ridge
- Texas 1874
- Oklahoma 1874
- Arizona 1876
- Arizona 1881
- Arizona 1882
- New Mexico 1882
- Colorado 1884

War With Spain
- Santiago

China Relief Expedition
- Without inscription

Philippine Insurrection
- Without inscription

Mexican Expedition
- Mexico 1916—1917

World War I
- Without inscription

World War II
- Normandy
- Northern France
- Rhineland
- Ardennes-Alsace
- Central Europe

Troops additionally entitled to Campaign Participation Credit

Troop G:
Indian Wars
- Texas 1867

Troop K:
Indian Wars
- Arizona 1877

War With Spain
- Puerto Rico

Company M:
China Relief Expedition
- Peking

Decorations

Presidential Unit Citation (Army), Streamer embroidered *Harlange Pocket* (6th Cavalry Group cited; WD GO 40, 1946)

Symbolism

The regiment took part in the eastern campaigns of the Civil War, its outstanding feats being at Williamsburg, Virginia, 1862, when it assaulted intrenched works, and at Fairfield, Pennsylvania, 1863. At Fairfield the unit engaged two enemy brigades of cavalry, completely neutralizing them and saving the supply trains of the Army, but in the process was literally cut to pieces. This is symbolized by the unicorn, held to represent the knightly virtues and, in the rampant position, a symbol of fighting aggressiveness, combined with speed and activity. The shield is blue, the color of the Federal uniform in the Civil War. The Chinese dragon represents the regiment's entrance into the Forbidden City in Peking in 1900. The arrows symbolize service in the Indian Wars.

Distinctive Insignia

The distinctive insignia is the shield of the coat of arms.

Motto

Ducit Amor Patriae (Led by Love of Country)

ARMOR

The Magazine of Mobile Warfare

July-August 1982

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 1982 Vol XCI, No. 4

FEATURES

DEPARTMENTS

COVER

Armor combat techniques in built-up areas are discussed by Lieutenant Colonel Esposito on page 34. The interdependencies of armor and infantry are explained and workable solutions presented.

LETTERS

Due to constantly increasing printing, distribution, and materiel costs, it has become necessary to raise the annual Armor Association membership and subscription price of *ARMOR* magazine to the following levels:

$12.00—1 year
$21.00—2 years
$30.00—3 years

The increase will become effective on 1 September, 1982.

Reservist Speaks Up

Dear Sir:

Major King's letter in the March-April 1982 issue of *ARMOR* voiced a concern that I have had which was reinforced at the recent Armor Conference. Major King expressed the thought that "higher headquarters doesn't really understand who makes up the Total Armor Force."

At the Armor Conference, much was said about new equipment for the Army to support new doctrines for the year 2000. We were also told that armor crewmen and officers attending the Basic Course were trained on *M60A1, M60A3* or *M1* tanks, depending on their unit assignment. With the Reserve Components being equipped with *M48A5s* and *M60s*, that means that our recruits and junior officers are not being trained on the equipment they will use—and the Reserve Components account for approximately 40 percent of the armor in the "Total Army."

Based on my experience of more than 20 years in the National Guard, when the Active Forces are equipped with a follow-on tank to the *M1* to fight on the battlefield of the year 2000, the reservists may be issued the *M60A3*—if our allies don't need them first.

Hopefully, something different will be done, but I cannot generate a whole lot of enthusiasm for the "One Army Concept" based on its history.

CLARENCE L. BECKHAM, JR.
Lieutenant Colonel, Armor
MSARNG

More From Reserves

Dear Sir:

Permit me to also decry the Skipper-Kerr article, "The Reserve Component Armor Force," in the November-December 1981 *ARMOR* and echo the sentiments of Major Marc King, RR IX, voiced in his letter in the March-April 1982 *ARMOR* entitled "The Forgotten Men." In addition to being "forgotten" it *is* totally regrettable that the counterfire had to come from an AC type and not from one of the aggrieved. However, we of the "forgotten" have, for so long and in so many ways, been barely tolerated stepchildren that any amount of favorable recognition is graciously received since the wearing of hair shirts and littering the battlefield with expended sack cloth and ashes is a favorite pastime at Fiddler's Green among Armor and Cavalry part-timers. Hopefully, your in-basket was filled with a multitude of anguish from the RC arena and the volume so overwhelming that space did not permit publication. In any event, I suspect Majors Skipper and Kerr will not soon forget the potential impact of operative words such as "TOTAL" when in the future they attempt to put type on paper.

Having said all that, let me now move above the "alligator line" and pay some small homage to those "Combat Multipliers" who so selflessly ply their trade by sharing their expertise among the RC Armor and Cavalry community. True, it is their assigned mission, but our Advisors and Assistors from the Readiness Groups and Regions have demonstrated an outstanding ability and dedication to serving our mission of attaining and sustaining the maximum degree of combat readiness. The Marc Kings in our world frequently represent the "total" difference between a successful and a deplorable readiness status, and they are to be congratulated for their effort. Unfortunately, we in the RC do not always effectively employ their talents or recognize with any sufficiency what they can and will contribute . . . , but it is high time that we did! A tip of the worn and dusty Stetson to them all!

H. S. ROBISON
Lieutenant Colonel, Armor
INARNG

T-72; T-64 Clarification

Dear Sir:

I am writing this letter to emphasize a very important point made in the very significant article "Soviet Armor—Past and Present" which appeared in the July-August 1981 issue of *ARMOR*. This point concerns the role of the "new" Soviet T-64 main battle tank within the overall Soviet tank plan.

Ever since the T-72 was first shown to the public in Red Square on November 7, 1977, there has been a varying degree of confusion concerning this tank and one which had first appeared a short time earlier. This older tank finally became known as the T-64 and has been surrounded by controversy ever since. Western experts were suddenly faced with a problem; they had been following the development of a "new" Soviet tank, which differed from the T-72 paraded in Red Square.

The point made by Mr. Burniece and Mr. Hoven in their article is that the T-64 is the new Soviet tank. This idea, while obviously not universally accepted, is clearly the correct one. The evidence of this can be summarized as follows: (1) The T-64 is apparently not exported to any other country regardless of how close that country is to Moscow; (2) the T-64 is currently deployed in the Group of Soviet Forces-Germany (GSFG); (3) the T-64 has never been shown to the public, or put on parade (which goes along with the policy of not parading the best equipment available, since it is not for sale). This last fact is important when it is remembered that the Soviets have not only paraded the first version of the T-72 in 1977, but they have also shown the newest version of the T-72 with forward-firing smoke grenade launchers, track skirting, etc. . . in 1981. Mr. Burniece's and Mr. Hoven's point is well taken.

Finally, in reference to my letter in the January-February 1982 issue of *ARMOR*, the sentence: "Could the T-72 (and T-62, for that matter) be fitted with still a different type of armor?", the designation T-64 should have been used instead of T-62.

JAMES M. WARFORD
1st Lieutenant, Armor
HHC, 2-81 Armor

Comments On An Issue

Dear Sir:

This issue (January-February 1982) was very good.

I am all for an armor badge. An expert tanker badge would be a mark of distinction that would separate the best tankers from the good ones.

Why not have a cavalry scout badge as well...

My only complaint about the CFV is that its 25-mm gun is not heavy enough. The Germans put a 20-mm gun on their armored cars and had to add a *Pak40* antitank gun later. The 25-mm can kill BDRMs and other lightly-armored vehicles, but what if you run into an MBT and your *TOW* tube is empty? A heavier CFV gun would also be useful in fire and maneuver tactics...

As for adiabatic engines, that would make obsolete the present type of engines. They would be more efficient, use fewer parts and be easier to supply and maintain...

As for dimensions of mobility, it pays to keep your tail as fast and light as possible. This is especially true where there are poor roads and light-weight bridges. Tracked supply vehicles are the answer here.

Also, the Russians are more solidly bound to their command and control systems than we are. By shooting up the battalion and brigade commander's tanks, you'll ruin their communications and have a better chance of beating him...There is nothing new about 'deep attack.' It is nothing more than a tank raid: You go in deep, shoot up his support elements, and get out...

The *M1 Abrams* tank should be the 'best tank in the world,' because the Army doesn't buy junk. A British sergeant once described the *M3* light tank as a "honey." I think that fits the *M1* as well. How many other tanks do you know that are faster cross-country than any other tank in the world is on the road? None...

Colonel Boudinot forgot to mention that the weight of a vehicle is distributed over a much larger area more evenly when that vehicle is tracked...You need studded tires on wheeled vehicles to help in climbing. Wheeled combat vehicles are best suited to roads or hard terrain...

Quality is no substitute for quantity, as the Germans learned. Their Panther tank was a highly-sophisticated (for the day) tank compared to the Soviet T34. But the Russians had masses of T34s, and the German didn't have very many Panthers. The Panther could outshoot the T34, but there were ten more T34s coming along when you shot the first one...

MICHAEL MOSKOWITZ
Philadelphia, PA

Time Is Of The Essence

Dear Sir:

"Dimensions of Mobility" by Colonel O'Meara in the January-February, '82 *ARMOR* Magazine is of primary importance to every person in the Army from the private to the general.

It is not just another article in *Armor*—it is knowledge! It stresses one of the most important facets of any leader's job—time management. Everything takes time to do, and too many of our present day leaders simply don't take time into account when they plan.

Time could well be the difference between victory and defeat in the next war. Time to plan an operation; time to execute the operation; time to plan for follow-up operations. We, as leaders, should train our troops to know and appreciate the tremendous impact that time will have on our present training and on our future operations.

There are at least 10 paragraphs in the article that deal responsibly with the *time* factor. They should be reread by everybody in a leadership capacity.

Colonel O'Meara is to be congratulated for writing such a timely and worthwhile article.

OSCAR COLBERT
Staff Sergeant, Recruiting
Antioch, GA

Battalion XO as HHC Commander

Dear Sir:

After reading Major Boyd's article "The Executive Officer as Commander," in the January-February issue of *ARMOR*, I wish to add my opinions concerning the command of the HHC in an armor or infantry battalion.

Having just finished 18 months in command of an HHC in a mechanized infantry battalion in Europe, I know at first hand the responsibility of being the commander and not having the clear advantage of being the ultimate authority in the company.

At best, HHC command can be described as guiding a rope from the middle.

I agree that the unit can best be commanded by the battalion XO. Why? Because all of the assigned officers in an HHC (except the commander) work for and are rated by the battalion XO. By aligning authority with responsibility, a better focal point for leadership can be established for the company, especially for the NCO's who are responsible for both mission as assigned by their staff officers and soldier leadership as assigned to them by the company 1SG.

Until the DA changes the TOE of the armor and infantry battalion to having the battalion XO commanding the HHC, I recommend that HHC commanders seek and gain the support of the battalion XO to facilitate the operation of the HHC. It would be ideal for both officers to develop jointly the 30-, 60- and 90-day training plan for the company, thus insuring accomplishment of the daily missions without wasting the soldier's time.

My past experience has shown that an armor or infantry battalion is no stronger than the HHC, and with a coordinated, trained and disciplined HHC, a battalion will repeatedly attain a much higher level of mission accomplishment.

STEPHEN A. BRASIER
Captain, Infantry
Fort Benning, GA

Recon Revamp

Dear Sir:

Captain Mitchell's article "Reconnaissance Revisited" presented an excellent suggestion in the proposal to form a brigade reconnaissance company, one long overdue. The brigade commander needs his own "eyes and ears" unit to provide a continuous "feel" for the battlefield, particularly with the rapid changes that alter the brigade's task force structure so frequently. Such missions as passage of lines, screening brigade flank(s) and protecting the brigade rear area could be more effectively accomplished by this company, leaving battalion scout platoons for other missions.

Some of the details the article presents, however, will create problems, two of which are discussed below:

First, while the combat organization for the recon company is good, the support answer is not. A brigade headquarters company is simply not equipped to support another company's operations, even with the article's proposed personnel additions. The maintenance requirements for the current USAREUR *M113A1/M901* vehicle mix are demanding and require the full complement of tracked vehicle and *turret* mechanics and supervisors, and I don't see the CFV easing those requirements (to say the least).

To refuel, rearm, feed, and maintain this company would be a tough job for a company support element dedicated to that unit; for one that also has to support a brigade TOC, TAC, and trains, it would be impossible. Ask any CSC 1SG how tough it is to look after his single scout platoon, and then imagine three of them scattered throughout the brigade area. The lack of a company executive officer also would be sorely felt for the same reasons, and then some. The XO performs a myriad of tasks, freeing the commander to command his unit, as well as being ready to take the CO's place immediately and effectively upon his loss.

The second problem is the proposed source for this company—the consolidation of the battalions' scout platoons; robbing Peter to pay Paul is not the answer. The battalion/task force commander desperately needs that platoon for his own recon and security purposes. Indeed, a much better case can be made for adding a second scout platoon than for tasking the existing one away. The attached mechanized infantry company is there to fight, and all the teams need that infantry platoon with them (there is never enough infantry).

Captain Mitchell's basic proposal is an effective answer to a real requirement. The idea needs to be followed through to the logical conclusion—put a brigade recon company together from scratch, complete with its own support asset, without taking away other units' critical assets.

Captain Matheny's "Professional Thoughts" on cross attachment also caught my eye. As a student in the last AOAC Military history class he taught, I can personally attest to his tremendous talents on the forum, and from reading his article, his tactical thinking seems equally superb.

MARK C. THOMSON
Captain, Armor
Co C, 1-35 Armor

The Last Word

Dear Sir:

I was delighted to see that Messrs. Burniece and Hoven have replied to my letter and to that of Captain Halbert.

I will confine my comments on their reply to a single point—that of the so-called *T-34* light tank and the re-use of a "T" number. The vehicle in question did exist and was photographed in the company of an *SU-76M* light, self-propelled gun, but was actually observed on only one or two occasions. No further information on it ever was obtained. From all appearances, it seemed to have been a training device rather than a production or prototype tank. To the best of my knowledge, there have been no references to it in Soviet documents or literature or in reliable non-Soviet East European publications. The nomenclature "T-34 light tank" seems to have been used first by John Milsom in his book on Soviet armor and since gained currency in other publications. There is no foundation for this nomenclature since not a shred of evidence exists. To this day the so-called "T-34 light tank" remains one of the minor mysteries in the history of Soviet armor. Until firm evidence becomes available, however, it should be removed from the main stream and quietly placed in a footnote filled with question marks.

DR. ARTHUR G. VOLZ
Charlottsville, VA

Liked Diagnostic/ Maintenance Articles

Dear Sir:

The article on the Future of Diagnostics and the one on Division 86 Maintenance Platoon were excellent. (January-February, 1982 ARMOR).

As I originally started as a tank maintenance officer, both articles struck home. They brought up some of the problems and what is being done about them. They also pointed out how far we have come from the 60's.

We had a nightmare with regard to repair parts. As a result of WWII procurement systems, the same part had either an Ordnance part number or a Navy part number, or an Air Force part number. You could request a part by Ordnance number and be told there were none in stock while there were 100 with Navy or Air Force numbers. We had tons of cross-reference books to check numbers against parts.

I once had a class of 88 officers, all lieutenants and one major from Libya who had fought against Rommel. After a 4-hour block of instruction on maintenance in the desert he was asked for his opinions and comments. He said it was hot, dusty and maintenance was a real problem. Now, 40 years later, has anything really changed?

I read John Dwyer's letter on Vietnam, and I agree that there is much to be learned from Vietnam, but I suspect that it is a subject that will have to take a few more years before it can be discussed objectively.

WILLIAM L. HOWARD
Major, Armor
USAR

Thoughts On "Continuous Operations"

Dear Sir:

I thought that Captain Frank's article was probably the most important in the March-April issue of ARMOR magazine. ("Continuous Operations). Few, except tankers who have been in battle, really understand the result of fatigue in continuous battle.

When (General) Montgomery took over the 1st and 9th Armies during the "Bulge" from General Bradley, he was reputed to have said: "There comes a time in any battle when you should take time out to tidy up the battlefield. " This lead to an improvement in readiness and in morale. By the end of the week, we had won the battle and Hitler's headquarters was so notified on 24 December, 1944.

When General Chaffee created the armored force and the armored divisions, he directed that there be two combat commands and a reserve command. The combat battalions were to be rotated through the combat commands and the reserve command, on about a 2 or 3 to-1 day basis, so each few days each combat battalion would have a day to maintain and "let down" and be ready to go again.

The 4th Armored Division followed this concept in training and in operations. I believe its greatness was in a very large measure due to this concept.

On November 1, 1944, I was sent to another armored division that had been organized on activation into three equal commands; "A", "B", and "R". Battalions were never rotated and the division commander was reduced and sent home. General Hasbrouck immediately eased that rigid organization.

Starting on the evening of 16 December, the 7th Armored Division was either marching or fighting day and night until noon on the 23d. In this 7-day period. nobody from the combat commander on down had any time to relax, bathe, or sleep. The tankers reloaded, refueled, and maintained in darkness and in rain and mud. At the end of that period, all who were not casualties were hardly fit to function as effective combat troops.

This situation could be worse if the Russians attack NATO. Our divisions are now organized and are considered ready to be employed in three equal brigades—probably constantly.

Will the armored and mechanized divisions be able to fight effectively by the end of ten days? It could well be looked into. There may be a lot of fighting to do after the first couple of weeks.

BRUCE C. CLARKE
General, USA (Ret)
McLean, VA

A Major Rebuts

Dear Sir:

A word on the Professional Thoughts piece by Staff Sergeant Bunce, "NCO Responsibilities" in the March-April issue of ARMOR.

In the old *M114/M551* organization, the scout section sergeant was responsible for himself and *two* men *(M114)*, the tank commander for himself and three men (*M551/M60*). With the *M3*, the same scout section sergeant is now responsible for himself and *four* men.

It is true that a lieutenant was added to lead the tank platoon (formerly a tank section), but it should be noted that a platoon sergeant was added to the scout platoon (formerly a scout section), helping to increase the leader-to-led ratio at *platoon* level. It should also be clear that NCO responsibilities are increased, not decreased, at the squad/section level with each *M8* having a five-man crew vice the *M114 M113* three-man crews.

MARC A. KING
Major, Armor
Fort Lewis, WA

More On XO As Commander

Dear Sir:

"The Executive Officer as Commander," by Major David G. Boyd in the January-February, 1982 issue of ARMOR gave me an acute attack of *deja vu*. In the early fifties, commanding the headquarters and service company of a tank battalion in Germany, and later commanding the headquarters company of a combat command (brigade) in an armored division, I found myself often caught up in the conflict of interests that are inherent in the "staff officer vs headshop CO" relationship. As a battalion communications officer, I savored the other side of the same bouquet.

I believe that Major Boyd has presented a well thought out, practical suggestion to remedy what I perceive to be a problem of organizational efficiency. Implementation of his suggestion would increase unity of command at the headquarters staff level, eliminate a friction point in the chain of command, and contribute generally to the effectiveness of armor units, in my opinion.

JAMES C. MCBRIDE
Colonel, Armor
USAR

New Subscriber Speaks Out

Dear Sir:

I have just received my second issue of *ARMOR* magazine and I am extremely pleased. I especially enjoyed the articles on armor aviation, German tank gunnery, and the British tank, the Challenger. More articles like these would be welcomed. I would also like to see historical articles. Judging from the comments and letters concerning the Bastogne article in the November-December 1981 issue, I would conclude that others might share this desire. I deeply regret that I was not yet a subscriber when that issue appeared. It must have been exceptional. Also, is there any possibility of the magazine exploring trends and developments in Armor in other countries such as Israel, France, Sweden and, of course, Russia?

GARY E. COBURN
Westerville, OH

An article on Swedish armor by Brigadier Richard Simpkin appears in this issue and an article on French Armor is scheduled for September-October. Articles on armored vehicles of other countries will be published as information becomes available. Ed.

Equation Equated

Dear Sir:

The equation on page 22 of the May-June 1982 issue of *ARMOR* is incorrect. The correct equation is as follows:

$$ES_r = 100 \left\{1 - \left[\left(\frac{100\text{-}ZV_1}{100}\right)\left(\frac{100\text{-}ZV_2}{100}\right)\right]\right\}$$

DAVID C. HOLLIDAY
Fort Knox, KY

The Closing Argument

(In reply to Mr. Zaloga's letter in the May-June 1982 issue, Mr. Smith has the following comments. Ed.)

Dear Sir:

. . . I state specifically that ". . . you need a lie detector to go through any Soviet history . . ." Perhaps Mr. Zaloga misunderstood that this means that one must use one's sources carefully?

I further state that the tendency to ". . . rely more and more exclusively on the German accounts . . . is equally fraught with problems . . ." Again, Mr. Zaloga apparently fails to understand that this statement also states that critical use of any source material is necessary, especially when dealing with as emotion-fraught a situation as the War in the East.

Mr. Zaloga states that ". . . Soviet military history is frequently of shoddy quality . . ." and goes on to mention the numerous useful histories of various Soviet units (that apparently he has access to), yet gives John Erickson's work as an example of such material. I personally possess over 450 Soviet histories of the Great Patriotic War, as well as numerous microfilmed materials on the subject, and have found that none could be used without the "lie detector" test above. Let me quote Earl Ziemke, author of the U. S. Army's official history of the Soviet Counterattacks, *Stalingrad to Berlin*, when he wrote his bibliographic notes sometime in 1968(?) ". . . virtually no significant Soviet documents relating to military operations in World War II have been made available . . ."

The comment that "Mr. Smith does not even seem to have his basic geography straight," seems to be Mr. Zaloga's tendency to alter the printed word. I specifically state that the German force was deployed on the west bank of the Oder, . . . not the east bank as Mr. Zaloga states.

Insofar as the question of the importance of this battle is concerned, I find that Generaloberst Halder and the Chief of the U. S. Army's Military History program agreed with me, including it in the description of Small Unit Actions On the Eastern Front.

As for the balance of the comments on the conduct of the battle, the material was extracted from the diary of a man serving in the area adjacent to the Kustrin battlefield who personally inspected the battlefield shortly after the action and talked with the participants. I further stand by my contentions as to the area over which the battle was fought, based on photographs of the battle scene provided by the above source, and German Army situation maps of the period just 24 hours before the battle.

ROBERT C. SMITH
Merchantville, NJ

Battlefield Resupply

Dear Sir:

Throughout military history, the high consumers have imposed heavy burdens upon the supply systems. Like today, the supply system has usually found itself lagging (behind) consumption demands.

Those of us who struggled with the problem liked the rugged jerry cans, then the "milker" type gas trucks and, finally, more and bigger trucks that eased the problem. What we liked best was the change from gasoline to diesel for our tanks.

We started out with a tank that got about 2 miles per gallon, and by the middle of the 1950s, we had progressed to a tank that got about ¼ of a mile to the gallon. Then along came diesels, and our consumption of fuel improved to about a mile per gallon.

One can appreciate that a swing in consumption made possible by diesel engines made a dramatic change, improving our capability to keep our tanks running. Today, with a tank that consumes at the level of about 4 gallons per mile, the resupply problem shapes up like the one we had with our *M47s* and *M48s*.

Getting back . . . by the early 1960s we had diesel-powered tanks and 1,200 gallon and 5,000 gallon tanker trucks and a poor logistics organization. The 3d Armored Division, SPEARHEAD, changed division logistics by establishing the Forward Area Support Team (FAST), the General Area Support Team (GAST), and Division Trains HQ as the Division Support Command (DISCOM) as it is known today. Within a year, our sister division, the 8th Infantry Division, adopted the organization.

The concept was a task organization of tailored FASTS for leading brigades. The remainder of the division was supported by the deployed elements of the GAST. Trains headquarters called the shots and the commanders of the FASTs and the GAST did the work. We crossed traditional lines; for example, the XO of the Medical Battalion commanded FAST 1 and performed like a veteran. Cooperation and enthusiasm was outstanding; a major constructive factor.

The operational concept, also important, was that we would "sell" fuel and other supplies to the brigades and other high consumers. The planners within Division Trains HQ kept rolling estimates of consumption requirements which were based many times upon best guesses as to what the division task organization would be for the missions ahead. The first big trial was the Seventh Army maneuver of 1963. The "Spearhead" Division, as the aggressor, moved, shifted, and counterattacked, but never ran dry.

We used the large pump-operated rubber bladder storage tanks to keep large amounts of fuel well forward within or close to the brigade trains areas. Safety was a concern, but was offset by using bulldozers to dig in our fuel sites. FAST and fuel points were kept under Division control. The FAST commander was the salesman and the data collector, feeding back planning-essential information. The operation was primarily a night one and geared to lead times of 12 hours, preferably 24 hours, ahead of demands. The location of rubber storage tanks had the prominence to Division Trains that tankcompanies had to a brigade commander. Perhaps the reader can appreciate the hyper activity that came with a major change of direction. At the end of the maneuver, we had great amounts of gasoline and diesel fuel on the ground, but in sum it was close to what the Division needed to roll home. This, too, had been anticipated by our fuel team.

During the exercise, ammunition resupply was seriously considered, but amounted to little more than a paper exercise by our ammunition team. It assured that ammunition trucks were not used to haul fuel. At a later time, Spearhead conducted a CPX to war game the ammunition problem. We based it on our GAO and a scenario built upon our estimates of Soviet capabilities and most likely plans. The war game aimed at maximum use of transport available to haul ammunition. This permitted the use of flat-beds and tank transporters to mobilize ammunition supply points which would orient upon the operation of high consumers. The ammunition team in Division Trains HQ used the tested procedures of the fuel team. They performed well.

Division 86 could be described as a logistician's nightmare, or logistically impossible. Perhaps it will be neither if our fighting commanders accept logistics as a principle of war as did General R. E. Lee, and if our logisticians accept his other two: (1) intelligence (knowing) and (2) concentration (getting the right things, in the right amount, to the right place, at the right time.)

Perhaps the best first step is to minimize handling by developing special loaders and transporters. In the longer term, we should strive for "no hands" resupply of fuel and ammunition forward of the Division rear boundary.

Logistics has always been a decisive factor. A commander's best logistician is himself. It is time for us to accept logistics as the tenth, but most influential, principle of war. This is the message I read when mentally deploying Division 86 in the Hessian Corridor.

CHARLES A. HENNE
Colonel, Armor
USA, Retired

COMMANDER'S HATCH

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

Junior Officers Maintenance Course

Army Regulation 750-1 *Army Materiel Maintenance Policies and Procedures* requires that there be a "qualified maintenance officer at each level of command". The Junior Officer Maintenance Course (JOMC) will graduate approximately 830 officers in FY 82, each of them trained to be an organizational maintenance manager. The course is branch immaterial and is for company grade officers of the United States Army, United States Marine Corps and officers of allied nations. Allocations for the course would normally be procured through branch personnel management sections. Every two weeks another 36 students begin a new JOMC class.

The course itself consists of seven weeks of resident instruction covering software and hardware oriented toward organizational maintenance skills as well as vehicle operations and recovery. Under the heading software skills, students are taught The Army Maintenance Management System (TAMMS) and Repair Parts Supply. Though the material in these areas is intensive, the goal is not to turn the officers into clerks, but rather to give them some appreciation for how the systems are supposed to function so that they can manage and evaluate their own unit's operation. Ten course hours are spent discussing the development of an organizational maintenance program. Since the Army has no standardized organizational maintenance program, this class serves to enable the JOMC graduate to tailor a program to meet the peculiar needs of his or her unit. Many more class hours are spent destroying the "Jungle Rules" that most students bring from the field to the course. Students are typically surprised to learn that such faults as headlights, brakelights and horns have little or no effect on equipment operational status and are not reasons for equipment being carried not mission capable. This reorganization of thinking takes time, but the result is a graduate who understands the Army materiel reporting system and can assist the field commander in rendering accurate reports.

During the management portion, students are brought up to date on current Army and DOD maintenance trends. This "Big Picture" approach is added to the instruction on forms and procedures with an eye toward not only promoting understanding of how to do something, but also why and "what happens, if . . . ?".

Just over four weeks of the course are spent learning the hardware associated with organizational maintenance. The student begins by learning the theory and how the various test equipment works. During this time, the care and use of hand tools and calibration procedures are also taught.

Following the theory classes, students are placed into groups of six and rotated through six engine bays where actual tank, personnel carrier, and truck engines have been set up to allow maximum visibility and participation. In these bays, the student encounters the engines for the *M60A1* RISE, *M113A1, M809, M35A2, M151A1, M151A2* and the *M880* vehicles. Not only does each student become familiar with the various engine configurations common to Army equipment, but also he or she is exposed to numerous fault isolation tasks. There is a lot of interaction between instructor and student to see who can outwit whom. These tasks, repeated six times, turn the often-dreaded job of troubleshooting into a routine process which gives the student confidence in his or her abilities. Wiring diagrams no longer appear as meaningless spaghetti, but as logical and routine procedures to the person who has been "through the bays".

Following the theory and troubleshooting tasks, the JOMC students are formed into yet another team to perform a semiannual service on a wheeled vehicle and a quarterly service on a tracked vehicle. The students choose which vehicles they will service for both the wheeled and tracked portions. On the menu for wheeled vehicles are the *M809* 5-ton truck, the *M35A2* 2½-ton truck the *M561* 1¼-ton truck and the *M151A1* ¼ ton truck. The JOMC is currently in the process of acquiring a 900-series 5-ton truck for future classes. For tracked vehicle services, the students are offered a choice of an *M60A1* tank, an *M109A1* howitzer or an *M113A1* personnel carrier. In the past, training vehicles had been used for these services, but today most of the vehicles come from actual unit motor pools. This, of course, adds realism to the instruction, as nothing can compare to real problems induced by actual operation. Approximately one week is spent on each type of service, and no matter what the inclination of the student may have been at the start of the course, by this time all hands are dirty.

During the hardware portion of the course, the JOMC is taught operational characteristics of the various recovery vehicles in the Army inventory. First, in the classroom, the "textbook" side of recovery including rigging, reduction factors, mechanical advantages, and safety are covered. Next, the class is taken to a place fondly referred to as "Down Below", where they actually apply recovery skills on vehicle hulls and live vehicles. Numerous recovery problems are induced, including wheeled and tracked vehicles mired, nosed and overturned. If the weather has been nice and the ground is dry, water will be trucked in to make the mud that is needed for this exercise. Since the organizational maintenance officer is closest to his equipment, he must be well trained in restoring battlefield mobility, and vehicle recovery plays a large part in achieving that goal.

At the end of the seven week period, some JOMC students will graduate, while others, depending on their branch, will remain and receive turret maintenance instruction. Armor, Ordnance, and Combat Engineer officers attend a 36-hour program on the *M60A1* turret. Officers with specific assignment instructions to *M60A3* units will be instructed on that system instead of the *M60A1*. Field Artillery officers attend a 36-hour program on the *M109A1* turret. In all cases, the turret instruction is self-paced, following an initial turret familiarization. At this point in time, students are well versed in performing troubleshooting procedures and reading wiring diagrams, so the real task is to apply those skills to the turret using the appropriate organizational maintenance manuals. If officers from branches other than those listed have assignments to Armor units, they too, will receive the turret instruction, although it must be noted that orders stating a specific assignment are required.

Graduation from the JOMC awards officers an MOS of 77D Motor Officer. Many graduates return to their field assignments to become organizational maintenance officers. Others, because of their seniority, may never be maintenance officers, but the course stands them in good stead as executive officers and, later, as commanders. The course meets the AR 750-1 requirement of having a qualified maintenance officer at each level of command.

The Junior Officer Maintenance Course produces a maintenance manager capable of establishing and directing a quality organizational maintenance program. Units which are fortunate enough to have one or more graduates of this course (formerly known as the Motor Officer Course) should seriously consider assignments which can benefit from their training. Units needing allocations to the course should contact the branch of the officer being considered.

Junior Officers Maintenance Course

Title	Hours
Logistics and Maintenance Management	
Welcome and Orientation	1
The Army Maintenance System	1
Maintenance Publications	5
Operational Records	3
Maintenance Records	5
Historical Records	4
Materiel Condition Status Report (DA Form 2406)	5
Repair Parts Supply	11
Maintenance Management Retest I	1
Maintenance Records Evaluation	8
Management of Maintenance Resources	3
The Maintenance Program	10
Maintenance Management Retest II	1
Field Exercise for Motor Officers	6
Maintenance Management Evaluation	4
Maintenance Management Retest III	2
Principles of Automotive Engines	3
Principles of Automotive Electricity	3
Test Equipment and Battery Maintenance	6
Calibration Records and Procedures	1
Performance Evaluation Retest	1
Power Plant Troubleshooting	54
Tools and Test Equipment	3
Performance Evaluation Retest	1
Semiannual Services, Wheel Vehicles	36
Quarterly Services, Track Vehicles	36
Auxiliary Equipment	3
Staff and Maintenance Support Activities	2
Ground Mobility Division	
Vehicle Operations	8
Vehicle Recovery	13
Performance Examination	2
Additional Specialized Training	
M60A1 Turret Maintenance	
DA Maintenance Forms, and Unit OJT Programs	2
Turret Familiarization, M60A1	4
Turret Inspection, M60A1	4
Special Tools, Equipment, and Troubleshooting, M60A1	26
Examination, M60A1	4
M60A3 Turret Maintenance	
DA Maintenance Forms, and Unit OJT Programs	2
Turret Familiarization, M60A3	4
Turret Inspection, M60A3	4
Special Tools, Equipment, and Troubleshooting, M60A3	26
Examination, M60A3	4
M109A1 Howitzer SP	
Turret Familiarization, M109A1	6
Turret Inspection, M109A1	8
Special Tools, Equipment, and Troubleshooting, M109A1	20
Examination, M109A1	4

DRIVER'S SEAT

CSM John W. Gillis
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Article 15s: Command Decision

Company Grade Article 15—An "open and shut case." Counseling, extra training, nothing has turned this soldier around. The offense reported has been committed. The company commander reads the Article 15 charge to the soldier and tells him he has 72 hours to see a lawyer. The soldier tells the commander he doesn't need the 72 hours, and states he will accept the Article 15 now. What happens? Ah . . . the "infamous" 72 hours . . . the commander *makes* him take it! It's not mandatory. The soldier doesn't want it.

Why do most commanders force the soldier to take these 72 hours? It's "safer". Get JAG involved. Less chance of "losing".

That's not command; it's closer to mediation. A situation that could have been handled in 30 minutes takes a week or more, involving more time than necessary for all concerned, including the soldier. The positive effect on the discipline of the entire command is lost as justice is not swift. Swift justice may also have made a positive impression on the soldier. This "normal" delay simply discredits the command. The soldier walks away disgruntled, telling his buddies that "they" couldn't even make their minds up on what to do after "I told them I did it!" All that could have been gained *for the command* by handling this type of Article 15 swiftly, as authorized, is lost.

More on Company Grade Article 15's—"SP4 Smith, your punishment is reduction to PFC, a fine of 7 days' pay, 14 days' extra duty, and 14 days' restriction." However, because of your financial situation and being married, I am suspending the reduction and fine for 30 days." This company commander has taken good care of the soldier's family while doing nothing for the Army and/or the discipline of his unit. Maybe the reduction *or* the fine should be suspended due to financial/marital considerations, but the suspension of both makes the soldier a "winner"! Ask his buddies. He has kept his rank, all his money, and due to normal conditions in most units, will "beat" at least part of his extra duty and restriction. Commit an offense and become a "hero" with your peers . . . now that *really* frustrates the unit chain of leadership!

Field Grade Article 15's—Everything stated on Company Grade Article 15's apply.

More on Field Grade Article 15's—"SP4 Smith, your punishment for this offense is a fine of $75 per month for one month." Great! This battalion commander just gave a company-level punishment at Field Grade Article 15 level. That is obviously his prerogative and well within his authority, but there is more to a Field Grade Article 15 than just punishing the offender. How the offender is punished will show support or nonsupport for the company chain of command. A punishment showing nonsupport, or perceived as nonsupport, will frustrate the entire chain of leadership in the company. First of all, the company commander has decided (usually after involving the first sergeant) that SP4 Smith's situation requires resolution at Field Grade level. He is seeking a stiffer punishment in hopes that it will make SP4 Smith "see the light". He is still trying to make SP4 Smith a productive soldier, but all other endeavors (to include Company Grade Article 15's) have failed. He submits his *recommendation* for Field Grade Article 15 in writing, explaining the charge and all other circumstances. He then waits for the battalion commander's first decision; to accept or reject the company commander's recommendation. The battalion commander accepts the recommendation, and SP4 Smith is scheduled to appear before him. SP4 Smith knows he is in real trouble, if for no other reason than knowing the battalion commander can really "sock it to him". (His buddies know this, too.) The company commander, first sergeant, and others involved are satisfied because the "old man" has supported them by acceptance of the recommendation for the Field Grade Article 15.

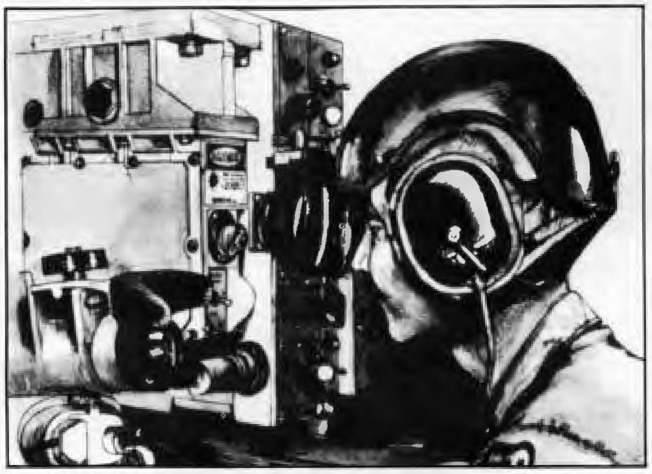
In they all go and out they all come . . . with a company-level punishment. SP4 Smith is a "winner" ("The colonel's easy" . . . "no sweat on field grades" . . . "appeal all your company Article 15's").

I'm not suggesting that all Field Grade Article 15's should result in field-grade punishment. The battalion commander is obligated to make his *own* decision on each individual case, and, above all else, the right to make that decision must be supported by all of us. I would suggest that the battalion commander consider how his support for the chain of command of the companies in his unit will be viewed as the result of his punishment decision. I would also make the point that field-grade punishment, suspended to where the soldier's punishment *may* end up equal or less than company level, is also viewed as nonsupportive by the company chain of leadership.

I have tried to point out, by using the above examples which, in my view are common occurrences, that there is more to an Article 15 than just punishing the offender. The end result should also accomplish what every leader, commissioned or noncommissioned, is responsible for . . . and that is reinforcing the chain of command.

John W. Gillis

MASTER GUNNER'S CORNER



Major Kent J. Jewell
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Idaho Shooting Gallery

When a reserve component tank crew includes travel time to the range, target placement, and firing preparation, the commander is fortunate if his crew gets two hours of actual training time. When you add other real costs such as soaring fuel expenses, range targets destroyed by the weather, and training time lost to vehicle draw and turn-in, then, the practical values of an indoor tank range become attractive.

In 1977, the Idaho Army National Guard tank gunnery committee reviewed the constraints facing tank crews using the post's 250-square-mile desert training facility and asked Gowen Field's combined service and maintenance shop (CSMS) to design an indoor tank range. CSMS inquiries to higher support headquarters to locate 1/60th and 1/35th scale targets were futile, so the shop technicians built six portable, pop-up target sets.

The committee spent the next year securing an abandoned WW II building on post, installing sheets of armor plating on the walls, positioning two *M60* tanks fitted with Brewster mounted subcaliber weapons, adding 1/60th scale model tanks, and installing simulated flare lights and a sophisticated controller's position.

The "Idaho shooting gallery" was supplied with rectified DC power to the tanks so that fuel requirements and exhaust problems would be eliminated. Night bodies were incorporated so that realistic training on Tank Tables I, II, III and IV could be achieved. Two permanently placed *M60* tanks were fitted with miniature white and infrared lamps, and these were duplicated at the master controller's position. Communication refinements were accomplished, and the end result produced a very workable indoor scaled target system range.

The original Brewster mount used at the indoor range was designed for a semi-automatic rifle firing .22-caliber long rifle ammunition. Since Idaho's miniature range would be operated within a heavily populated post environment, the semi-automatic weapon was scrapped and a bolt-action weapon installed. This allowed the tank crew to fire a 15-grain frangible round. By not using the long rifle ammunition with its ammo clip also enabled the gunner to exercise his crew duty. He's wired into the commo net and responds to the fire commands with "up" and "misfire" and, thus, gets into the action along with the other tank crew members.

Training time for National Guard and Reserve forces is critical, and there never seems to be enough of it to complete all missions. The mini-range is designed around the concept that tank crews should be able to unlock the door to the indoor range, switch on the power to a few control circuits, and begin their weapon qualification training. The indoor range eliminates boresighting, mounting, prep time, and the "traditional" six-hour problem-solving period prior to dropping the first round downrange.

The mini-range also eliminates weather problems, malfunctioning targets, vandalism, and the laundry list of other road blocks facing a commander on the tank tables. Today, Idaho's shooting gallery is used by guardsmen, US Army crews and the local Marine Corps reserves. In Training Year (TY) -80, US Army tankers trained in the range for a total of 60 hours, and reserve components used the facility for 160 hours. TY-81 figures indicate usage by the Army at 40 hours, while reserves trained on the system for 200 hours.

Idaho's tank committee also discussed the merits of the DeCarlos audio-visual system and purchased the necessary 35-mm slide projectors, theater-type lenses, and software, and the system is now installed and functioning.

FM17-12 became the tank committee's "bible" during the designing process of the mini-range. Later, it was reviewed to incorporate battle-area environments to the mini-range. Consequently, when the tank crews train on the main gun range in the desert, they discover that they have become well trained and disciplined, and that they operate very smoothly as a team.

Idaho's mini-range refinements have been completed. While its environment could be modified through the addition of smoke generation, field fires, or additional lighting displays, the tank committee feels that it now serves the purpose for which it was intended. The tank commanders agree and say that any training device can be made so complex that it requires a crew of specialists to maintain and operate it. If that were to happen, the precious time gained by the tank crew could easily be lost.

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 50)


①


②


③

④


⑤


⑥

The Future of Swedish Armor

by Brigadier Richard Simpkin

To accept the actuality and future of Swedish armor as credible, the NATO reader may need to refresh his perspective on that country as a whole. Neutrality does not mean weakness and lack of conviction but instead, calls for strength and resolve. The Swedes are not shy about expressing their pride and patriotism. They put their money where their mouth is with the world's fourth highest per capita contribution to defense. With near-miss nuclear protection for the bulk of their population, notably for the families of essential workers, they are physically—and I would think, morally—geared to three months of nuclear red alert and/or post-strike survival. Their outstanding technology is wholeheartedly and rationally applied to defense—not least because small is beautiful and "old boy nets" link user, civil servant, and manufacturer in personal friendships. Despite the view of a British officer, even more conventional than he was senior, recounted to me with great glee by my Swedish friends, I see no reason to change the opinion I expressed in *Tank Warfare*[1] that put the Swedes on a par with the Israelis (and maybe the Swiss) as the only soldiers currently able to get the most out of advanced close-combat weapon systems.

One other general point needs making. Apart from the extent and distribution of inland waters—almost 100,000 lakes, to say nothing of rivers and canals—Sweden's defense situation is a microcosm of the shape NATO policies are taking. She faces two distinct threats. One is an airborne and/or seaborne landing on her soft underbelly of good tank country; a threat broadly comparable to that facing the NATO center. The other is an incursion into the extreme terrain of *Norrland;* a situation comparable to that facing NATO both on its flanks and in any intervention in North Africa or the Near and Middle East.

The Swedish General Staff had originally intended to replace *Centurion* and *S Tank* in the eighties, leaving the northern brigades to soldier on the *1Kv91* tank destroyer and the excellent *Pbv302* infantry fighting vehicle. But once they became aware of the antiarmor performance conferred on the 105-mm gun by long rod penetrators, they decided that, with up-dated fire control and, in *Centurion's* case, mobility (in the shape of a new diesel), these tanks would meet the main battle tank (MBT) requirement up to the mid-nineties. In an about-face, they decided to switch priority to a quantum jump in the antiarmor capability of the northern brigades.

We can thus envision Swedish armor policy as divided rather neatly into two compartments — an eighties TD (Project UDES XX20, where "XX"=extra experimental) for the infantry-dominated forces in the north, where the terrain lends itself to positional defense and the problem is getting there to conduct and support this; and a nineties program (Project UDES XX40), centered on the MBT successor(s) for the mechanized forces in the center and south.

I will deal first with the "northern" TD, which spearheads the "extra experimental" articulated armored vehicle program, with a conventional tracked backup; then consider the technical pros and cons of articulation in a broader context. After that, I will look at the articulated concept as the basis for a vehicle family, and finally address the nineties "MBT" problem.

The light articulated tank destroyer. For the reason I already touched on, *all* Swedish tactical vehicles must be able to swim, naturally, or with on-board aids, and to negotiate approaches and exits which are likely to be either boggy or composed of alluvial soil liable to collapse *en masse*. In the north, though, this is only the start of the story. While of totally different physical constitution, the terrain is

Figure 1. Possible developments in Swedish articulated armored vehicles. Left to right: APC/IFV; a tank destroyer and an alternative fire support vehicle with ATGMS and 40-mm gun for ground and antihelicopter roles. (Foersvarets Materielverk).

highly analagous mobilitywise to a mixture of the worst the Middle East and Far East can combine to offer. There are narrow tracks hacked out of the walls of precipitous defiles, there are side slopes steep enough to throw any conventional track that dares set link on them, there are swamps and expanses of soft drifting snow, there are slopes of slippery packed snow, and there is (literally) thin ice.

In other words, the terrain imposes extreme constraints on nominal ground pressure, track and overall width. Because lateral resistance and/or "end-of-track loading" (see reference to *Centurion* below) are apt to produce extreme steering conditions, these pressure and width constraints impose even tighter limits than usual on the length of track on the ground. At the same time, the short-pitch ridges of exposed ice surfaces and the terrain below the *bergschrund* allow few liberties to be taken with pitch ratio. In sum the "vicious spiral of tank design" becomes a medieval Iron Maiden—no place at all to be in.

A while back Volvo developed an articulated family of tactical and logistic softskins (the *BV202* series) for the northern brigades. These vehicles proved highly successful; my guess is that they will come to occupy a place in the history of mobility analogous to those of the Jeep, the White and International half-tracks, the *Wehrmacht's Hanomag* three-quarter tracks, and the Soviet full-tracked tractors. Later Haegglunds took over the project and developed a second series of similar vehicles, the *BV206* (figure 1.)

Within this new series, the tank destroyers, armed respectively with the 90-mm recoilless rifle and the TOW ATGMs, met some platform stability problems. At this point, Haegglunds came up with "vertical steering". Here the driver has positive control not only of the horizontal angle between the two parts, as he does in a wheeled semitrailer with one or more steered bogies, but also of the vertical angle between them. The driving technique appears to be present no problems in a softskin, where the driver can look over his shoulder, though it could be another matter in an armored vehicle.

The advantages of the system can be summed up under four heads:

- The driver can jack the rear of the front part up on the rear part.
- He can "bridge" a trench by holding the two parts in the same horizontal plane.
- He can heave either part up, using the other as a platform.
- For tight turns, he can reduce the effective length of track on the ground by bringing the two parts into a V configuration.

Evidently all this is subject to weight relationships and turning moments; the tail can rather easily come to wag the dog. I will leave the more technical factors over the next section. For the moment, let us accept that the principle works excellently for single-figure, all-up weights.

It is a long step, though, from there to the light TD with unit weights of 12-13 tons and a predicted train weight around 24 tons (rather under *MLC30*). The gun is the German 120-mm smoothbore with a special muzzle brake, now in the final stages of development at Bofors, which reduces trunnion reaction by 50 percent. Even so, we need to keep our feet firmly on the ground and recall that this is an infantry support weapon, lacking the higher levels of protection. A commercial engine gives it a power-weight ratio of around 25:1 (1 × 600 bhp) or event 33:1 (2 × 400 bhp) should this prove desirable in the tactical setting. While the mounting has 360-degree traverse and is theoretically stable round the clock, the designed usable traverse arc is limited to around 11 to 1 o'clock; and the mounting is unstabilized.

The autoloader transfers rounds of either of two types one-by-one from a magazine in the rear half, above the power train. This is a relatively unsophisticated design; it requires the gun to be returned to the 12 o'clock position and zero elevation relative to the hull axis. The West has always regarded this limitation as totally unacceptable in a tank. But with a loading cycle of 6 seconds from/to an azimuth within the designed traverse arc, it seems a fair tradeoff in an antiarmor/close support gun for use by infantry-dominated formations in positional operations.

I have already made great play in these columns and elsewhere with the importance of optronic systems in the tank design revolution. Swedish confidence in charge-coupled devices (CCD) seems to be mounting; but even if they are ready in time for this TD, the user will have had no chance to gain confidence in them. So, if the advantages of concealment in the equivalent of turret defilade are to be exploited, the problem of commander's vision remains unsolved. Since the crew must be in the front half to have optical vision, it may be possible for the commander to use a retractable periscope mounted to the right of his station. Another concept, astonishingly rated the most effective and cost-effective at this time, elevates the commander's whole station to gun level in a cylindrical armored sheath.

Knowing Sven Berge and his military and industrial colleagues as I do, I can accept that this TD represents an optimized design for deployment to Sweden's northern Brigades in the eighties. I am less sanguine about this particular concept having much interest for most other armies or in the longer haul.

The principle of articulation for armored vehicles. By contrast, once proven, the principle of articulation with "double steering" is of extreme interest, so much so that I would ask fellow tankers to set aside for a moment the adverse reaction I am sure they share with me. I believe it merits serious consideration in its own right, as well as in conjunction with the needs of rapid intervention forces and with the modular or task-configured concept I proposed a few months back in your columns. The arguments about articulation mostly lie in the fundamentals of tank design and are of four distinct kinds. The first two I threw at the reader above and will now try to explain in simplified form.

On *all-up weight,* articulation is a drawback. Any deliberate complication of design will cost weight. For instance, a swap-body system for logistic invokes a deadweight penalty of around 5 percent. Despite compensatory savings, the same could well be true of the modular approach I recently proposed.[2] Articulation involves not only massive power transfer and hydromechanical control mechanisms, but results in two additional aspects (astride the join) having to be protected. It thus entails a penalty currently put at 10 percent but one that is susceptible to growth in the development and engineering stages. So it may seem an odd way of solving a problem which centers on weight.

By splitting the track plan in two, this expedient offers both a way out of the fundamental interlocks of tracked vehicle design, allowing width to be reduced, and an increased contact area, reducing nominal ground pressure (NGP). The root limitation on the configuration of a tracked vehicle is the *L/C ratio* (a term borrowed from naval architecture). This is the relationship (figure 2) between the length of track on the ground (L) and the distance between track centers (C). If this ratio rises above a certain value, the vehicle will not steer. *S Tank,* in which precision of steering is critical for laying the gun, is down at 1.11; but thanks to advances in regenerative steering systems (which transfer power from one track to other instead of wasting it) a future fixed-gun tank could probably have a ratio in the 1.40-1.45 range (like the *M60* series and Soviet tanks of similar vintage).

By the same token, a modern turreted tank might have a ratio up to 1.55 *(Leopard* 1) or even 1.65 without sensible loss of agility. *Centurion* and *Chieftain,* with power-weight ratios and L/C values of 1.69 and 1.75, are apt to continue in a straight line when they are crossing a gulley and most weight is on the forward and rear roadwheel stations ("end-of-track loading"). Within a given overall width, increasing track width reduces C, and an attempt to reduce NGP by increasing L is equally damaging. The last door in this nightmare of an escape-proof prison clangs to when one throws in the fact that the pitch ratio, the relationship between overall hull length and length of track on ground, should not exceed 1.5. *(S Tank's* is almost 2.5 and feels it.)

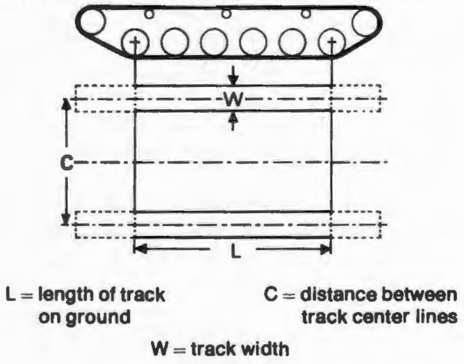


Figure 2. L/C Ratio

If we now cut the beast in half, these constraints apply separately to each half; this is a whole new ballgame. With the weight of each part thus reduced, we can cut NGP, push the track center-lines outwards and thus increase length, or reduce width. Taking this payoff in a combination of reduced width and lowered NGP results in vehicles suitable for extreme terrain.

Figure 3. An *M113/2E Hotrod* undergoing acceleration tests and showing extreme track deflection.

The third bunch of arguments is at once more subtle and more debatable. It concerns *track dynamics.* Track throwing has been one of the tanker's nightmares ever since World War I. A tank like *M60,* with an automatic track tensioner, only 320-mm of total vertical roadwheel movement, and a usable cross-country speed of around 25 kph, probably represents an optimum conventional solution, but it still throws tracks. With the high mobility and agility (HIMAG) test vehicle, we are looking at usable cross-country speeds some three times that of *M60.*[3] To achieve these in a service vehicle, one may be forced to go to vertical roadwheel deflections as high as 1,000-mm and to reduce unsprung weight by going for a much lighter and more supple, beltlike track.

At the same time, the cycling speed of the track is trebled, so that the centrifugal forces are far higher in relation to the circulating mass. And the total (wraparound) length of track has to be greater to accommodate the larger differential roadwheel movements. It may help to visualize the resulting track catenary (Figure 3.) the way the number of roadwheels engaging the horns at any one moment will be reduced, as will the duration of these contacts; and the possibility of the track taking on a kind of hula hoop existence of its own relative to the suspension. We are evidently into a potential track-throwing situation no conceivable tensioning system can cope with, as is already being borne out with *M1 Abrams* and, to a lesser extent I believe, with *Leopard 2.*

As against this, yet another step advance in the ability of roadwheels to "follow" the track may well put this shortcoming back into reasonable perspective. The key seems to lie simply in limiting linear distortion by keeping the length of track on ground short. Other promising trends appear to lie in large-diameter roadwheels and increasing the contact arc on front and rear stations, thus likewise improving angles of attack/departure and pitch ratios.

At the moment, hydropneumatic suspensions seem to have the edge in speed and precision of roadwheel response, as evidenced by *S Tank* and HIMAG. But the Germans do not care for the wear rates on these systems; they are putting their money on steel technology to improve torsion bar systems. At least one of their ultra high-mobility Project KPz3 test rigs looks to be getting the same kind of track retention in this way.

Nonetheless, there may well be some absolute limitation here on usable cross-country speed; and it may occur at a speed significantly below those achieved by HIMAG and its kin.

Once again, if we scale the whole running gear down by chopping the vehicle in half and begin by considering each half separately, we can expect a dramatic scaling down of the unwanted effects of track dynamics for a given usable cross-country speed. Two large question-marks remain. One is how, despite the damping effect, or positive constraint of-

Figure 4. A test of an articulated vehicle demonstrating the extreme flexibility of this particular rig. Such tests are an ongoing part of Sweden's armor development program. (Foersvarets Materielverk).

fered by vertical steering, the two halves even of, say, a 25-ton train will interact at HIMAG-like speeds on rough going, especially over short-pitch ridges (or, if you prefer it, a giant washboard section).

The second is whether the coupling with its power transfer and double steering mechanisms will withstand the resulting accelerations and dynamic loadings and still have acceptable reliability and life. The "northern" TD which currently has priority is only a medium-performance vehicle by modern standards, so that its development is unlikely to highlight this problem. Nonetheless, the chief designer of Haegglunds' armored vehicle division, Alfons Falk, is working on this aspect with considerable confidence. Judged by the results of his own efforts so far, and the excellence of Swedish armored vehicle technology in general, these efforts can confidently be expected to bear fruit. But it will be some time before the practical limit conditions are established.

To my mind, though, the biggest question mark that hangs over *armored* articulated vehicles is the driving of them. During a demonstration of the automotive test rig (figure 4) I witnessed—admittedly on an obstacle course so extreme that the machine finally threw a track, stripping a set of horns in the process—I was struck by the way the driver, although well provided with mirrors, constantly leaned out and looked back and down (or up) at the rear half. Evidently this would be impossible in an armored vehicle even when unbuttoned. Certainly two CCTV systems would be needed—one showing the coupling and rear part for obstacle crossing and one, mounted on the rear part and showing the ground behind it, for reverse driving.

On the other hand, the other crew members could help in maneuvering the vehicle across obstacles, much as the commander of a conventional tank does. And the designers' claim that these kind of problems only arise at obstacles which would defeat a conventional tracked vehicle of equivalent size anyway may well have force. Nonetheless, my user skepticism makes me wonder whether either this approach or the kind of multiple analog display used in instrument flying would solve the problem well enough to exploit the vehicle's capability to a worthwhile extent. I am sure this question will be fully and honestly answered by the trials now in progress on the automotive prototypes. But once again it behooves one to distinguish between getting a direct fire gun into and out of position in extreme terrain on the one hand and fluent armored maneuver on the other.

Articulation and the armored vehicle family. At first sight, articulation looks like an ideal solution to the creation of an armored vehicle family. But once again I am inclined to question whether it offers the same real versatility as a dedicated parent vehicle with a brood of specialized derivatives, or as the rigid; i.e., non-articulated, modular concept. To my mind, this question turns on the presence or absence of a chemical threat—something I would regard as equally present for Sweden and NATO. I am convinced that there are two prerequisites for survivability in face of persistent nerve agents:

- Crew and power train must be in the same half of the vehicle, so that an F kill leaves them able to motor to safety without dismounting;
- The maneuver squad commander must be able to move between crew station and squad compartment in a protected environment

A glance at the 'light' (20-25-ton) family under consideration for the northern brigades shows that none of them meets the first condition, and the APC or IFV version meets neither.

Seeing the TD lined up with its possible derivatives likewise highlights the key long-term question about articulated armored weapon platforms—whether you put the crew in the front half or the rear. For the eighties, when the primary vision, surveillance and sighting systems are still optical, this question answers itself. Crew and armament just have to be in the front half. Once one goes over to an optronic primary system presenting a processed image from a multisensor head, it becomes technically feasible to split the vehicle into a crew/automotive unit and an armament or other functional unit. It would be tempting to put the IFV unit in front of the crew/automotive unit. With a gun and its ammunition, no such ethical objections arise. The question is, whether this train, whichever way round you put it, can really be maneuvered into, within, and out of fire positions in a tanklike manner.

I believe we can clear the "which way around" point first. If the crew/automotive unit is the rear member of the train, the crew will have to face forward, that is towards the divide. I accept that having the armament unit in front will protect me against some forms of attack. But I frankly do not fancy having the main magazine with a fratricide ammunition fire jettisoning itself in my face or on top of me. The same goes, incidentally, for the notion of a train with the crew/automotive unit in front reversing into a fire position because that is the only way the gun can be brought to bear.

I have never seen types of observation and fire position (in conventional terms, "turret and hull defilade") described or discussed except to a limited extent in *Voennyi Vestnik.*[4] But to my mind there are two kinds of position. We might call them (figure 5) the "creep up" and the "tuck in." The more common and definable "creep up" position, typically with a crest angle ("a", figure 5) of 3-4 degrees, should be reasonably manageable. For a rear armament pod, the gun trunnions need to be around 750-mm above the highest point of the roof of the crew/automotive pod to provide 10 degrees of usable depression. This allows observation and fire positions to be taken up behind crests with a mean slope of up to 7 degrees (equivaling to a maximum depression of around 10 degrees) without exposure of the crew/automotive unit. I guestimate this would cover more than 80 percent of potential fire positions in rolling terrain—terrain, that is with mainly convex slopes.

In more extreme terrain, where negative angles of site of 20 degrees or more may arise, the Swedish concept has two advantages. One is that, within a frontal arc of 45-60 degrees, an external gun mounting, *per se,* removes many of the constraints on depression which bedevil conventional tank design. The second is that the vertical steering facility can provide an additional 10 degrees or so in the way of "on suspension" elevation arc.

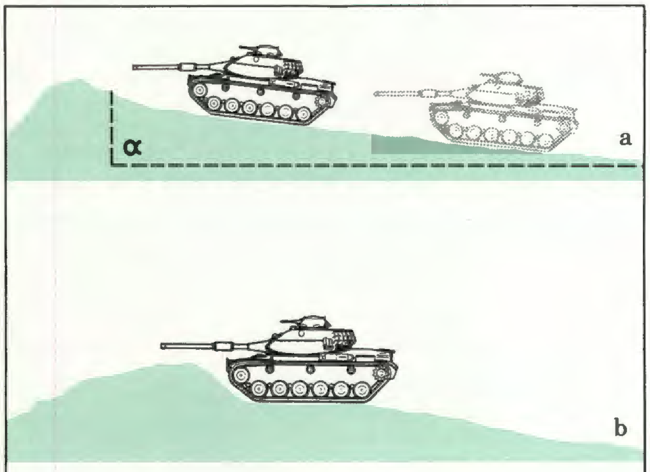


Figure 5.

"Tuck in" positions are another thing again. ("b", figure 5). By definition these tend to be on broken, basically concave-sloped terrain. I have no idea whatever of the proportion of such positions which are not deep enough or long enough to allow the train to roughly leveled out but which would accept a rigid vehicle of tanklike dimensions.

Now that we are steadily homing in on the MBT successor, I want to stay on that course and skip the other pros and cons of articulation. *ARMOR* readers can work these out for themselves; and if I am to address them, I should prefer to do so in a rather different context.

The main battle tank (MBT) role. I believe I have now established enough common ground between the reader and the Swedes for you to see the problem of a vehicle to succeed *Centurion* and *S Tank* in the mid-nineties very much through their eyes. In the early sixties, the Swedish General Staff disagreed with all other major armor users in trading off top traverse, and notably the ability to fire on the move, for the evident advantages the *S Tank* offered. But they still had *Centurion;* they, like the rest of us, thought it slightly odd to have a TD with all-around traverse and a tank with none; and the excitement of *S Tank* led, I guess, to an upswing of armored thought which, in turn, made its lack of traverse less acceptable. The *Marder*/105-mm test rig pointed the way to having their cake and eating it. This second postwar landmark in tank evolution has gone on its way, leaving its impact on Swedish, American, and to some extent, German, thinking. Two big question marks hung over it.

One was the problem of command and the distribution of crew duties. It was fine to put the gunner in the one-man turret under the gun where he had the best view and was right in there pitching. It was fine to put the commander in a stabilized cupola to one side. Problem was, the place for the commander was evidently in the turret. But then what did the guy in the cupola do? This argument, combined with experience of *S Tank,* bore fruit in the idea of having a commander and deputy commander with duplicate facilities rather than a commander and gunner. Meanwhile, growing confidence in the development of an acceptable optronic primary vision, surveillance, and sighting system for the nineties made it unnecessary to put anyone under the gun. The crew of three, on which the Swedes insist for versatility, can now be accommodated at hull level in line, or as nearly so as width between the tracks allows. So, we move from the model on the right to that in the center, with a pillar-mounted gun. And looking further to the left again we see that this mounting could be made retractable.

Given the basic assumptions that the primary optronic system *does* prove equal or superior to an optical system for the critical surveillance role, and that two men apart from the driver both receive the output from multisensor heads above gun level, there seems little *real* advantage in making the gun retractable. One has to question whether a pillar mounting would stand comparison with the more widely favored full yoke mounting in terms of real target area or ruggedness in face of attack, firing accelerations and the vibration environment of movement. Additionally there is no convenient place to mount the multisensor heads so that they are, as they must be, independent of the gun in traverse and elevation; and a full yoke provides a basis for possible umbrella-like protective systems.

There may be some advantage in being able to change from the observation to the fire position by elevating the gun mounting rather than moving the vehicle, but this would scarcely justify the very considerable cost of a retractable mounting. I can see a *psychological* value in it as a sop to the conservative user, who could then have the option of using an optical system at hull roof level for surveillance. But I believe in fact that this particular approach is likely to be dropped in favor of a larger diameter nonretracting pillar or maybe a full yoke mounting.

Once digital data transmission and optronics have made a slaved external mounting feasible and acceptable, the remaining problem area is the *autoloader.* The Swedes share the general Western opinion that, in a tank with top traverse and the ability to fire on the move, it must be possible to load the gun in any position relative to the hull. With trials on a full-scale test rig (mounted on *S Tank*) virtually complete, they have moved surprisingly fast from the limited system of the light articulated TD to a tank system both simplistic in its appearance and elegant in its simplicity. Before describing its mode of operation, it is worth outlining the underlying philosophy.

Sven Berge and his colleagues are less sanguine than others about the suppression of ammunition fires, so the first

Figure 6. The magazine mechanism of the Swedish designed automatic loader feeds a round of the selected type forward into the tray. The arm lifts the tray clear of its protective trough, traverses it under the gun and presents it to the breech, into which it is loaded by an on-mounting rammer. Two points maybe worth highlighting are the autoloader ring concentric with, but independent of, the "turret" ring; and the way the tray is pivoted on the arm to allow for alignment in any position of elevation. The system is electromechanical, and will have an emergency manual facility for operation or clearing a jam.

requirement was for an external magazine at the rear of the hull, where even a fraticidal fire from overwhelming attack would cause only superficial damage and there would be a high probability of successful jettison. Their present magazine caters for only two types of round, but there seems to be no reason why redesign should not allow small quantities of a third to be carried and selected; this is a matter for their users.

The second point of departure was avoidance of an on-mounting ready round magazine. This offers a high risk of a fratricide fire wrecking the mounting, and of burning propellant getting down inside the hull; and the shift in center of mass presents stabilization problems. Additionally the user may be caught with the wrong type of round "up."

The third factor is that exposure of the round during the loading the cycle must be minimized in extent and duration. Then of course there is the requirement to load the gun in any position within an acceptable cycle time. The figure of 6 seconds may sound slow to American, German, and Soviet ears; but experience of the side effects of firing suggests to me that it is realistic unless one is going for a multiple shot system (like the DARPA/AREA *Super 75*). Loading time is naturally shorter with the gun in the frontal arc. Last but not least, in fact I suspect well ahead of cycle time in the designer's mind, come reliability and the resistance to the exposed parts to attack (figure 6).

Finally a few more general words on this concept. It is undeniably a true tank. The Bofors muzzle brake allows it to mount the German 120-mm/44L smoothbore with standard ammunition (or of course the 105-mm/51L gun with advanced ammunition), along with a quasi-coaxial machinegun and two flexible hull guns. The Swedish General Staff was offered 30- and 40-ton options and went for the latter because of the vastly higher level of protection. In the nineties this should allow a power-weight ratio up to 55 bhp/t (or 37.5 with eighties tank engines); and at a similar weight and volume to *S Tank* this vehicle would be a swimmer. An articulated version would come out around 45 tons, minus the 10 percent penalty mentioned earlier. Should the need arise to boost the antiarmor performance of the guns envisioned, the rigid hull would adapt very readily to a fixed gun TD with an overlength tube up to, say 72-caliber-lengths (L) at 105-mm or 62 at 120-mm.

Conclusions. As far as a nineties MBT, or a "hi/lo profile" pair of tank successors, is concerned, American thinking appears to be very closely in tune with Swedish pioneering, with the experts of both countries a quantum jump ahead of Britain, France, the FRG and for once, as far as one knows, the Soviets. Given time and good design, a nineties vehicle now put at 40 tons could well be trimmed to become the parent of a *MLC40* (36 tons *plus*) family. The crunch point of the whole concept lies in the image quality available from an optronic system; but for reasons I recently set out in your columns, I myself would put my shirt on this particular horse.

On the question of articulation for an *MLC40* (or so) family for the primary maneuver force one must retain an open mind. At the moment it looks as though, quite apart from any technical difficulties, articulation at this weight would produce more user problems than it would solve.

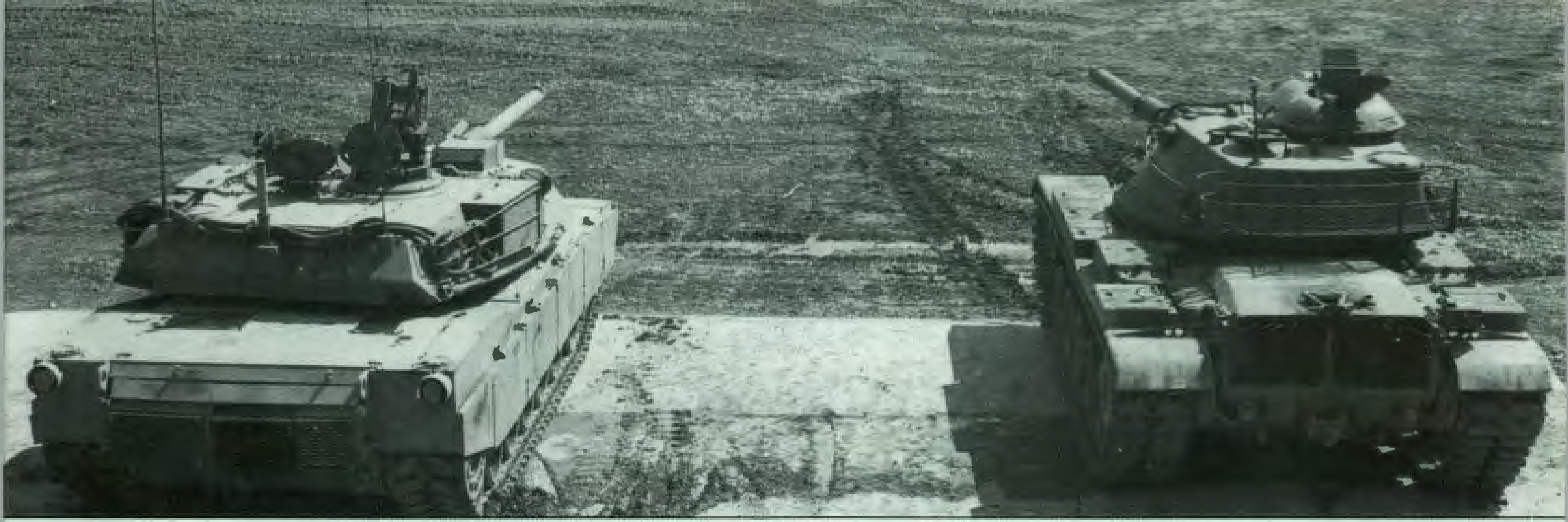
By contrast, for a "light" (20-25-ton) family, articulation adds up to a whole new ballgame, if it works. Sweden has a clear-cut need to play this game. For powers with an interest in intervention, articulation looks to offer a quantum jump in strategic mobility, trafficability, and flexibility of force structure. Whether this justifies a division of effort between materiel for "main" and "light" maneuver forces is not even a strategic question, but a political one.

See Recognition Quiz for additional Swedish armor vehicles. Ed.

Footnotes

1. Simpkin, Richard E; *Tank Warfare–an analysis of Soviet and NATO tank philosophy,* London, Brassey's, 1979 and New York, Crane Russak
2. Simpkin, Brigadier Richard; "Closing the Survivability Gap," *ARMOR Magazine,* Nov/Dec 81, 19-24
3. Ogorkiewwicz, R M; "The US Armoured Combat Vehicle Technology Program—a closer look," *International Defense Review,* 5/1979
4. I am sorry not to be more precise, but at the time of writing I have three Russian books (Radzevskii, Losik(1979) and Babdzhenyan) and 728 pages of extracts from *Voenno-Istoricheskii Zhurnal* and *Voennyi Vestnik* awaiting research for my fifth military book.

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.



New Tank Gun Calibration Policy

by Major James D. Brown and Captain Robert L. Kloecker

Let me offer you the following bet: I can hit as many targets without zeroing as you can shooting from your established zero. Are you interested?

This article explains the reasons for such a bet being offered, recounts the testing and study which were devoted to the subject, and finally establishes the procedures you can use to win the bet virtually every time—without zeroing.

The Armor Center began its investigations of the zeroing process in 1977. Its purpose was to rationalize the benefits of some of the practices which had crept into normal zeroing procedures. For example, the study examined the contribution that muzzle boresighting makes to system accuracy, and it questioned the value of using training ammunition zeroes as substitutes for zeroing combat ammunition.

The US Army Armor and Engineer Board (USAARENBD), acting as test agency for the Armor Center, published the results of this study in a report entitled "Battlefield Boresight Techniques and Zero Retention".[1] The report advanced twenty-seven separate findings about the value of our then-prevailing zero methods, some of which raised or confirmed, doubts about the benefits achievable through zeroing. The report also differentiated between the effects of tanks "losing boresight" and the so-called "loss of zero", since the actions required on the part of tank crews to remedy either condition are markedly different.

Principal among the Board's findings were descriptions of the sensitivity of individual zeroes to factors relevant to the way we operate our tanks in the field. Examining the zero policy in light of these factors introduced some doubt regarding the continued validity of the current method.

- Units in the field seldom have an opportunity to fire combat rounds. These rounds are expensive, and require larger range safety fans than our training ranges can accommodate. Moreover, some of the newer kinetic energy rounds contain alloyed penetrators which are environmentally sensitive. The Board report proved that training-round zeroes are not necessarily useful when applied to combat round firing . . . a direct contradiction of the unproven assumptions behind our previous zero methods.
- In principal, zeroing is supposed to be done once in the life of the tank; excepting those times when major components are exchanged. The previous policy supposes that it should not be necessary to rezero the tank. Yet, the Board report identified several reasons why a tank can fail zero confirmation tests, and thus must be rezeroed many times during its life. Some of the reasons include the imprecision of the confirmation test itself, and the shortcomings of standard string boresighting as a means of recognizing and correcting boresight loss. More importantly, the report stated that many tanks actually lose zeroes merely by changing to a different lot of ammunition. In other words, if you zeroed with a given lot of ammunition, but switched to a different one later on, then a noticeable difference in your ability to hit targets can occur. We don't see this problem very often in training. In combat, however, it can occur with great regularity, and thus present some very complicated resupply problems to the unit.
- Zeros change for many other reasons and further improvement in zero retention by making more sophisticated fire control systems is a long way off. Our present level of sophistication in these areas, even in tanks of the latest design, does not yet guarantee that zeroes obtained sometime in the past will rival the precision of zeroes obtained immediately before or during combat operations. The Board report explained the zero instability problem in some detail, but the basic conclusion came as no surprise: today's zero is terrific for today, but is less useful as the circumstances of the tank and its environment change later on.
- At that point, the problems of zeroing did not appear out of hand. Zero retention is an admitted problem, but maybe not so severe as to question the basic value of zeroing. The limitations of firing combat rounds routinely in training could even be a mixed blessing: at least we wouldn't be firing up our combat stockpiles to gain zeroes that might fail a confirmation test someday or which might have to be regained after a tube changeout. The simple solution was to defer all combat zeroing until it was absolutely necessary to do so. But simple solutions can be deceptively difficult. The Board report stated that effective zeroing was not an easy thing to do. The considerable effort and organization that some of our units have displayed on the zero range would indeed be difficult to duplicate in the assembly area before a combat operation. Without careful supervision, and downrange examination of zero groups, crews have often *created* more calibration error than zeroing was supposed to eliminate in the first place. That's not a criticism of the crews' ability; it's just difficult to zero under less than favorable conditions.
- There are other complicating factors. How much time will be available? And what else might the unit be doing in preparation for battle that would preclude reserving an opportunity to zero? Would operational security considerations prevent the unit from disclosing its intentions and location through an obvious zeroing exercise? Should units be expected to pull rounds

meant for enemy tanks from the ready rack if there is some doubt that those rounds could be replenished before actual combat? Tough decisions! A policy that banks on all those factors working in it's favor suffers loss of relevance and credibility in the field.

This line of reasoning raised a fundamental question: Can we calibrate fire control systems using a procedure that frees the combat unit from the incredible burden of precision zeroing under combat conditions? The Armor Board was directed to examine the potential impact of several alternative calibration methods, and to compare their likely accuracy benefits with the current individual zero policy.

The Board evaluation[2] reconsidered the large volume of live fire information generated in support of the original boresight and zero study. Hitting performance of tanks calibrated by all the reasonable alternatives were computed as if they had been applied to the tanks examined in previous tests. Two boresight methods were considered: the string-on-muzzle method and the muzzle boresight method. The Pye-Watson boresight device was used as a representative muzzle boresight instrument because of its familiarity to tank units in the field. Three "zeroing" alternatives were examined: (1) a one-time individual zero, (2) a no-zero or "shoot from bore-sight only" policy, and (3) a common zero policy in which every tank carries the same zero setting. This common zero number reflected the average fleet error in tanks firing from a given boresight alignment.

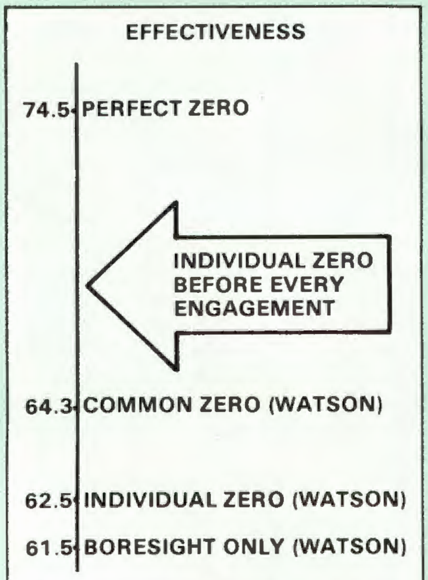


Figure 1. Probability of obtaining a first-round hit against a Threat target array on a European battlefield expressed as a function of calibration policy.

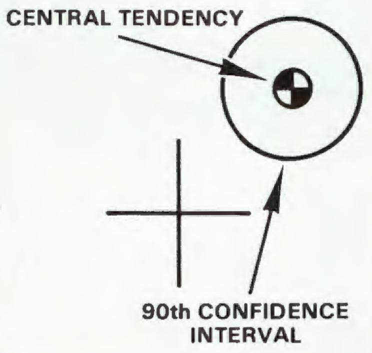


Figure 2. Zero retention is shown as a center point and a circle that represents the neighborhood into which zero groups would fall 90 percent of the time.

Figure 1 depicts the results of the study. Against an hypothesized distribution of engagement ranges from 500 (1,609 feet) to 2,500 meters (8,202 feet), *M60A1* tanks exhibiting errors like those seen in the test fleet hit targets at the rates shown. Perfect zero results correspond to tanks whose only error was round-to-round dispersion. If a tank could zero out the error in the system before each engagement and trust only its fire control solution, then the specified upper limit of effectiveness can be considered a "best possible" result.

Three of the resulting conclusions are relevant to this discussion:

- Whatever method is used to calibrate the fire control, it will be more effective if muzzle boresighting is used than if string boresighting is used.
- The incremental gain in accuracy achievable by zeroing is relatively small with respect to the accuracy achievable by muzzle boresighting alone.
- The accuracy achievable by another non-zeroing alternative, i.e., common zero, improves upon the accuracy achieveable by boresighting alone and probably equals or exceeds that of individual zeroing if muzzle boresighting is used.

Obviously, the results ran counter to the intuition of many who have held that zeroing was the only way to maximize system hitting performance. "How," they asked, "could these results occur?" Here is a simple explanation. Figure 2 is a convenient model of a particular tank's error when shooting from some kind of boresight alignment. The cross is the aimpoint against which a tank fires after boresighting. The Central Tendency (CT) is the average of all shot groups that tank might fire to obtain a one-time individual zero. The circle represents the neighborhood of all shot groups that tank might fire on all other occassions; that is, shot groups that might be considered updates of an individual zero if one could zero on every occasion.

If, however, only one zero is to be used throughout all those other occassions, then the best zero is the one closest to the central tendency for that tank. The best calibration policy is the one which does the best job of finding each tank's central tendency.

Let us now consider how the characteristics errors (Figure 2) of a whole fleet of tanks might look by examining the three cases in Figure 3. Case 1 depicts an imaginary fleet as widely scattered individual tank errors. If errors were distributed this way, then of the three zeroing alternatives proposed for consideration, individual zeroing does the best job of finding individual tank

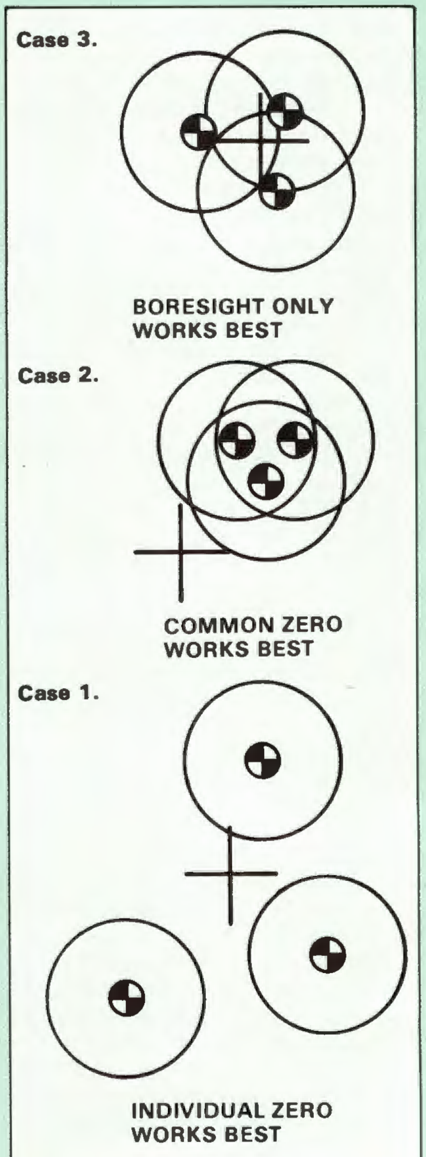
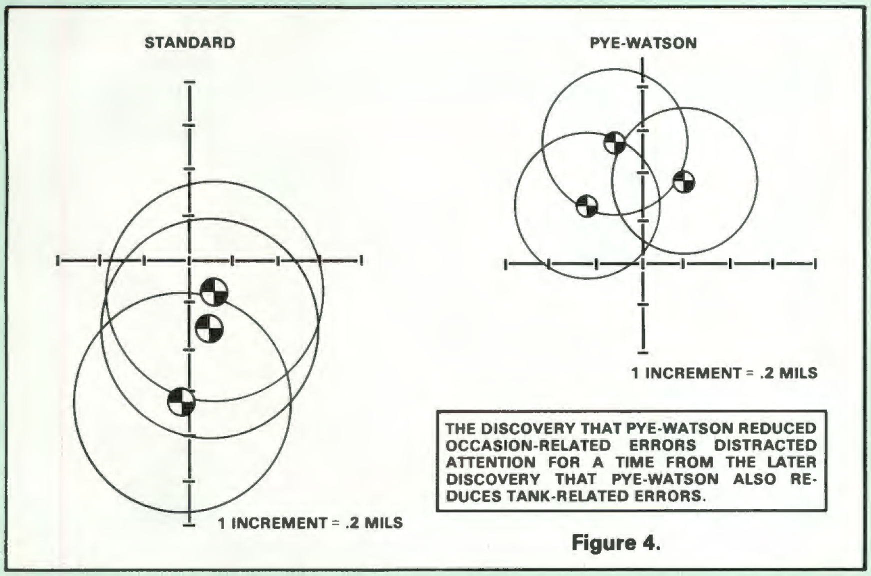


Figure 3.



THE DISCOVERY THAT PYE-WATSON REDUCED OCCASION-RELATED ERRORS DISTRACTED ATTENTION FOR A TIME FROM THE LATER DISCOVERY THAT PYE-WATSON ALSO REDUCES TANK-RELATED ERRORS.

Figure 4.

central tendencies. To shoot Case 3 tanks from boresight only would be disastrous; the differences between tanks are too large to ignore.

Cases 2 and 3 depict fleet error distributions that are more tightly grouped, the differences between tanks being of the same order of magnitude as within-tank zero instability. Case 2 and 3 tanks differ only in the size of average fleet error. Case 2, the general case, shows all tanks consistent, but far removed from the aimpoint. Case 3 tanks have a much smaller average error. Case 2 and 3 tanks are not as dependent on individual zeroing as Case 1 tanks, and can theoretically shoot better from Common Zero (Case 2) or Boresight Only (Case 3) than if they had zeroed one time only.

Going back to the results shown in Figure 1, some plausible explanation of why these results occurred should be found in the descriptions of our test fleet's characteristic error from both string-on-muzzle and muzzle boresighting methods. Figure 4 depicts that error. Note the advantage gained by Pye-Watson boresighting. Zero retention properties in the fleet are better (smaller circle sizes), but, more importantly, the differences between tanks are also reduced. If standard boresighting seems to yield errors like Case 1 (Figure 3), then muzzle boresighting yields results more like Cases 2 or 3. In our muzzle boresighted fleet, one should expect to see Common Zero or Boresight Only permitting tanks to hit as well or better than individually zeroed tanks.

Plausible explanations are not necessarily convincing ones, and we have already mentioned the hidden difficulties lurking behind deceptively simple solutions. The Armor Center commander ordered a field validation to demonstrate the contention that we could adopt non-zero calibration without degrading hit performance.[3]

U.S. Army, Europe, agreed to sponsor the field validation, and 3-63 Armor, 1-64 Armor, and 3-7 Cavalry, 3d Infantry Division, agreed to test the three competing strategies during their spring 1981 gunnery qualification period at Grafenwoehr. A blind assignment of strategies was made so that the inevitable prejudices and biases of each crew could not influence their performance during qualification. The assigned strategies were indexed on the fire control by a member of the test directorate from Fort Knox, and all scales were then slipped so that the true setting could not be discerned by the crew. All the crews knew was that the same strategy would be assigned to their tank throughout the qualification period in order to eliminate the need to estimate the shooting characteristics of the strategy each day. The results of qualification firings can be shown in many ways, but perhaps the simplest and most dramatic way is as depicted in Table 1.

It can be seen in Table 1 that although the commonly perceived improvement due to zeroing did not take place, the results predicted by the computerized study were in fact born out. The conclusion of the test was that individual zeroing did not improve hitting performance and could thus be abandoned in favor of a simpler, cheaper strategy without loss of combat effectiveness.

This reassuring conclusion, which is fully explained in the resulting test report,[4] encouraged the Armor Center to seriously consider the potential alternatives to individually zeroing all tanks. The formulation of a policy, which would be workable in combat and use available training time to prepare for it, began in earnest.

The resulting procedures duly considered the substantial results of previous testing and were tempered with a real-world appreciation of the harsh circumstances in which tank units operate. The Armor Center Commander's policy statement contained five essential elements.

Armored units must emphasize stringent fire control maintenance efforts, supported at progressively higher command levels by assistance and surveillance programs.

Seasoned armor noncommissioned officers and unit commanders know that attention to the subtle mechanical details of fire control readiness means more first round hits on the gunnery ranges and in combat. Regardless of the calibration techniques being used, this will always be true. Many units do a laudable job in this area, but it is worthwhile to address a few possible problem areas.

Fire control systems perform two basic tasks; they retain a boresight alignment condition once it has been established by the crew, and they apply ballistic corrections to the gun and sight in response to recognized engagement parameters. Most of the common fire control defects that units experience diminish fire control efficiency in one of these two areas. Sometimes these defects are very subtle, and hard to find unless we search them out in a carefully orchestrated maintenance effort. Many of the preventive maintenance checks already included in the semi- and annual maintenance procedures are good ways to ferret out these potential problems. However, these checks are poorly explained in our manuals, are not totally understood, and are sometimes overlooked. Furthermore, units sometimes unduly depend on an initial live-fire exercise, like zeroing, to identify problems that could have been detected and resolved in the motor pool.

Another problem involves the man-

Table 1. — Results of Field Validation Test

Strategy	Population Tanks/Shots	% of First-Round Hits
Individual Zero	55/507	70
Common Zero	46/425	67

ner in which product improvements are sent to the field. A cogent example is the *M60A1* Product Improvement Program. Five years ago, testing at Fort Hood, Texas, uncovered several design and production flaws in periscopes and ballistic drives. The eventual improvements that evolved are simple, elegant, and cheap. But it is a long line from engineering drawing boards, through production and rebuild facilities, through theatre and command channels and into the repair point. We must take steps to shorten that line by insuring that the priorities for applying such changes are commensurate with the benefits we expect to gain.[5]

Tanks will be calibrated by boresighting–preferably with the muzzle boresight device.

The recurring theme in all previous studies is that, no matter how tanks are calibrated, better hitting results, over the long term, are achieved by boresighting with a muzzle device.[6] But it was also found that the amount of "additional accuracy," across all likely engagement ranges, is not substantially improved if yesterday's or past year's zero is added to today's boresight alignment.

Even if this were not true, there is a substantial problem with zeroing combat rounds that defies easy solution because the *TPDS* zeros that have been maintained routinely in training won't help improve accuracy with APFSDS. If fact, inaccuracies seem to develop simply by changing "lots" of the same ammunition, a factor that may occur more often in combat than it does in training. Where will we zero the new kinetic energy rounds that have depleted uranium alloys in the penetrator? And, if we should plan to zero in combat, how would we possibly match the level of organization and control we have on training ranges while in an assembly area preparing for battle?

Despite the appearance of circumstances conspiring to make zeroing a hard thing to do in combat, the 3d Infantry Division test suggests that we are already "healthy enough" as a tank force to hit targets as well and maybe better, if we simply boresight the fire control system. An additional margin of improvement for tanks like the *M60A3* and *M1*, which we expect to shoot at somewhat longer ranges than the *M60A1*, is to apply "computer correction factors" to the fire control. These factors help us improve long-range accuracy by trimming out the natural biases that some ammunition types have shown us in testing. We initially plan to inject these corrections using the conventional "zero" channels built into the advanced tanks. If experience shows that these corrections are of continuing usefulness, our intention is to cause fire control solutions to automatically include these biases with no crew action required.

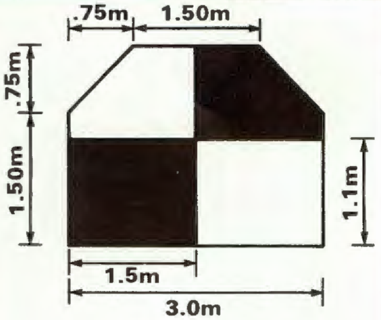
The Armor Center is committed to implementing muzzle boresighting as the standard technique for all armor units. While some units have already acted to obtain muzzle boresight devices, the Armor Center overall role still mandates a deliberate approach to fielding an accurate and supportable device in the appropriate quantity.

The accuracy of the calibration scheme will be checked in training by a live fire screening process.

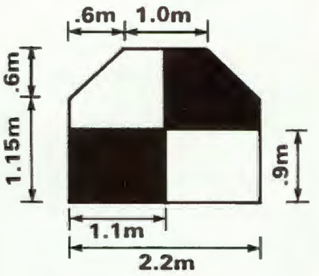
It is important that we use our available training time to reinforce the confidence of our crews in this calibration concept. It is important to find the expected small portion of the fleet that might perform poorly if calibration were limited to boresighting.

Certainly the first part of the screening process has already been identified—back in the motor pool where we carefully checked the boresight retention properties of the tank, and checked the proper function of the fire control solutions for all ammunition types. But some of the potential limiters to shooting performance lie in the tube itself, and some can only be identified given the shock of firing. When such faults exist they tend to affect all rounds although in slightly different ways. So our approach was to create a live-fire exercise that examines the dynamic shooting characteristics of the tank while firing one ammunition type, and simultaneously use that exercise as a confidence and experience builder for the crew.

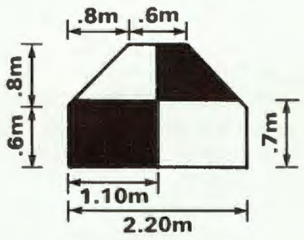
The exercise is a three shot, deliberately executed, series of engagements at three separate tactical silhouettes. Figure 5 describes the targets and the manner in which they are engagd. Here is how it works. After a careful prefire check and accurate boresighting by the crew, the gunner fires one round at each of the three known distance targets, always aiming at the point marked at the center of each target. If two or three of the targets are hit it is reasonable to assume that we have done a good job of preparing that tank to fire combat rounds accurately from boresight. Tanks that miss more than one target are a particular challenge to us. As the test is presently designed, we are likely to find three or four of these in each battalion. Why have they failed? The unit commander may have already designated his master gunner and a knowledgeable turret mechanic to immediately begin asking questions of the crew, checking the boresight alignment, and verifying the operable status of the fire control. Finding and correcting a human error or fixing an obvious mechanical fault are grounds for refiring the exercise.



Range 1,500 meters,
Full tank, frontal



Range 1200 meters,
¾ tank, frontal



Range 950 meters,
turret, defilade

Figure 5. Screening test parameters—crew firing exercise. Gunner lays on center of mass, indexes known range, and fires one round of TPDS-T at each target. Tank passes with two hits, fails with two misses. Test is conducted at the outset of each gunnery training period.

But suppose they draw a blank in these instances we specify that a "proofing test" be done. The master gunner should supervise the boresighting of the tank and he should fire three *TPDS* rounds at a panel at 1,200 meters. It looks for all the world like a three-round zero exercise, but its purpose is not to obtain a zero correction. Rather, that target should be closely examined. It contains certain clues that will help determine why the tank missed too many targets during the crew firing exercise.

Table 2 is a guide that shows how bad

Table 2. Proof-test Pass Criteria

	Mean Impact of rounds is within	and	Largest spread between rounds is less than
Muzzle boresighting	.75 mil of aim point		.64 mil (horizontal or vertical)

the bias error in the shot group or the spread between rounds has to be before we suspect an error in the tank. Furthermore, the direction of the bias error and the direction of the biggest spread suggest where we might look for the cause of the problem in the fire control.

Assume that tanks failing the screening test possess mechanical faults which could limit combat effectiveness.

We have been leading up to this throughout the discussion. The assumption we must make when a tank fails the screening is that it has something wrong with it. Something that we can find and fix. If that flaw is not corrected it will probably degrade that tank's shooting performance in combat when firing combat ammunition.

Why not zero those tanks? Well, quite apart from the problem of even getting combat round zeroes, we have little guarantee that zeroing will even correct the problem. The very large bias that was evident today may not be the same later on. And if excessive dispersion was the cause of test failure, then no zero will erase its damaging effect. Why postpone what must eventually be done? That tank is not ready for combat. At least not yet.

The severity of this condition cannot be minimized. No effort can be spared in determining and correcting the cause of that tank's problem. Just like public health officials learn the most about preventive medicine from the sick members of the population, so also do we improve the overall "health" of the fleet by insuring that those nagging faults are not duplicated anywhere else. The tank that fails the screening is not just the battalion commander's problem, it's a problem for all of us. Our strongest recommendation has been to flag that tank, deadline it, and summon whatever reinforcements are necessary to assist in identifying the problem. But above all we cannot afford to defer the solution by declaring the tank fit to fight.

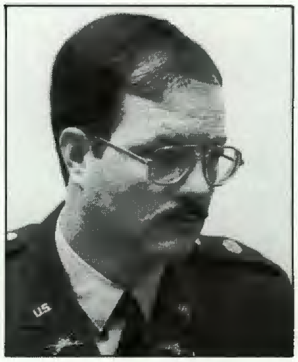
The policy applies to all 105-mm tank types.

The tank types in our arsenal differ in many ways. *M1* and *M60A3* and *M60A1* tanks all create fire control solutions differently. As tank technology advances, so does the sophistication of fire control systems. These advanced systems extend the accuracy of our newer tanks to areas that used to degrade the vintage tanks below useful levels. The *M60A1* cannot match the *M1* in shooting on the move and it tends to have more accuracy-related problems than either the *M60A3* or *M1* at longer ranges. Many of the error sources, which the *M60A1* can only address by zeroing, are at least partially addressed in the fire control systems in the latter tanks. In short, the more advanced tanks are less handicapped in extreme combat circumstances than are such tanks as *M60A1* and *M48A5*.

Some of the other problems remain the same regardless of tank type. Since most of the fire control componentry on advanced tanks do not contribute during stationary-to-stationary, cant-free engagements at close range, it is not totally surprising that all three tanks display about the same kinds of error under those circumstances. In terms of obtaining useful combat calibration, no tank is inherently better if zeroed, or simply boresighted, or anything else for that matter. It is the handicap described above that is comparably more relevant than calibration in establishing different hitting expectations for our tanks.

The policy change just described was driven by realities of combat. We can't guarantee a reliable zeroing opportunity before and during hostilities. Target practice zeroes will not work with combat rounds and our training ranges will not support peacetime zeroing with *APFSDS* and *HEAT*. We may fight with little or no advanced warning and we face the prospect of rapidly moving troops to man prepositioned tanks for immediate employment.

The studies, testing, and initial experience of some of our units suggest that we may forgo the burden of zeroing and not reduce the level of hitting performance we can achieve. In fact, we expect an overall improvement in delivery accuracy as muzzle boresight devices become more readily available. We expect that a benefit of increased maintenance awareness will continue to diminish the tank-to-tank differences that were a major reason for zeroing in the first place. We expect to gain time and ammunition in training. We expect to reinvest those savings in practicing gunnery skills that we must master in order to fight effectively though outnumbered.



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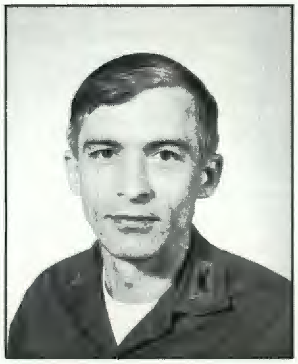

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Footnotes

[1] Concept Evaluation of Battlefield Boresight Techniques and Zero Retention USAARENBD, Jan. 80. Published in Vol I (Unclassified) and Vol II (Confidential).

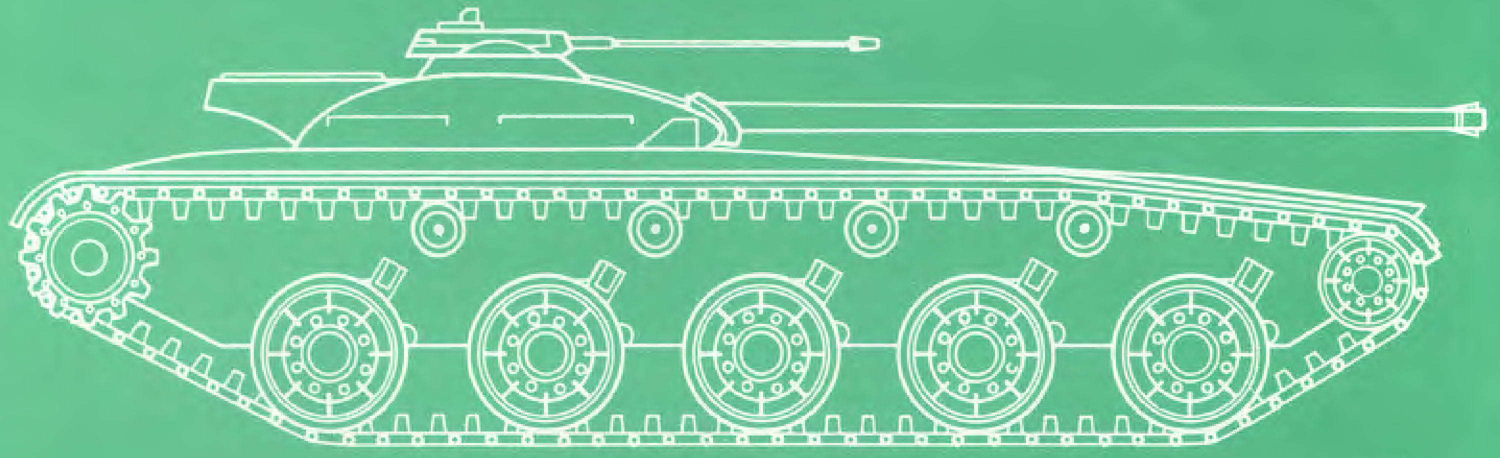
[2] A Preliminary Analysis of Tank Main Gun Calibration Strategies, USAARENBD, Jan81.

[3] Test Design Plan for Concept Evaluation of Field Test of Tank Main Gun Calibration Strategies, USAARENBD, Feb 81.

[4] Final Report on "Field Test of Tank Main Gun Calibration Strategies," USAARENBD, Sep 81.

[5] The "Update on Armor Activities" letter of 9 Jun 81, para 3, dscribes the *M60A1* Production Improvement Program.

[6] See W02 Albert Hogg's description of muzzle boresight procedures in the Master Gunner's Corner, ARMOR. Sep- Oct 81.



Weapons Versus Armor: A New Approach

by Clifford Bradley

The tank has existed for just over 60 years, having made its debut in the latter part of WWI. Machine guns provided the firepower, and tracks and armor provided relative immunity to barbed wire, trenches, and enemy automatic weapon fire-all deadly deterrents to infantry movement. Thus, the forerunner of the modern tank came into existence and incorporated the basic fundamentals of land assault: mobile, protected firepower. It restored mobility to the battlefield, and ushered into this era a system that was destined to change and dominate land warfare for decades to come.

Beginning with the first tank and continuing through its development, a major distinguishing characteristic has been its relative immunity to battlefield threats through its commitment to armor protection. In the beginning and through the early years of tank development, the armor required to provide protection against a wide range of battlefield threats and the armor for protection against enemy tanks did not vary widely. Likewise, the level of armament needed for regular tank mission targets, as well as for defeating the armor of its counterpart, were similar and could be handled reasonably well by a fieldpiece mounted in the tank.

However, over the ensuing years, the inevitable one-upmanship between weaponry and armor has caused the configuration of the tank to be driven more and more by the requirement to duel with its opposite number at a given range in the direct-fire role. This has become an increasingly dominant factor in the choice of weapons, fire control, frontal armor, and the integration of these subsystems into the overall tank design. In fact, the size of the weapon, its characteristics, and the ever-increasing frontal armor are selected almost totally for the tank-versus-tank requirements, with the resulting compromises in overall effectiveness adversely affecting the many other vital roles of the tank on the battlefield.

The increase in weight, created by ever-increasing levels of armor and larger cannons with continuing higher impulse and muzzle energy, has taxed the ingenuity of mobility component developers and system concept designers literally to the limit of their resourcefulness. Thoughtful military analysts, planners, and future system developers are all now beginning to ask, "When will it end? We must take a new approach." A projection of future cannon and frontal armor, based on the present practice, translates into some awesome characteristics. At the same time, many other vital surfaces of the tank and the track will have increasing vulnerability to the future battlefield threats, unless there is a change in the design approach.

The message is clear; mobile, protected firepower must take on a new look if it is to be a viable part of future close combat forces. History is replete with systems that failed to heed the need to change.

The *M1*, which began production in February, 1980 at the Lima, Ohio, tank plant, is now also being produced at the Warren, Michigan, plant in parallel with the *M60A3* tank. The *M2* Infantry Fighting Vehicle (IFV), and the *M3* Cavalry Fighting Vehicle (CFV) entered production in mid-1981 and are being produced in San Jose, California, where the *M113* Armored Personnel Carrier (APC) is nearing its production run end. These vehicles—the new *M1, M2* and *M3*, along with the *M60A2, M60A3* and the *M113*—will constitute the Army's close combat vehicle fleet (CCVF) for the next decade and beyond.

All of the above-listed vehicles are in production; the *M60* tank series and the *M113* reflect the technological developments of the 1950s, while the *M1, M2* and *M3* reflect the technology of the 1960s and 1970s. This being the case, the US Army has for the past two years been formulating the developmental strategy that will provide the follow-on systems for this family of future close combat vehicles in a timely manner.

The US combat vehicle development strategy is one that is believed by most to contain the proper elements for a successful program. The elements for a successful development strategy are shown as a triangle (Figure 1). They have a logical and interdependent relationship. First and foremost, a well laidout and well-funded component and subsystem development program is one that explores and advances the state of the art across all the technological disciplines that play a part in combat vehicles. A second vital leg of the triangle is the timely introduction of the maturing advanced technology into the currently-produced vehicles as product improvement (PIP) programs. Well planned product improvement programs offer a very cost-effective and low-risk means of providing significant upgrading of both RAM and system performance. The third leg of the development triangle is experimental prototypes, or test beds. These types of programs offer a means of assessing the introduction of new and advanced technology that may be either higher risk or involve the integration of several advanced components at the same time, such that it would be beyond the capabilities of the currently produced or fielded system to incorporate as a product improvement.

The Army's future combat vehicle programs are in line with the development strategy reflected in this triangle. It is believed that this approach will guarantee the availability of future combat vehicles that have the latest and most cost-effective technology in keeping with a constantly increasing threat. The means by which advancing technology is successively introduced into currently produced systems, experimental prototypes, or test beds, and eventually into new follow-on systems that may flow from the test beds is shown in the schematic in the lower portion of the chart.

The Army's programs for the improvement and development of the combat vehicle fleet throughout the next two decades are shown in Figure 2. Note that the programs are in accordance with the philosophy laid out previously in the successful development strategy reflected in the triangle concept; i.e., continuing technolgical advancement, product improvement programs for current systems, test beds to explore innovative system integration of new technology into new concepts, and even longer range technology development suitable for incorporating into future more advanced long-range combat vehicles.

Product Improvement Program. Updating currently-produced combat vehicle systems by judicious technology insertion through preplanned improvement has been emphasized since the initiation of the *M1, M2* and *M3* programs. For example, even though the first *M1* did not come off the line until February, 1980, the decision to initiate the 120-mm gun program was made in January, 1978, and initial planning for additional improvements (block-1) was begun in February, 1979. Both are now scheduled for introduction into production in August, 1985 in the *M1E1* tank.

Included in the block-1 product improvements are: armor modification to improve protection; and Hybrid NBC collective protection including compartment overpressure, crew cooling, and a new alarm system. State of the art improvements in the transmission and suspension modifications to accommodate weight growth will also be incorporated in the *M1E1*.

Improvements under consideration and contemplated for introduction by the end of 1986 include:

- Improved commander's station with a panoramic thermal sight, automated search and detection capability, and an improved target designation and handoff capability.
- Improved computer with increased capacity for enhanced command and control of the vehicle by the commander.
- Increased refuel rate.
- New smoke launcher.
- CO_2 Laser.
- Driver theral viewer.

A new hydropneumatic suspension system is being considered for inclusion into the second phase improvement program.

The fighting vehicle systems were also considering and exploring product improvements for the *M2* and *M3* before first production with the first PIP submission occurring in October, 1979 based on a DA/TRADOC/DARCOM PIP meeting on 17 May, 1979. Firm requirements and prioritizing of these requirements by TRADOC will of course be the basis for the final selection of product improvements for the IFV and the CFV. The following items are being assessed:

Short term (now through 1985).
- TOW 2
- Commander's back-up sight.
- Ventilated facepiece.
- Improved Bushmaster penetrator.

Long term (beyond 1985).
- Driver's thermal viewer.
- Heading reference unit.
- Low profile antenna.
- Biological/chemical protection.
- Nuclear hardening.
- Improved maintenance/diagnostic capabilities.
- Bushmaster munition improvements.

The Tank Test Bed Program. The tank test bed program (TTB) will develop a test bed to explore mid-term (1989-1992) options for introducing a lighter, more survivable, tank configuration based on current components and technology. The initiative for this program is based on both a "top down" and a "bottom up" approach. From the "top down," high-level Army officials in the Pentagon, after reviewing both European and US tank development plans, asked whether a lighter and more survivable combat-effective main battle tank (MBT) configuration could be obtained utilizing major automotive, fire control, and firepower components from current tank programs. At the same time, from the "bottom up," TACOM design engineers were analyzing the survivability challenge facing future tanks. For many years, it has been generally acknowledged by both the user and the development communities that the armor protection initially designed into a new tank begins to be slowly degraded or compromised at a pace that is a function of the rate at which enemy firepower advances. The progress that is currently being made in firepower technology has caused many combat vehicle analysts to be concerned about the slope of the vulnerability gradient, or the rate at which armor protection is being degraded.

As a result of that question by high-level Army planners, and the concern of TACOM design engineers concerning future tank survivability, TACOM conducted a design study to ascertain the feasibility of developing a more survivable and lighter weight tank utilizing the *M1* component base. The results of this study were briefed through various command levels to the Vice Chief of Staff. The innovative conceptual approach required the successful resolution of the following

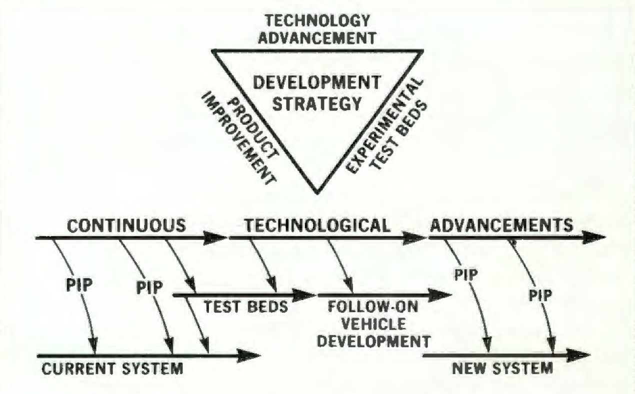


Figure 1. A successful development strategy.

issues: an externally mounted 120-mm gun with automatic loader; a three-man crew operation; battlefield surveillance and target acquisition from a new location in the hull, and a separate armored compartment for crew functions. The program calls for the fabrication of up to two hardware test beds to provide technical alternatives from which to make a decision on a mid-term tank development program. In addition to supporting the mid-term decision, the tank test bed can also be highly useful in establishing the degree to which current components and technology may limit future innovative tank design and performance.

To assure a high probability of successfully resolving the critical issues, the program will use a progression of design tools including full-scale mock-up, "brass board" automatic loaders, and field experiments with a surrogate research vehicle, (SRV), which will culminate in full-up test beds (technology demonstrators). Major components and subsystem interfaces will be addressed by use of design studies and full scale wood mock-ups highlighting critical areas. The critical components of the automatic loader will be "brass board" tested during the first year of the program. User evaluation of the crew tasks, vision, and command control aspects of the TTB vehicle design will be based on the testing of the SRV prior to the first major review. The test will assure a solid data base for assessing performance and progress of TTB contractors design effort.

Both the SRV and the TTB will undergo extensive user evaluation. The SRV will be ready for initial evaluation early in 1983, and the TTB will be completed and ready for user evaluation 24-26 months after contract award—tentatively scheduled for early June, 1982.

The Future Close Combat Vehicle Program. The third program in the chart (Figure 2.) is the future close combat vehicle program (FCCVP). Unlike the product improvement programs and the TTB, which are somewhat limited in their objectives and scope because of technology and schedule, the FCCVP is a broad and unrestricted exploration of the potential follow-on vehicles for the *M1, M2* and *M3* roles. Such follow-ons can include entirely new members of the close combat vehicle family.

From a presolicitation conference hosted by TACOM, and the issuance of a request for proposals (RFP) in mid-1980, contracts were awarded on 21, January, 1981 to four contractor teams to address the FCCVP challenge. They were to have one year to perform the studies with a final report due two months later. They were given the best extended Threat information available in a series of briefings, and a Threat document developed by the Assistant Chief of Staff for Intelligence. They were provided with an operational concept (Airland Battle 2000), and a series of briefings on future technology applicable to combat vehicles. From this information, they were to develop system capabilities, requirements, then project plausible conceptual options or alternatives for accomplishing future close combat vehicle roles. Through a series of tradeoffs, they were to establish a final set of recommendations. Each industry team worked independently and progress was reported every four months to a DARCOM/TRADOC review team chaired by TACOM.

The studies were completed essentially on time and the draft results were presented to the review team in a series of briefings during the last week of January and the first week of February, 1982. As this article is being written, the final reports for the study effort are coming in.

Although each team was given essentially the same information and had access to the same additional sources of information, each team worked totally independently of the other and thus, to some extent, the results were different in several areas, as was expected. Each of the teams did a good job in assessing the challenge; there were, however, some differences in how each of the teams perceived the interaction of the Threat, the operational concept, and technology. This difference was especially noted in the interpretation, timeliness, and availability of future technology; thus, there were marked differences in the projections of system capabilities and future concepts by the four industry teams.

All teams assessed the challenge facing the future configuration of the tank in pretty much the same way. Generally, the traditional one-upmanship between armor and firepower was portrayed, with the industry teams reflecting a playback of government-furnished data on both weapon and armor technology and the enemy threat.

The study teams highlighted the gaps in our technology base efforts, and were of great help in focusing attention on needed technical problems that must be initiated to meet the challenge of the mid-1990s, and beyond. The four studies generated a great amount of excellent material that will provide a large data base for future tank development researchers and designers.

The results of these FCCV studies, and follow-on studies that are now in the planning stage, will be evaluated by a team of DARCOM and TRADOC experts, assisted by combat vehicle consultants. The evaluation will assess both the entire FCCV family as proposed by each team, and individual vehicle concepts, and finally, new families will be synthesized from outstanding individual concepts from all the teams. The evaluations will serve to identify critical issues within the FCCV family. related to components and subsystems, operational features, and vehicle performance of the most promising concepts. This, in turn, will serve to help select and define the test beds that will be built and evaluated in order to resolve the critical issues. These test beds will be built and evaluated throughout the period 1983-1989.

Results of these test bed evaluations and other supporting technologies will then form the technical basis for the specifications for the next family of future close combat vehicles to be introduced near the turn of the century.

Questions That Need Resolving. The FCCV studies served to confirm that the major tasks facing future combat vehicle users and developers will be in determining the roles of tank and infantry vehicles in the close combat vehicle family. A derivative question then becomes will the roles be based on purely tactical considerations as defined by TRADOC, or will the role of both the tank and future infantry fighting vehicle be largely determined by the capability of technology to provide unique performance? The answer, of course, is that some combination of both operational concepts and technology will determine future close combat vehicle family roles.

For the future IFV, the question is do we continue the trend reflected by the transition from the *M113* APC to the

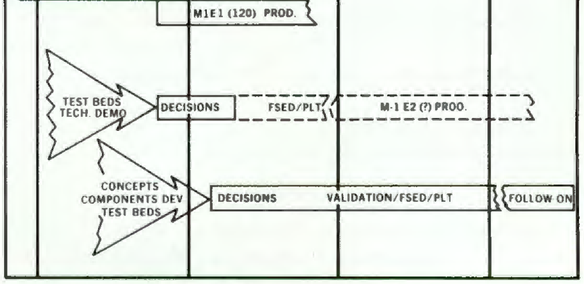


Figure 2. Future tank program.

M2 IFV which combines relatively light armor protection with the firepower of the 25-mm Bushmaster and the antiarmor TOW missile? How will the traditional infantry dismounted role be affected, if at all, by a continuing emphasis on operating within an armored vehicle and fighting on the move in a mounted role? What is the required armor protection for the future IFVs, and what are the firepower capabilities required for the future infantry vehicle as a member of the FCCV family? One alternative is the possibility that the future tactical vehicle needs of the infantry will require two vehicles; an armored carrier with emphasis on transporting infantry troops on the battlefield for accomplishing the predominantly dismounted fighting role, and an armored fighting vehicle with firepower and protection suitable for fighting predominantly in the mounted or assault role when supporting tanks.

Historically, before the *M2*, there was no strong relationship between the infantry and its battlefield role and the vehicle it used to go into battle. With the introduction of the *M2*—and for the future—the infantry squad, its role, and its vehicle must develop a new relationship. That relationship will tend to be more like that recognized by the armor people and by the combat engineers, where, historically, their missions and their roles have had strong ties with the vehicles or materiel they use to execute their missions.

Future tanks pose a somewhat different problem. The primary role of the tank will continue to be aggressive assault; i.e., to dominate the battlefield with armored, mobile firepower. The challenge to technology will be how to make the tank survivable enough to continue this traditional role in the face of ever-mounting multiple threats from antitank munitions on the battlefield.

"Over the years, the design configuration of the tank has been driven more and more by the requirement to duel with its opposite number at a given range in the direct-fire role."

Since tanks were first introduced on the battlefield, a major distinguishing characteristic has been this commitment to heavy armor protection; thus giving it immunity to a considerable portion of the enemy threats expected to be encountered. However, the contribution that a given level of armor makes to overall tank survivability is a transient one and is related to the evolving weapon and firepower technology that is being developed for the antitank role in order to minimize the dominance of the tank on the battlefield. Thus, the evolution of tanks over the years has reflected their contest between armor and firepower. This contest has led to successive introductions of heavier and more costly tank vehicles. This escalation of tank weight and cost have caused some high-level military planners to seriously question the continuation of the armor-firepower contest in future tank design, especially in view of the widening gap between the rate of development of firepower related technology and the relatively slower rate of the more mature armor or defensive technology.

The emphasis on armor protection in the development and employment of the tank and the increasing difficulty to maintain a relatively high-level of armor protection over the years at reasonable weights even with improvements in armor, automotive technology, and imaginative and innovative design, have led to often and widely-publicized conclusions that the tank was doomed because some new armor-piercing threat was introduced. And indeed, we do appear to be at a real crossroads as far as tank design is concerned. It is possible that the traditional tank configuration may have been taken as far as passive armor technology can take it. The introduction of more sophisticated antiarmor precision guided munitions (PGMs) will most certainly upgrade significantly the importance of countermeasures and counter-countermeasures to survivability, even to the level that armor protection has today against more traditional threats. The example of the sinking of the British destroyer, *HMS Sheffield,* by a single missile fired from an Argentine plane 20 miles away will certainly be viewed by military analysts as a portent of things to come in future land combat. The next step may involve "stepping up" the integration of suitable countermeasures coupled with a new design approach as reflected in the tank test bed program that reduces the volume and surface area to be protected but still provides a configuration that will effectively fill the tank role. Tank warfare is a microcosm of war, reflecting in a single machine: firepower, mobility, maneuver, protection, shock, surprise, offense, defense, breakthrough, encirclement, etc. These capabilities are as important to the art of war today as they were a thousand years ago, and will continue to be vital to the winning of any future conflicts.

Over the years, the design configuration of the tank has been driven more and more by the requirement to duel with its opposite number at a given range in the direct-fire role. This has become an increasingly dominant factor in the choice of weapons and the frontal armor, and the integration of these subsystems into the overall tank design configuration. The real importance and contribution of the tank, combining mobile, protected firepower with shock and surprise in the breakthrough, and exploitation role has over the years tended to be relegated to a lesser degree of importance in favor of the tank-versus-tank role. Therein may lie the reasons for some concluding the tank will not be cost effective in view of future antitank threats, mainly in the form of enemy numerical superiority, plus antitank weapons and precision guided munitions. One answer may lie in designing and configuring other members of the future close combat vehicle family in a way, especially in the defense, that will increase their capabilities against enemy tanks, therefore permitting the tank to once again be optimized for its original role of providing mobile, protected firepower and shock action to the battlefield.

These are some of the questions that the tank test bed program and the future close combat vehicle program will play a major part in resolving.

CLIFFORD D. BRADLEY served as Chief of the Exploratory Development Division, Tank-Automotive Concepts Laboratory, Tank-Automotive Command (TACOM) preceding his retirement in May 1982. He joined TACOM in 1951 after receiving his BS degree in mechanical engineering from Wayne State University. Before entering college, he served in the U.S. Army from 1940 to 1945 with the 7th Cavalry Brigade and 1st and 4th Armored Divisions. Following a 15-month engineering training program at TACOM, he was associated with advanced military vehicle concepts for his entire career, and participated to some degree in all major vehicle development programs initiated at TACOM.

Armor Operations

by Lieutenant Colone

Although current doctrine recognizes the vulnerability of armor in urban fighting and recommends that such areas be bypassed whenever possible, armor units must expect to fight in the streets as an integral part of the combined arms team.

Major Adolf Carolson's excellent article, "Tanks In Urban Combat" (March-April, 1981 ARMOR) provided both an historical perspective and important operational considerations for armor units fighting in built-up areas. This article has been written to expand on some of his concepts at a lower level. In particular, the "how to" for individual tanks and platoons are offered in an effort to fill the relative tactical void in current doctrine. Some answers may be found, but many questions will be posed. The professional soldier must develop a better appreciation for the complexities of armor operations in urban combat.

The general nature of armor operations in the urban environment can be described as follows:

- Small unit, combined arms, operations.
- A three-dimensional battlefield.
- Restricted, canalized, routes of movement.
- Limited observation and fields of fire.
- Greatly reduced engagement ranges.
- Difficult command and control.

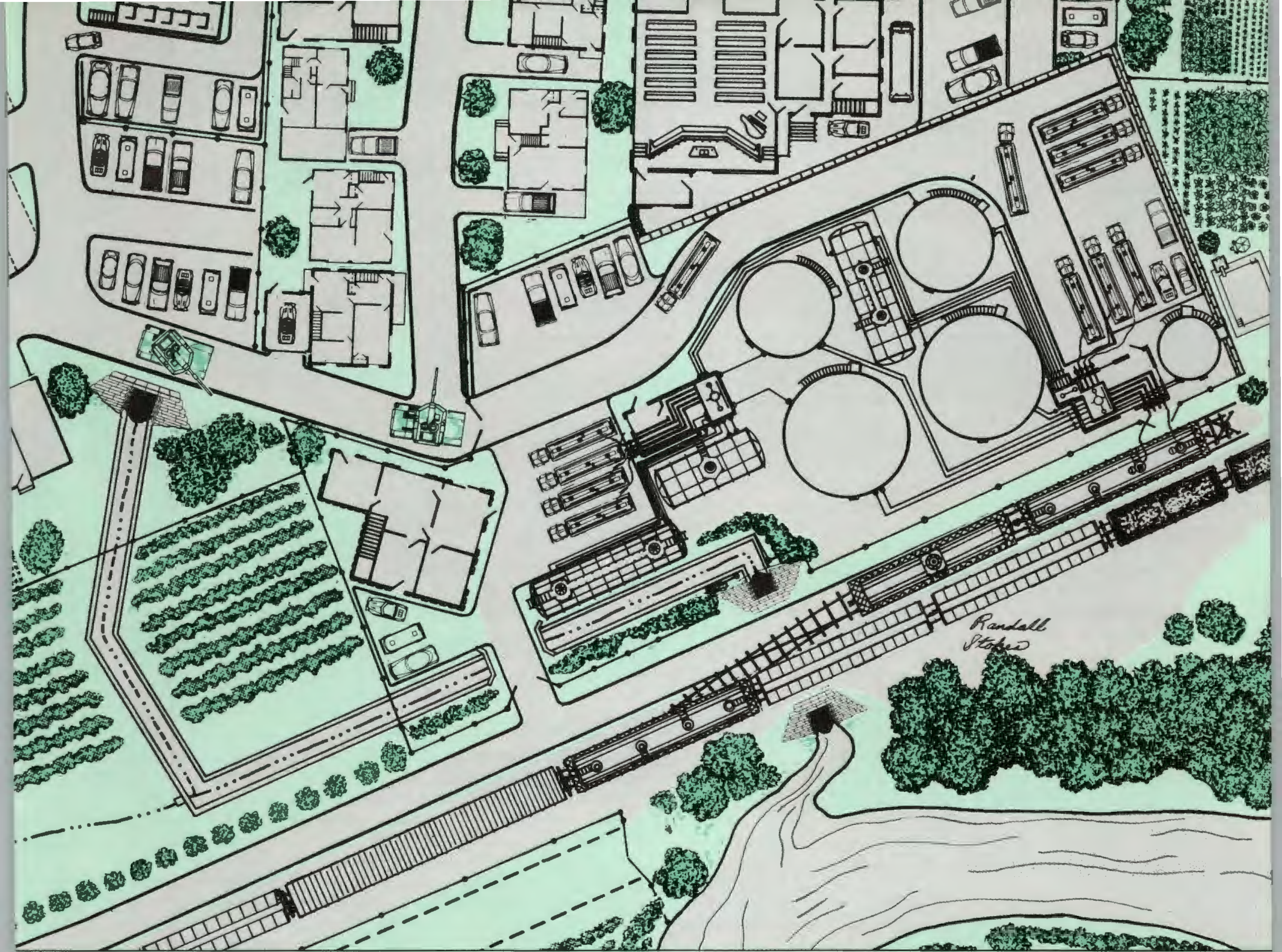
Fundamentals. With these considerations in mind, let us briefly examine the three fundamentals of armor employment: combined arms, mutual support, and all-round security.

Tanks cannot survive in urban combat without infantry support, and the infantry will normally control the operation. In built-up areas, cross-attaching infantry and armor platoons to form company teams will be the rule rather than the exception.

Every effort must be made to employ tanks in platoon formations. In general, this will be a staggered formation with two up and two back on alternate sides of the street. Maintaining platoon integrity enhances the movement of the tank-infantry team, enabling the tanks to provide overlapping and overhead fires, and improves command and control.

The lead tank's primary sectors of fire will be to the opposite side of the street (figure 1.) This will improve the tank's ability, with a maximum 10-degree depression, to engage street level targets including basement windows.

When an infantry squad dismounts from its *M2* it will generally form into a six-man close combat team and a



in Built-up Areas

l Curtis V. Esposito

three-man fighting vehicle team. The close combat team will move ahead, alongside, and to the rear of the tanks and IFVs to provide close-in protection and to identify targets. Effective communications between the infantry and the vehicle commanders is critical.

The infantry teams must aggressively clear buildings along the route of advance and provide a continuous envelope of protection for the tanks and IFVs which are generally restricted to movement along a highly predictable avenue of approach.

The extreme heat immediately to the rear of the *M1* will prevent dismounted infantry from following closely, but protection from small arms fire is still provided by the tank's bulk and armor.

(Although the *M1 Abrams* tank and the *M2 Bradley* Infantry Fighting Vehicle (IFV) have been used for illustrative purposes throughout this article in order to highlight the force modernization and considerations that are having an impact upon both organizations and tactical doctrine, students must adapt the concepts to a mix of *M113s, M1s,* IFVs and *M60A3s.*)

Particular care must be taken to protect the dismounted infantry from the discarding parts of Armor Piercing, Discarding Sabot (APDS) rounds and the blast over-pressure of all main gun ammunition.

Since the *M1* has greater armor protection than the *M2*, the tanks should generally move in front of the IFVs and provide a measure of defilade protection when contact with enemy armor or antitank weapons is expected. The 60 degree elevation of the *M2s* 25-mm cannon and 7.62-mm coaxial machinegun give the IFV excellent direct fire weapons to engage targets in buildings above the moving tanks. The firing ports in the sides of the *M2* will provide excellent covered firing positions for the infantry inside. The IFV can also be used as a mobile command post, a resupply vehicle, or a medical evacuation vehicle.

Gunnery Techniques. Many of the standard tank gunnery techniques practised routinely in open terrain also apply in urban areas; however, there are several different considerations which are of particular note.

Although the elevation and depression of the *M1's* main gun and coax machinegun are greater than the standard Soviet tanks, these advantages may be offset in an urban environment where battlesight gunnery will be the norm, and well-placed and protected infantry antitank systems in buildings will be a major threat. Tank commanders must develop an "eye" for potential targets than can, and cannot, be hit with the main gun.

In general, if you know the distance between your tank and a building, you can place direct fire on a target in that structure which is one-third of your stand-off distance above the ground. (Figure 2.)

Of critical concern to the tankers are potential targets that cannot be engaged because they are within the 10.78 meters (34.69 feet) of dead space.

The dead space will remain virtually constant to the front and sides of the *M1*; however, with zero degrees depression over the back deck between the battery box access door (right) and air cleaner screen (left) the tank is vulnerable and must neutral steer (axis turn) to convert a rear target to a side target in order to effectively engage that target. Both the maximum elevation and depression are slightly reduced (to 19 degrees and 8 degrees, respectively) with the stabilization system "on"; therefore, you may want to consider operating in the manual mode in the built-up area. These target engagement limitations highlight the importance of dismounted infantry providing close-in, all-round security.

Combat in urban areas will frequently involve fighting in close proximity to buildings, walls and other solid objects. Special consideration must be given to the gun tube extension during traverse and to the turret overhang beyond the sides of the tank when the main gun is traversed.

A bustle rack added to the *M1* would increase this overhang distance. These dimensions are important considerations when fighting in urban areas. Drivers must be trained to move forward and backward on a line with sufficient distance from a wall or building to insure that a 180-degree traverse of the main gun is not impeded. In addition, gunners must know when the main gun will extend beyond the side of the tank, and the turret ring may have to be marked to provide a ready visual reference in the absence of an azimuth indicator. If the main gun remains inside the headlight brackets, the gun tube and turret will not extend beyond the tank sides.

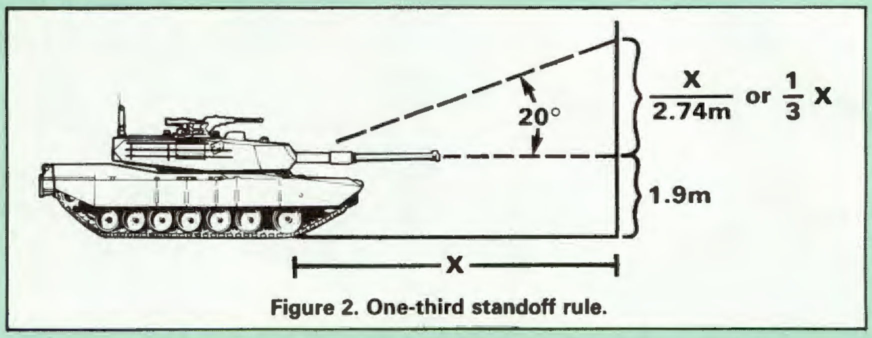


Figure 2. One-third standoff rule.

With the *M1's* sophisticated and accurate primary sighting system, gunners have been trained to place the crosshairs at the base or the center of the target. In urban terrain, you may be required to off-set your point of aim when firing at targets located in buildings in order to get the spalling effect desired against personnel targets inside the building. The high resolution thermal sight (TIS) can be used to identify targets in the shadows of buildings at ranges up to 1 km; however, glass in the window will make it impossible to detect personnel within a room. Enemy weapons which have been recently fired can also be detected by this thermal signature. Fortunately, with the *M1*, the primary sight has a projected reticule which compensates for the parallax in the sight at close ranges. Remember, however, 200 meters (643 feet) remains the minimum reading for your rangefinder. In addition to offsetting the aim against enemy positions in window and doorways, special consideration must be given to the main gun ammunition selection.

High Explosive, Antitank (HEAT) is the most effective round against masonry walls. HEAT ammunition causes lethal spalling on the interior wall and creates a hole large enough for a soldier to enter or through which the close-combat team can throw a grenade, a very lethal weapon in the close confines of a room. A HEAT round requires 36 meters (115 feet) to arm itself; therefore, APDS may have to be fired at very close ranges. Note that the flight characteristics of the APDS round produces approximately 2 degrees of drift (yaw) out to ranges of 750 meters (2,413 feet). APDS will also produce effective spalling at close ranges; but the discarding portions of the round are lethal to the lightly armed infantry providing close support for you. Because of the characteristics noted above, you should expect to fire predominately HEAT rounds, using battlesight techniques in urban areas. Ammunition stowage and resupply should be taken into consideration on this account.

The thermal sight greatly enhances your night and limited-visibility capabilities. Although dense smoke will restrict precise ranging, it will still be possible to acquire the target and engage it using battlesight techniques.

On-board, self-generated smoke may be used to reduce the visibility on the urban battlefield. Care must be taken to observe changing wind directions. Also, the use of the turret grenade launchers will often be restricted by the close proximity of buildings and the close combat teams providing all-round security.

The red phosphorous content of the turret grenade launcher will burn your relatively unprotected infantry close combat teams and make target acquisition and engagements more difficult.

Vehicle crews must be constantly aware of the potential defilade positions, since the tank's direction of movement is both restricted and predictable. Corners, buildings, and rubble offer good defilade positions; however, you must remember the dangers of the three-dimensional battlefield that prevail in a city.

Close combat teams should reconnoiter ahead of tanks. This is particularly true as a tank approaches a corner. Drivers should be trained to expose only the front slope of the tank to enemy observation and direct gun fire. The building will protect vulnerable suspension systems, and if care is taken in positioning the tank, it will be possible to neutral steer quickly, provide enfilade fires, or rapidly move forward if necessary.

Buildings provide both cover and concealment for tanks. Excellent hull and turret defilade positions can be

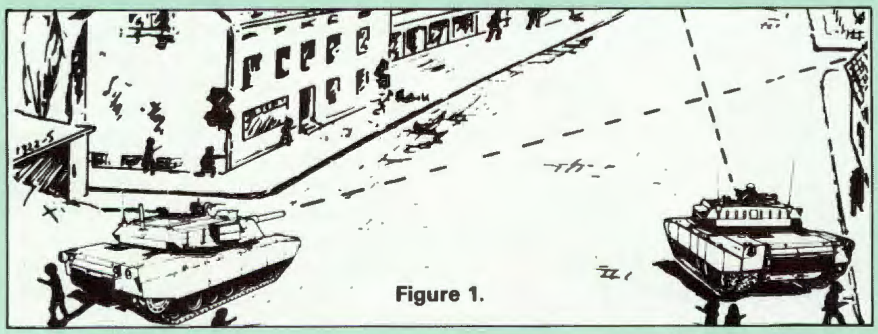


Figure 1.

found if a careful reconnaissance is undertaken on foot in advance. Buildings also present a dangerous trap for armored vehicles. First, close-combat teams must carefully clear the structure from rooftop to basement and provide continuous all-round security to prevent enemy infiltration for a close-in kill shot. Second, the tank should never enter a building with a basement if there is any doubt about the ability of the ground floor to hold the vehicle's weight. Third, vehicles should enter through a rear wall to permit hasty withdrawal under pressure. Remember to protect the gun system. This may require hitting the wall with the frontal armor (gun tube over the rear deck) to create the entry hole, then backing out, traversing the main gun, and entering the building to assume a firing position.

In addition, you will want to hide in the building, but your actual firing position should allow the end of the gun tube to project outside the building, otherwise the muzzle blast could collapse the building or injure infantry or tank crewmen within the structure.

The natural rubble caused by combat can provide excellent defilade for tanks. Some obscuration can be expected during main gun firing and close-combat teams must protect themselves from rocks, glass, and other sharp objects that may be hurled from the rubble when the main gun is fired.

Movement techniques. The factors of METT (plus time and space) must be considered when moving toward an urban area. Aviation, EW, patrols, and other intelligence collecting means must be used to help determine the enemy's defensive position at the edge of the urban area. Thermal sights can assist in locating heated occupied structures. *M1* units should take maximum advantage of the dash speed of their *Abrams* tank to cross open fields on the edge of the built-up area, in order to reduce the enemy's engagement time. Prior to entering the built-up area, crews will range to targets or use established zeros. As they close with, or enter, the built-up area, the tank commander should use the "battlesight adjust" button on the commander's panel to set a more appropriate battlesight range—probably between 200-500 meters (636 to 1,600 feet). In addition, maximum suppressive fires, both direct and indirect, in conjunction with smoke, should be used to cover the movement. Careful consideration should be given to maintaining platoon and company integrity to enhance command and control of the forces as they enter the urban area. Mounted infantry should follow the tanks closely and the close-combat teams must quickly dismount and disperse upon entering the edges of the city to insure that combined arms teams are formed and that immediate all around security is established. Whereas the movement technique of traveling overwatch may predominate for *M1* units in open terrain, urban combat will frequently require bounding overwatch. The major adjustments that must be made in the confines of the urban environment are reduced speeds (consistent with the efforts of the dismounted close combat teams), restricted maneuver space, and the three-dimensional battlefield. The bounds will be limited primarily by visibility from position to position, rather than by distance and weapons range. Frequently encountered terrain features will be streets, corners, and intersections. Tank units must train together with infantry forces to reduce unnecessary confusion. Although the tank sections and platoon are shown, remember the vital role that dismounted, infantry close-combat teams must play in each situation.

Adhering to the fundamental principle of mutual support, and in order to reduce the dead space, tanks should move as a section on alternate sides of the street with sectors of fire overlapping.

Close combat teams clearing buildings along the route of advance must be alert to the dangers of antitank mines on the building walls as well as in the roadways. Tanks may move by bounds within sections, or as a section, depending upon the enemy situation and the width of the street.

Overwatch is provided in depth. The overwatch element provides protection for the lead section by engaging enemy targets that are above, or to the rear of, the lead section. The IFV is ideally suited for this role since its high angle of fire will permit the fighting vehicle team to stay closer to the lead tank section, which reduces the excessive dispersion of the close-combat teams providing all around security. The vehicle commanders with the overwatch section (tanks or IFVs) must know the elevation capabilities of their primary weapon system, be alert to the varying heights of the buildings under which the lead elements will pass, and maintain sufficient trail distances to insure rapid, direct fire, engagement of elevated enemy positions. (Remember the 1/3 rule.) Since the lead section will probably expend greater amounts of ammunition, periodically switching positions of sections in the formation should be considered.

Corners provide a special problem for armor and you must move taking advantage of the tank's frontal armor, speed, and suppressive fire capability.

The tank firing from position 2 (figure 3.) will cover the move of the tank from 1 to 3. Once a good corner defilade position has been established at 3, the other tank can move directly from 2 to 4 to minimize flank exposure.

Negotiating a very sharp corner is even more dangerous because the side of your tank is exposed for a greater amount of time. The degree of exposure can be sharply reduced if this tank neutral steers under the protective fires of another tank and then backs into position. The *M1's* reverse speed and excellent stopping capability make this possible; however, training must encourage mental flexibility in a rather unorthodox maneuver. There are many combinations available, and the proper use of the on-board smoke generating capability will help to secure your movement.

When crossing an intersection, the lead tank will provide direct suppressive fires as necessary while the overwatch (trail) sections moves rapidly through the intersection and clears the intersection sufficiently to assume a lead section position (figure 4.) and permit the remainder of the platoon to cross. Special care must be taken to protect the dismounted infantry as they cross these open areas.

The greater the speed used to cross the intersection, the less time the flanks will be exposed; therefore, tanks

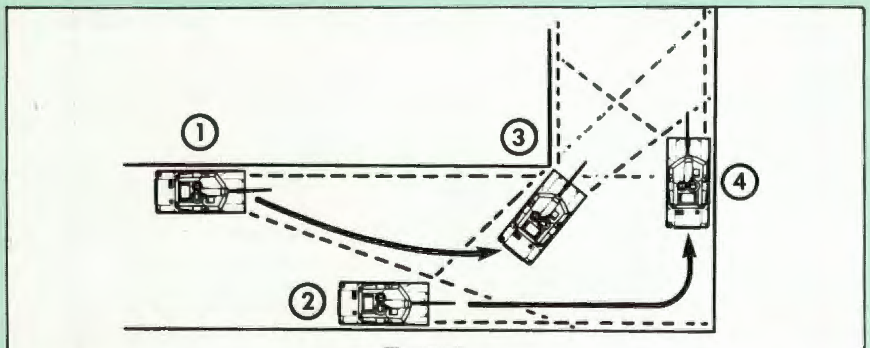


Figure 3.

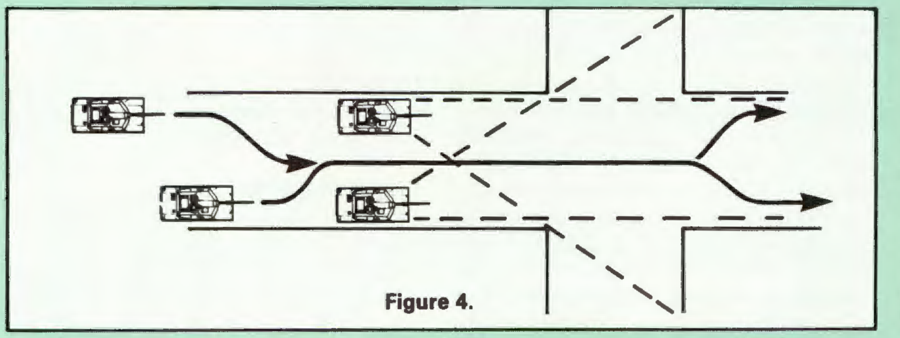


Figure 4.

should develop a good rate of speed prior to crossing an intersection. Simply put, an *M1* going 50 kph (31 mph) can cross a 40 meter (128 feet) intersection in 3 seconds.

In a defensive operation, tanks should remain in good hide positions until the enemy forces have been identified by the infantry manning OPs. Movement to preplanned firing positions should be rapid to reduce exposure time, gain surprise, and provide shock effect. When time permits, kill zones can be preplanned which take maximum advantage of the long range tank fires and combine infantry, engineer, and artillery weapons. Retrograde operations are extremely difficult since maintaining frontal armor toward the enemy, concentrating firepower to the front, and moving directly to the rear are all necessary.

Communications. Visual signals and radios remain the primary means of communication in urban fighting situations. Although the ranges of FM radios are reduced by the proximity of the buildings, platoon and company-size units can communicate while operating on multiple routes. Reporting locations to higher headquarters by radio or messenger will be difficult. Prominent structures, roads, and intersections are suitable points of reference, and aerial photographs, street maps and street plans are excellent, up-to-date navigational tools. Because the *M1* has no external interphone and will probably be moving in either the buttoned-up or popped-hatch mode, communications between the tank commander and the infantry close-combat teams will be very difficult. Hand and arm signals will be the infantryman's primary means of communicating to the tank; therefore, the infantry soldier must develop an appreciation for the limited vision of the tank commanders who will have difficulty signalling in return. Hand and arm signals of particular importance are: "I am ready", "Attention," "Enemy in sight", "Commence/Cease Firing," "Cover and Move". Additional, mutually-understood signals are absolutely necessary and should be developed and standardized. For example, an infantryman can relay the message "Enemy in sight"; however, the tank commander needs to know, "what kind of enemy threat?" Tank, personnel carrier, infantry AT weapon, mines, or obstacles? In addition, the general location should be indicated so the tank commander knows in advance to be looking above, at, or below street level. The infantry must acquire targets for the tank, and maintain visual contact with the tank commander in order to relay the appropriate information. If this sounds complicated, it will be unless you train properly in peacetime in order to execute with precision amidst the confusion of the urban battlefield.

Conclusions. Tanks must operate as part of a combined arms team in urban terrain. Infantry support is vital and artillery, engineer, aviation, and air defense assets must be used to good advantage. Cross attachment at platoon level will frequently be required during offensive operations and the infantry commander will normally control the operation. During defensive operations, tanks may be employed by platoons under control of the tank company commander if the terrain and time permit preparation of kill zones.

Training is the key to success in combat. The terrain is relatively predictable, the enemy is not; therefore, we must develop and practice combined arms techniques for urban combat that are mutually understood and still permit flexibility in execution. Tank commanders and platoon leaders must develop battle drills for the basic terrain that can be anticipated in urban areas and understand the capabilities and limiations of their weapons systems in this difficult and dangerous environment.

References

Many of the concepts in this article were first presented by the author at the Military Operations Research Society's 48th symposium in December, 1981. (See also TT 71—1.2, volume II, part IV, chapter 3.)

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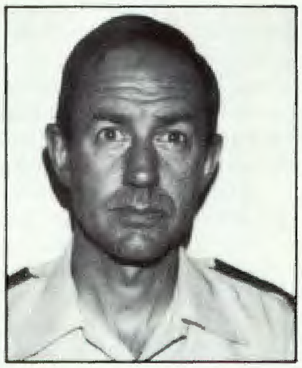
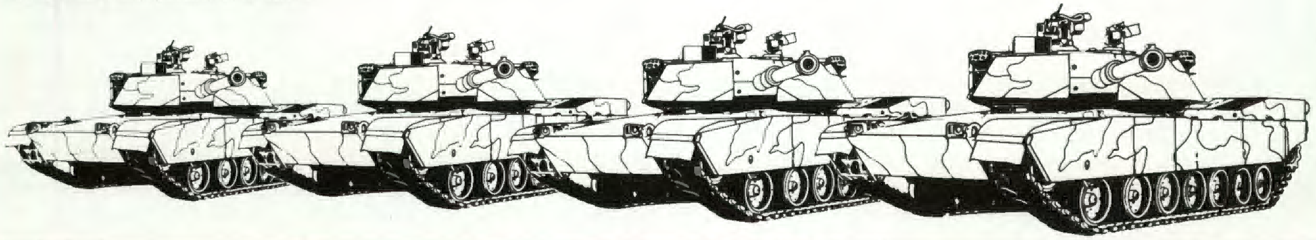


LIEUTENANT COLONEL CURTIS V. ESPOSITO was commissioned in Armor from the USMA in 1963. He has served as a tank company commander with the 1st Battalion 69th Armor in Vietnam, an armored cavalry squadron S3 and XO with the 3d Squadron, 11th ACR in Germany, and a battalion commander with the 1st (AIT/OSUT) Training Brigade at Fort Knox, Kentucky. He also served as Chief, Advanced Tactics Division, Command, Staff, and Doctrine Department, USAARMC, Fort Knox, and has been reassigned as G3, 2d Armored Division (FWD), Germany.

ARMOR CONFERENCE 1982

Commander's Report

MG Louis C. Wagner, Jr.
Commander, USAARMC



The theme of this year's conference is "The Armor Force—Teamwork in Action." We will focus on the interaction of the many activities here at the Center that are involved in the development, fielding, training and support of the Armor Force. As the "Home of Armor," Fort Knox has a tremendous impact on Armor doctrine, organization, training, and equipment and that is what we will be talking about for the next two days. For those of you who haven't been back here for a few years, we would like you to leave with a good understanding of what the Center is doing these days, and the role we are playing in providing the Army with a vital, vibrant, and dynamic Combat Arm of Decision.

But simply because we here at the Center are the official Armor proponent, the integrator of all facets of US Armor and the official contributor of the Armor aspects of combined arms doctrine, does not mean that we are the fount of all knowledge. Quite the contrary, most of what comes out of here is generated by what you all do in the field, in the armories, and in the reserve centers. We need to know what you know just as much or more than you need to know what we are doing. We need to know what your problems are, and maybe even more important, what you see as the solutions.

The first series of presenters will talk about how the Armor Center impacts on what the Armor Force is and what it should be. This portion of the conference is labeled "The Concept Developers." It could just as appropriately have been called "The Requirement," since basically that is what these folks do—determine what the organization, doctrine, training, and equipment requirements are. Force modernization generally and Armor Force modernization in particular, follows a logic that will be laid out in the first presentation. All combat developments are based on a concept—a notion of how we want to fight. In presenting this logic, The Directorate of Combat Developments (DCD) will also discuss the concept that drives the system—The AirLand Battle. We will receive a status report on the Close Combat "Heavy" Mission Area Analysis (which is a study of how our force will do against the anticipated Threat force) and see the main product of that analysis; corrective actions needed in the areas of doctrine, organization, equipment and training.

Following the DCD presentation, the Command, Staff and Doctrine Department of the Armor School will explain how they then translate the organizational and doctrinal requirements into useable form for the Army. They will also bring us up to date on the status of the changes being made as a result of this analysis. Finally, in this session, we will hear from DCD and the Directorate of Armor Aviation on some of the equipment and weapons system development that is occurring as a result of the identified requirements.

A number of years ago, a catchy little phrase appeared in the language of our trade that just about says it all when dealing with weapons system development and procurement—"Fly before you buy." The concept of testing is critical in the development process—whether for an organization or a tactical concept or for a piece of equipment. We have to know something will work before we accept it as part of the overall force structure. The systems approach means just that. A new tank system is not just a piece of equipment. It includes how we should organize and how we should fight in order to best reap the maximum benefit of the hardware's characteristics. The US Army Armor Engineer Board is the official tester of those systems here at Fort Knox and today they are going to bring us up to date on both a new gunnery procedure that they perfected and some countermine warfare systems under development. Following that, the TRADOC System Manager for the *M1* tank will present a discussion of the results of the Operation Test Number III for the *Abrams* Tank and bring us up to date on its status.

The Armor Center does more than just contribute to the determination of what the Armor Force should be. We provide the most critical component of the entire force, the people who make it work. And from your newest loader through your brigade, battalion, and company commanders, it is our job to ensure that you have quality people who can do just that.

This is a rather big school house we have here. Our average daily student population during the first quarter of this fiscal year was 6,062. Our graduates range from colonels, who will command our brigades, to senior NCOs, who will run your platoons and help conduct your gunnery programs, down through that new loader mentioned earlier. Providing armor warriors, our oldest, and probably most important function, is also probably the most dynamic thing we do. Changes occur almost daily and about the only constant is the dedication, professionalism, and exuberance of the people who make the decisions and do the training. The Directorate of Training Developments will present an overview of the current status of institutional training at the Center and will talk briefly about where we are going in the future. Then the 1st Brigade, our armor soldier trainer, will brief you on the status of a number of their ongoing programs.

I told you that our average daily student load during the first quarter of this fiscal year was 6,062. That is a fairly impressive figure, but of course it is greatly inflated by the large number of initial entry soldiers we train. The exportation of training on the other hand reached every armor soldier in the Army; in the active component in the field, in the armories, and in the reserve centers and units. Our nonresident student population alone, that is, those officers and NCO's taking professional development courses at USAR schools or through correspondence courses, exceeded 20,000 last year and will be over 22,000 this year. And of course our input to the SQT system, the publication of training literature, new equipment training teams, ARTEP development, and a myriad of other forums, all enable the Center to have a significant impact on the state of training, for individuals, crews, and units, throughout the Armor Force. This extension of our knowledge again is a reflection of the decisions made during the process started by the concept developers. There is a continuous thread that ties the system together.

The last two categories of presenters for this year's conference, the Evaluators and Standardizers and the Force Maintainers, are either the first or the last link in this chain that determines the status of the Armor Force, depending on your perspective. They are charged with determining how well the Armor Force is functioning in the field, but they also provide some of the feedback that energizes the concept developers into a new round of analysis.

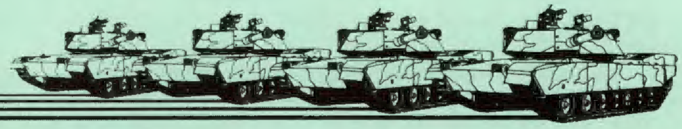
And while we are on the subject of feedback, let me emphasize that we are highly dependent upon your feedback—which we haven't been getting lately. I can count on the fingers of one hand the number of feedback items that I have received from the field in the two years that I have been commander of the Armor School. I tell everybody that comes to our school that we are not the font of all knowledge; that the knowledge is out there in the field. We need the feedback from the field in order to develop the techniques, the gunnery techniques, the doctrine and many related subjects to help us and to make sure that we do a better job. The knowledge is out there in the field where you're utilizing what we try to develop. We need your feedback and I urge all of you to present your ideas, problems, perhaps even solutions, to my staff members during this conference. And when you get back to the field, take another look at things and then write to me about them.

The Office of Armor Force Management and Standardization is my primary communications link to commanders throughout the armor community. Through visits and surveys conducted by this office, information that you provide on equipment, training, personnel and logistics problems is fed back to me and is used as input on an equal basis with that of the members of the Armor Center staff. It is also the office that coordinates my monthly letter to you.

On 2 October 1981, I became the proponent for personnel matters related to Officers' Speciality Code 12 and the enlisted Career Management Field 19. Although the responsibilities of this new function have not been fully explored, as the proponent, I provide input to the DA staff on personnel policies and programs related to the accession, career management, and separation of personnel in the Armor Force. This added responsiblity is just one more facet of managing the Armor Force and one that I have taken on with as much enthusiasm as any other job that has been given to me.

And now let us get into the meat and potatoes of this year's Armor Conference.

Keynote Address



GEN Glenn Otis, Commander, USA TRADOC

Clearly the Armor Conference is indeed a combined arms meeting this year.

I've got a few remarks that I want to share with you and the theme goes from the past to the future. For example, in the 1960's some will recall, we started working on the MBT 70. We didn't get there. By '71 we were turned completely around. We were told "You fouled up the course. You missed the mark. You couldn't do it." So we had to change our whole tune. And of course we did that. At any rate, the fact is today that we have the *M1* tank, the best in the world. But the *M1* tank was designed with 1960 doctrine and with 1970 tactics, techniques and technology in mind. And so I don't think we're going to stop with the *M1*. I'm sure, in looking at the schedules that you and your people have produced, where we're going beyond the *M1*. But I think that we ought to take a hard look at how we get there.

Actually, armor can trace its origins back many centuries. Out of the past have come some examples of where we are going and where we should be going in the armor and the combined arms forces. Let me take that into another dimension.

I said earlier that when we developed the *M1* tank, it took us so long that we were really developing a tank for the past. Today it is the best tank in the world, but it's still outdated for what we really need. It's big, its heavy, it has every weapon now under development aimed at defeating it from the top, from its flanks and from the rear as well as from underneath. And of course, it's main strength is in the front and in the rear side flanks. It has great fire-power, yet many of the other tanks in the world today are being developed just to defeat that kind of direct-action firepower aimed at brute force penetration. And so, perhaps out of the past, we'd better be thinking of where we're going.

Now, if the past has that lesson, and I'll draw from it later, let's talk about today. For the last several years our basic fundamental doctrine, was the active defense. From this stage, we have also discussed over the last several years the battle that we call the Central Battle, the battle against the second echelon, or the lack thereof, and what it means for the integrated battlefield with chemical and nuclear weapons. We talked to the extended battlefield, that is in the sense that we look deep, see deep, find and then do something about that follow-up echelon. And today's doctrine is labeled the "AirLand Battle." And what today's doctrine says is this: That armor, from the beginning, has espoused doctrine of offensive and maneuver-oriented warfare correctly. That's what "AirLand Battle" says. It says the combined-arms team ought not to be looking at how to defend, but rather how to sieze the initiative and win on the battlefield by offensive action. That's where we are. But if that's today's AirLand Battle, armor itself, within the combined-arms team, is a student to that maneuver kind of warfare. The trouble is our weapons, and those of the enemy, are all designed to defeat exactly the kind of vehicles that we have, and the kind of armor weapon systems that we've already developed. And so I suggest to you that what we must do is look downstream, decide for ourselves what the battlefield of the future will look like and decide now what the requirements are. Having made that decision, at least with all the inputs that we can, with the best evidence available, and with all the human frailities that go into it, we've got to start making everyone else think about matching the requirements with the kind of doctrine, tactics, techniques training, organization and, finally hardware, to get there. And that's what "AirLand Battle 2000." is. For the first time, our army has decided that we would look downstream two decades and tell ourselves in the best way we can what the concept of the battlefield will be for that time frame and what the doctrine and tactics will be then; a view, at least, of the concepts of the organizations themselves for that time frame and then get the materiel developers to start working to achieve the right weapons system for them . . .

"AirLand Battle 2000" says "this is the way we will fight." What's different? First of all, you'll notice it does not say we're going to defend. It says we're going to use maneuver; we're out to kill the enemy and we kill him and maneuver such that it will be he that quits, not us.

By the turn of the century our potential enemy will have at least the same qualitative capability (read that 'sophisticated weapons systems') as we will have at that time. And so don't look for that qualitative edge.

Here's what operationally our tactics and doctrine say. Major emphasis is on initiative and by that consider the following: I believe that there will be no linear operations in that time frame, that the basic fundamental cell for fighting will be something on the order of 2,000-4,000 men. That they will be autonomous, that they will have their own capabilities for survival, for logistics and resupply, and as they fight that battle, they will understand the total plan, and maximum initiative will be given to that small unit, or middle unit, commander.

The depths in the battlefield will not be in terms of lines of depth, but rather areas of depth. A different concept entirely.

Agility, meaning the quick ability to change direction, to change perception of your movements on the battle field will be present.

Another point I would make is that we must become less manpower reliant. Today's tank takes a four-man crew which means you've got to have a bigger envelope to put them in, you've got to have more armor to protect them, you've got to have a heavier vehicle. And so today the UK is producing the Challenger that's going to go to 65 to 67 US tons. Is that the battlefield weapon system we want for the year 2000 and beyond?

Furthermore, as you and I both know, the manpower characteristics of this nation are changing. As a matter of fact, the projection by the year 2000 is that 50 percent of all the people in this country will be over the age of 40. And it was only 34 percent over the age of 40 five years ago—a dramatic difference. We've got to be less manpower reliant.

But there are other force characteristics that I think are important. We need a family of fighting vehicles and a family of support vehicles. . .

Another point that I'd like to make is that the force should have built into it mobility and counter-mobility integral to the force, and a built-in survivability on the battlefield. The challenge for technology is there. The force must have the ability to cross obstacles in its stride. Today, how long does it take you to take a combined-arms armored brigade across the Rhine River? And if we put in three tank ditches, guarded on either side by minefields, how long will it take you to get that armored brigade through that? We've got to find out how to get across those kind of obstacles without the delays and disruptions that we have today. And it's feasible.

Finally, in order to be able to take that concept and flesh it out we divided it into certain functional areas, forces, doctrine, tactics and materiel. The commandants of the schools and centers associated with these functional areas have now taken that AirLand Battle 2000 doctrine and its concepts and have fleshed it out in each one of those areas. And those studies are now available, and you'd be surprised to see the in-depth work that has been done to organize, train and equip the force for the year 2000.

Now we are not alone in our army in looking ahead. Let me tell you some of the things that I've learned from our sister nations. From Germany: "We need an armor-piercing, high-explosive machinegun, possibly with special ammunition for use against helicopters. And we are going to focus on enhanced vehicle acceleration and rough terrain capabilities."

From the UK: "Firepower remains the prime characteristic, but it should be divided into five further areas: lethality, accuracy, rate of fire, fire control and the application of fire under major meteorological conditions. Survivability is the second new characteristic and is divided into protection, size and agility.

Availability is another characteristic of equal priority to survivability and it is divided into maintainability, reliability, repairability and mobility. The UK tank of the future will be between 45 and 50 tons. And while making full use of the NATO 'rail gate' for width, it will be shorter than the current type. The frontal aspect of the hull will be made of aluminum and will be very similar to current tanks, but perhaps six inches or so lower. The frontal aspect of the turret, if it has one, will be about half that of present tanks. The gun may be a 120-mm and it may be either in an external or internal configuration. It will be fed by an automatic clip-fed magazine. The engine will be alongside the driver, the crew will be three, hopefully two, and they will have excellent protection from the frontal aspect. They will also have flank and overhead protection. From France we hear, "We are thinking as the Germans. We see an increased armor-piercing capability with a 120-mm gun firing fletchettes. At least the same potential for day and night fighting. Increased mobility with more powerful engines with a better horsepower to weight distribution and a weight increase of from 18 to 30 tons. Also, better realiability and maintainability, additional consideration for better protection, especially from a top attack with a shaped charge, and indirect protection with a reduced silhouette."

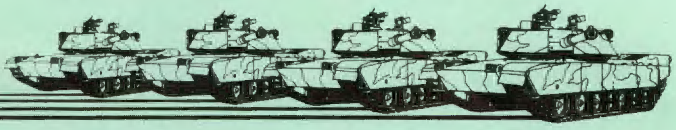
I'm not critical of our allies, I think that the idea that each of the nations is looking downstream for perhaps two decades, and is asking itself first, how will we fight—what will the battlefield look like, and then how we can organize and train, and only thereafter, asking for the materiel solution is the right system.

Let the weapons system and the technology do a lot of the integrating work, leaving the crew free to fight. Probably one of the most exciting things in electronics is that it gives us the final link in the chain to bring the combat vehicle and its crew into an integrated battle system.

What I've tried to show you is just in capsule form. It's some of the thinking now underway that stems from the army's total community attempt to project into the future.

There are lessons in history that it pays us to learn from. There are also lessons today that it pays for us to learn from. I suggest that if we stand still and do not reach out and challenge the mind, 20 years from now we will find ourselves with weapons systems designed to fight on the battlefield of the 1980's. And that isn't where we ought to be. That's why I am very confident that with the forward-looking commanders that we have today, coming together and putting these concepts down, that in the year 2000 when the Armor Association has its 110th meeting, they'll look back and say, "Well the legacy wasn't all that bad, but here's where we ought to be looking for the year 2020."

The Developers and Testers



Directorate of Combat Developments

The Directorate of Combat Developments is involved in force modernization. This force modernization system is bracketed squarely into a very important logic called the Concept-Based Modernization System (CBMS).

The concept-based system begins with several things flowing into the TRADOC commander's concept guidance. We overlay the Army's missions with views of expectations of the world at some future time, while maintaining a historical perspective. Many of the expectations of the world will be rolled into a Red battlefield development plan that predicts what our potential opponents will be like at a point in time. Ideas being explored at our various TRADOC centers—for example, the future fighting vehicle system exploration—and DARCOM labs and civilian defense industry also feed into the commander's concept guidance. This guidance—a document called AirLand Battle 2000 (ALB 2000), details how we want to fight. The basic guidance will be given fresh impetus in a series of concept statements and finally into operational concepts that begin to get at the "how" we do what we want to do.

The next part of the system is our own battlefield development plan (BDP). The first three versions of the BDP were done by way of a concept assessment, which was generic, not rigorous, in order to get a feel for the ground. Subsequent BDP's will be far more specific and rigorous and will involve the armor team. The TRADOC commander's concept guidance is given form by way of concept statements and operational concepts. There are two simultaneous development packages underway: ALB and ALB 2000. ALB 2000 is still very much at the concept guidance and operational concept stage. On the other hand, ALB is current doctrine spelled out in TRADOC PAM 525-5 on Corps 86 operations and others in the 525 series. The soon to be released update to FM 100-5 when added to our foundation manual, FM 100-1, which spells out the principles of war and who and what we are, will be the cornerstone of this doctrine. Numerous development activities in the directorates at Fort Knox are underway and are based on ALB doctrine—they include new company and battalion field manuals, training guidance for the 1990's, and others.

We are most interested in the close combat operational concept and we are developing this concept in conjunction with other centers and Fort Leavenworth is the ultimate proponent. Other proponent centers will undertake a mission area analysis (MAA), examining current and projected tasks of the mission area and capabilities. Several MAAs are complete, several, including ours, are nearly complete.

The results of the various MAAs are rolled together in a new BDP. The subsequent BDP that programs resources and mandates actions in the form of requirements to overcome shortfalls in capability, will track a deficiency out of one of the MAAs, along with its corrective action. The BDP might mandate improvement of doctrine, creating or modifying an organization, improving training, or developing a new hardware item. Hardware or materiel development may not be the best way to solve a problem. Changes in doctrine, roles and missions, organizations, or better or different modes of training are far more timely, and far less costly than new hardware.

ALB comprises an earlier concept that spelled out operations on an integrated and extended battlefield. (See *ARMOR* January-February 1982).

With the current ALB we have approved operational concepts—we know what to do, and roles and missions are defined within the functional concepts. It remains for us to determine, *in detail*, our capability to undertake what we want to do with forces in being and those programmed to improve the force. This is being done in the MAA.

The results of our MAA will feed directly into the follow-on BDP that will prioritize in one list the corrective actions indicated in all the functional areas and that will be a primary document for programming and budgeting actions at DA. Our MAA will lead to an action plan for close combat that will direct other development activities.

Some of the more relevant programs with which the MSDDCD is involved include the *M3* cavalry fighting vehicle (CFV); the military motorcycle; the armored forward area rearm vehicle (AFARV); the mobile, protected gun; and the future close combat vehicle (FCCV).

The CFV is part of a major force modernization program and under Division 86 structure will be found in standard six-CFV, 30-man scout platoons, in both tank and mechanized infantry battalions. It will also be found in the cavalry troops of the heavy Division 86 armored cavalry squadron, as well as in the Corps 86 armored cavalry regiment's cavalry troops.

There has been some mission realignment for the armored cavalry under Division and Corps 86 concepts, and the divisional cavalry squadron's primary role will be reconnaissance and surveillance. The squadron will not have the traditional security role and will no longer be considered a maneuver element. The squadrons will convert to Division 86 structure upon receipt of the CFV. The armored cavalry regiment retains the security mission under Corps 86 and conversion to that structure will take place upon receipt of the CFV.

The *M2/3* was type classified in February 1980 and is now in production and the first tactical unit to be equipped with the CFV will be a scout platoon of a mechanized infantry battalion at Fort Hood. The battalion will get the CFV and the IFV simultaneously in order to conduct the force development testing and evaluation (FDTE) on which the initial operational capability will be stated. The FDTE is being held to verify the supportability of the *Bradley M2/3* in a field environment. During the FDTE at Fort Knox during the summer of 1980, some operational deficiencies in the design were found and the MSDDCD is working closely with the TRADOC systems manager at Fort Benning and the project manager in Detroit to make the necessary changes.

Another product with which the MSDDCD is closely involved is the military motorcycle, a very versatile piece of equipment. It has excellent cross-country mobility, agility, and speed. It also offers a secure and reasonably prompt means of internal and external communication, as well as liaison and transportation—provisions that certainly are needed within a reconnaissance unit, especially when electronic jamming will be the rule on future battlefields. The motorcycle will be found in all type divisions.

Within armor units, the motorcycle will be found at almost every level and in order to fulfill a variety of missions it will have selected auxiliary equipment varying from unit to unit.

The armored forward area rearm vehicle (AFARV) will serve to obviate the long-standing problems in the ability of wheeled vehicles to accompany the Armored Force's tracked vehicles. This problem becomes even more critical in the AirLand Battle setting when we must commit our forces to deep strikes and, in turn, maintain crucial ammunition and fuel supplies well forward to accomplish resupply to maintain the momentum of the force.

The new AFARV will provide the combat trains with a vehicle offering protection and mobility, one that is capable of accompanying the maneuver force because it is no longer feasible to withdraw combat units from the line to rearm in a rear area.

Under Division 86 concepts, wheeled vehicles still accomplish the long haul back to the ASP and ATP and return to the field trains base. Ammunition is then moved to a forward point where it is transferred to the AFARVs. These vehicles are loaded with predetermined tank ammunition or missiles, move forward to the battle area and remain on call to rearm the fighting vehicles. During offensive operations and counterattacks, the AFARV will accompany the fighting elements to provide the added support capability to maintain the momentum of the maneuver force.

The AFARV was tested by the Armor and Engineer Board last year at Fort Knox. It was run in a head-to-head mobility comparison with the *M1* tank and it came out very well, indeed.

The AFARV will be in tank and mechanized infantry battalions and in cavalry squadrons. We expect some reduction in the number of wheeled vehicles. One immediate benefit of the AFARV will be the unit's ability, for the first time, to transport its full basic load.

The MSDDCD is also investigating new ammunition packaging in an effort to solve the age-old problem of two-round boxes that require a lot of time and labor to load, unload, and open.

The MSDDCD is also developing requirements documents for other support systems, such as the maintenance vehicle, the command and control vehicle, and the NBC reconnaissance vehicle.

The Armor Center is deeply involved in the definition of a light, armored fighting vehicle system and it is apparent that both the Army and the Marine Corps have a need for such a system.

Strategic and tactical transportability has been directed as a priority characteristic of this system. It must be air transportable by *C-5A* and *C-141B* aircraft as well as by *C-130* aircraft. Additionally, the Marine Corps requires the system to be transportable by the *CH-53E* helicopter. The mobile, protected gun is needed to provide a highly mobile and survivable antitank capability and is not intended to replace the tank.

The Armor Center, in cooperation with the Tank Automotive Command, is involved in a program oriented toward developing the successor to the *M1* tank and *M2/3*.

The main thrust is a program called future close combat vehicle (FCCV). The object is to develop a family of combat, combat support, and combat service support vehicles that have as many common components as possible and that take advantage of the most advanced technologies.

Some technical and tactical alternatives have been identified and need to be evaluated. They are, how do you build and then employ an externally-mounted gun vehicle with an automatic loader and a remotely-positioned crew? These problems are being studied in two related programs called surrogate research vehicle (SRV), and tank test bed (TTB).

SRV is a research turret mounted on an *M1* chassis. It will be delivered to Fort Knox this year and will be used to study variations in crew function, crew location and target acquisition subsystems.

The SRV should provide basic research information which can be used in the TTB program. The results of these programs could lead to full-scale engineering and experimentation starting in the early 1990's.

A second program which will feed the FCCV is the TTB. Contracts will be issued for the design and construction of a technology demonstrator vehicle employing a modified *M1* chassis, an external 120-mm gun, an automatic loader and a three-man crew.

Armor and Engineer Board

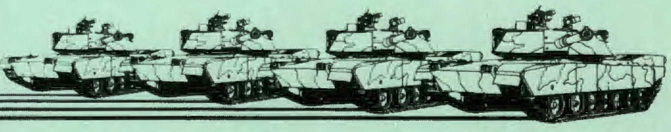
Tests were run this spring on two countermine devices. The first was, the Robotic Obstacle Breaching Assault Tank (ROBAT), and the second was the Vehicle Magnetic Signature Duplicator (VEMASID).

The ROBAT consists of a remotely-controlled *M60* chassis, a mine-clearing roller, a Marine Corps line charge and rocket, and a cleared-lane marking system. The VEMASID uses an inductive coil and projects a magnetic signature ahead of and to the sides of a tank, causing magnetic-influence mine fuses to detonate prematurely.

The countermine systems Concept Evaluation Program (CEP), is scheduled to begin soon, using four scenarios: armor alone, armor and mechanized infantry, armor, mechanized infantry and engineer, and engineer alone. The systems being discussed are the *M1* adapter with roller and improved track-width mine plow, full-width plow, Cleared Lane Marking System (CLAMS), Cleared Land Explosive Widening Proofing (CLEWP) and the *M1* dozer attachment.

CLEWP can clear an 8-meter-wide path through minefields. CLAMS uses chemilumenescent light sticks for both day and night marking of cleared lanes in mine fields.

The Trainers



1st AIT/OSUT Brigade, Armor

The 1st Brigade provides initial entry training for the 19K (M1 tanker), the 19E (M60 tanker) and the 19D (Cavalry scout). They train approximately 10,000 initial entry soldiers each year. The 1st Brigade is organized into four tank battalions and two cavalary squadrons. M1 training is conducted in the 1st battalion while the 2d and 4th battalions train on the M60A3. The 5th and 6th Cavalary squadrons train on the M113 and the M901. Programs of instruction are

13-weeks for the 19D trainees and 14-weeks for the 19E and 19K trainees.

Soldier quality in training has been good. There is a positive trend in the number of high school graduates who are entering training and these people enjoy a much greater rate of success than do non-high school graduates. In the M1 training, non-high school graduates attrite at a 3-to-1 ratio over the high school graduates.

In the area of scout training we note that the average scout is a year younger than the tanker trainee.

During the past year, a one-week expansion in training programs has come into effect to permit an expansion of basic training and physical training subjects. The 19F Military Occupational Specialty has been eliminated and all tankers are again trained as gunner, loader and driver.

More hours of instruction are now presented in less time than was required under the basic combat training'advanced individual training (BCT/AIT) program. Under the latter a total of 700 hours were presented in two 8-week courses. Under the (OSUT) there are three courses, two of 14-weeks and one of 13-weeks, and a total of 2,267.5 hours are presented. Additional changes are being made that will, hopefully, significantly raise the level of training performance during initial entry training.

The challenge that faces us now is to create an environment in the rest of the army that will sustain the level of performance at which the new soldier has been conditioned to operate. The new soldiers entering the tank companies and cavalry troops are training to a level of proficiency that exceeds that which their leadership acquired in earlier years. They demonstrate greater self-descipline, they can do more push-ups, more sit-ups, run farther, know their equipment better and are prepared to subordinate their will to professional leadership.

When new soldiers report to your unit, you must demand that they stand tall, work hard, achieve excellence daily in training, maintenance, and physical fitness in order that they may sustain a level of performance that they have been conditioned to expect here in the training center. Your capacity to employ their full potential is the only limitation upon their potential contribution. The bottom line is: our army is entering a revolutionary period. It couples modern equipment with modern instructional techniques. The synergism produced by these comprehensive and systemic improvements to our fighting forces can produce a quantum jump in the fighting capabilities of our units.

Weapons Department

Each tank in the active army is allocated 166 rounds of main gun ammunition for annual gunnery training. However, the cost of training prevents the frequency of training that would sustain proficiency. Most armor units have two gunnery training periods a year, after which crews are proficient. However, proficiency drops rapidly after the training period and more ammunition would be needed to maintain proficiency. But ammunition costs are sky-rocketing and the Congress is questioning the current main gun allocation. We realize, and accept, that 166 main gun rounds per tank per year cannot be sustained. How much that allocation can be reduced depends on tank gunnery devices using substitution, minaturization, and simulation.

Tank crews train and qualify on the tank tables and during the Army Training Evaluation Program, using the main gun and three tank-appended devices. On Tables I through IV they use the *Brewster* device, a bracket mounting either a low-intensity, eye-safe laser, or the M-16 rifle. These are used on the scaled range target system (SRTS) of which there are about 100 in the field, but they are not well supported. A type-classified, fully-supported SRTS has been approved and will be fielded within the next two years.

Telfare is the best available device for Tables V, VI. It uses a .50-caliber machinegun and is suitable at ranges less than 1,200 meters. When boresighting, zeroing, and zero retention procedures in TM 9-6920-374-12 are followed, and range limitation is held, *Telfare* is effective.

A simulation system called Multiple Integrated Laser Engagement System (MILES) is used for tactical training. It is not a precision gunnery trainer. The following devices are being considered for future training.

- *Tank Gunnery and Missile Tracking System* (TGMTS). This tank-appended laser device uses rear-screen movie projection and is now being used in USAEUR as a unit trainer where it is considered effective in training the 122 tasks listed in AT 17-12-2-1.
- *Tank Weapons Gunnery Simulation System* (TWGSS). This system is being evaluated at the Armor Center. An off-the-shelf device, the *BT41*, by SAAB, has been purchased to be used to determine if a tank precision gunnery trainer is a valid concept. Xerox, producer of MILES, is working on a product improvement to give MILES a precision gunnery capability to meet TWGSS requirement.
- *Perceptronics MK60*. This is a Defense Advanced Research Projects Agency project which has resulted in a video disc-based gunner's station trainer for the *M60A1*.
- *Conduct of Fire Trainer* (COFT). The COFT appears to be the most promising device. It uses computer-generated imagery to take the tank commander and gunner through a scenario that progresses from the simple to very challenging. Existing COFT software contains over 200 scenarios.
- *Eye-Safe Laser Rangefinder* (ESLR). A filter method of making the *M60A3* rangefinder eye-safe, will make it possible to conduct operational and maintenance checks as well as training on the laser rangefinder in the motor pool or on any size range. It can also be used in force-on-force exercises.

Unit tank gunnery will continue to use the *Brewster* or *Telfare* on all but Table VIII. They require a full-up tank and a range for training up for qualification gunnery. The main gun will be fired, as a minimum, on Table VIII. The Weapons Crew Training Study should determine if additional main gun firing will be necessary. The COFT will provide the capability to sustain gunnery skills in garrison. The TWGSS will add a capability to MILES that will allow precision gunnery training on all tables except Table VIII, and the Perceptronics MK60 holds promise as a part-task trainer for use in conjunction with the COFT.

Institutional tank gunnery training strategy for the future is to continue to use subcaliber, decrease the number of main gun rounds fired, and incorporate TGMTS, ICOFT, PCOFT, and TWGSS into the gunnery programs. The TGMTS could be used in the near term before being replaced by the ICOFT in 1986. The ICOFT will be used for training up to Table VI and additional training on Table VII. The PCOFT will be used for reinforcement training on Tables I through VII and give us a capability to simulate a platoon battlerun. The TWGSS will improve MILES and give us the capability to simulate all Tables except VIII.

The Armor Center believes that a minimum of a Table VIII qualification will continue to be necessary at unit level, and some main gun firing will continue at Fort Knox because there will always be a need to fire the main gun in training to give individuals and crews the experience generated by live firing.

Command, Staff and Doctrine Department

The Armored Officers Basic and Advanced Courses have been modernized by incorporating Division 86 initiatives and concepts. The courses are tough and demanding and emphasize competition, leadership, physical readiness, and technical and tactical proficiency.

The Command, Staff, and Doctrine Department (CS&DD) is responsible for these courses as well as for doctrinal literature and initiatives. Emphasis is placed on integration of combined arms at battalion level with the formation of company teams when necessary based on the factors of mission, enemy, terrain, troops available (METT). Combat service support (CSS) stresses a push system with emphasis on fueling, arming, and fixing forward. Initiative and freedom of action is required at all levels, with a philosophy of maneuver being critical to all operations.

Doctrinal literature for conversion to Division 86 organizations is a major responsibility of CS&DD that consists of three projects: updating the H series manuals, incorporating new concepts from FM 100-5, *Operations*; writing transitional texts to aid units in the field as they prepare to train and fight with new organizations and mixes of equipment, and developing a set of Division 86 manuals on new equipment, organizations and doctrine.

H-series manuals include FM 71-1, *The Tank and Mechanized Infantry Company Team*, FM 71-2, *The Tank and Mechanized Infantry Battalion Task Force*, and FM 17-95, *Cavalry*.

Transitional texts (TT) on How-to-Fight doctrine, tactics, and techniques for transition to Division 86 are: TT 71-1/2, *The Abrams Battalion*, TT 17-95-1, *Divisional Cavalry Squadron*, and TT 95-2, *The Armored Cavalry Regiment*. TT 71-1/2 includes the platoon, company, battalion, and transitional mix and was fielded in April. The coordinating draft of TT 17-95-1 was distributed in May and the coordinating draft of TT 17-95-2 was fielded in February.

Division 86 manuals covering new equipment, new organizations, and new doctrine include: FM 71-1(J) and FM 71-2(J), which will evolve from FM 71-1/2; FM 17-95(J), which will evolve from TT 17-95-2; and FM 17-36(J), which will evolve from TT 17-95-1. These are scheduled to be fielded in FY 85. However, transition training texts for the *M1* battalion and the armored cavalry regiment are already fielded. The transition training texts for the Divisional Cavalry Squadron are intended for use by units in the field and TRADOC schools as interim doctrine until DA field manuals are produced.

The Armor Officer Basic Course (AOBC) is a tough, two-track, course that prepares the newly-commissioned officer to lead either a tank platoon or a cavalry platoon. The tank platoon track is 15-weeks long and is divided into an *M60* track and an *M1* track. The cavalry platoon track is 16-weeks long with extensive training in reconnaissance and security. By January, 1983 all AOBC tactics instruction will be geared to Division 86 doctrine and organizations.

The AOBC is demanding; rigorous academic performance standards coupled with demonstrated leadership potential are among the requirements for graduation.

The Armor Officer Advanced Course (AOAC) prepares combat arms officers for company level command and battalion and brigade level staff positions. It is attended by senior first lieutenants or junior captains from armor, infantry, field artillery and other branches of the active and reserve components and armor officers from the US Marine Corps. Armor officers from foreign nations also attend. Primary instructional emphasis is placed at the company and battalion level with planning and execution stressed. The 26-week course includes some 950 hours of academic instruction with overall emphasis on tactics and leadership and a solid base of fundamentals in gunnery, maintenance, combat support and combat service support. All tactics instruction is being converted to reflect Division 86 organizations and equipment.

The integration of doctrine and instruction in the CS&DD not only insures that doctrine reflects the current thinking of instructors, but that instructors understand the operational and organizational concepts, and "how to fight" techniques contained in the most current field manuals. It further ensures that graduates of all courses are thoroughly grounded in the same doctrinal techniques published in current manuals with emphasis continually shifting to Division 86. All graduates are challenged both mentally and physically, making them tactically and technically proficient, physically fit, highly motivated and thoroughly prepared to lead our soldiers at platoon or company level.

Directorate of Training Developments

The Armor Center trains soldiers at Fort Knox to less than Soldier's Manual (Job) Standards because we have to look at the Total Army's needs, and its ability to pay the bill; and we have to learn to live with some trade-offs.

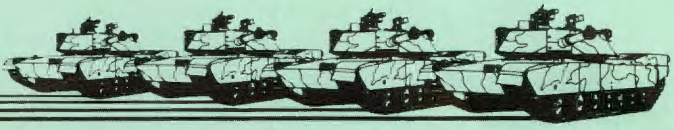
The less time the enlistee spends here, the longer he is available to man the force. Every tank we can do without at Fort Knox is available to the force. If we extend a course, add equipment or more instruction, we need more trainers—specifically NCOs, who are already in short supply. It is not cost-effective to burn up a lot of rounds and fuel for every soldier if we don't know he will be assigned as a gunner or driver. His first assignment is likely to be as a loader. With the large soldier output at the Armor Center, range time is critical. Finally, in the case of tankers, they cannot train to proficiency until they become part of a team—the tank crew.

In completing the refining of the "train the trainer" concept, the Master Gunner courses have been purged of tasks not unique to the Master Gunner. A new, 2-week, course has been specifically designed for *M60A1* Master Gunners assigned to units that have been transitioned to the *M60A3* tank. Also developed is a two-week *M1* transition course for *M60* series-trained NCOs who will use the *M1*. A similar transition course is being developed for NCOs who will use the *M3 Bradley* cavalry fighting vehicle.

The Center is currently developing 48 training literature products covering the general areas of gunnery, crew drills, platoon drills and Army Training Evaluation Programs. (ARTEP). The FM 17-12 gunnery manuals are being revised into system-specific manuals needed by the crews of particular weapons systems. New drills are being designed to allow crews to practice both individual Soldier's Manual tasks and collective tasks in a multi-level training environment. The FM 17-13 series will cover these drills.

A proposed FM 17-15, *Platoon Training*, manual series will be designed to support training of armor and armored cavalry units. The recently-fielded ARTEP 71-2 is awkward and we are looking at a new ARTEP format designed to break out each echelon and element of the battalion or squadron. We will also design tank and cavalry platoon tests, in coordination with Army Training Support Center, that will cause the principal fighting elements to show they have achieved proficiency by training to ARTEP standards.

The Evaluators



Office of Armor Force Management and Standardization

Force modernization is the army's greatest challenge and the Office of Armor Force Management and Standardization (OAFMS) maintains close contact with force modernizers worldwide. OAFMS is organized around the major subsystems of Armor— personnel, logistics, and training and is supported by a Systems Information Division. Major shortcomings are identified and actions are recommended that consider effects on the personnel, logistics, and training subsystems. OAFMS offers Armor two primary services. One is a concentrated effort to bridge the communications gap. Timely and accurate information is essential for effective, efficient decision making, but the key to any modernization effort is the Armor community and OAFMS relies upon frank, frequent input so Armor's concerns can be expressed in modernization circles. The second service involves force standardization. An OAFMS committee comprised of the directors of the developmental agencies, Reserve component (RC) advisors, and the Noncommissioned Officer Academy Commandant identifies topics for inclusion in the Standardization Program and reviews their implementation.

Feedback to the committee is obtained through Branch Training Team (BTT) visits.

Specalty Proponecy is yet another OAFMS responsibility and has been previously discussed in ARMOR magazine (See "Commander's Hatch," May-June, 1982 issue).

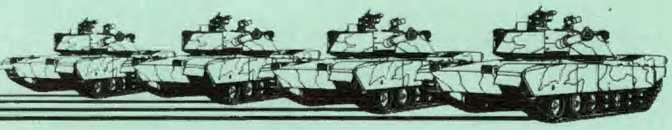
Force Evaluation is the fourth major function of OAFMS and is directed at processes and systems which support the armor force. The purpose of evaluation is to establish a data base from which decisions can be made that address the needs of the force. BTT contacts with units will be directed at specific needs so that the data base can be validated, deficiencies identified, and cost-effective solutions derived. The BTT is the most effective means of communication available to OAFMS for, in addition to providing information to the field, it gathers data that is used to recommend improvements Army-wide. BTTs visit both RC and Active Army units.

The U. S. Army Armor Center Commanding General's Letter is another OAFMS responsibility in which information is provided to every battalion or squadron in the force.

The Armor Update Conference updates personnel throughout the force on current developments in doctrine, tactics, logistics and personnel.

The *M1* Training Effectiveness Analysis (TEA) is a 2-year project to evaluate the effect of the total training subsystem on unit proficiency in selected individual and collective tasks. It will identify training system strengths and weaknesses among several *M1* battalions. TEA methods are fully expected to serve as models for future evaluations as users and developers work to assess the effectiveness of the *M1* training system.

Closing Remarks



MG Louis C. Wagner, Jr., Commander, USAARMC

It has been a very quick two days. It is a shame that we do not have the luxury of devoting a full week to these annual meetings.

I hope that we have been successful in accomplishing the purpose of this year's conference; to let you know what we are doing about fielding and supporting a strong and viable Armor Force. You certainly ought to know now who here is working what problems and who you should contact with yours. That is very important.

As I said in my opening remarks, we need to know what you are doing just as much as you need to know what we are doing. If you are not sure who to contact, write to me. That is one of the reasons why I am here and I will get the right guy involved and make sure that he gets back to you.

And finally, I want to express my appreciation to all of you for attending the conference this year. I hope it has been as professionally rewarding and personally enjoyable for you as it has been for me. I wish you a safe journey home.

Summary

The 1982 Armor Conference produced more material than could be printed. Some presentations, unfortunately, had to be omitted.

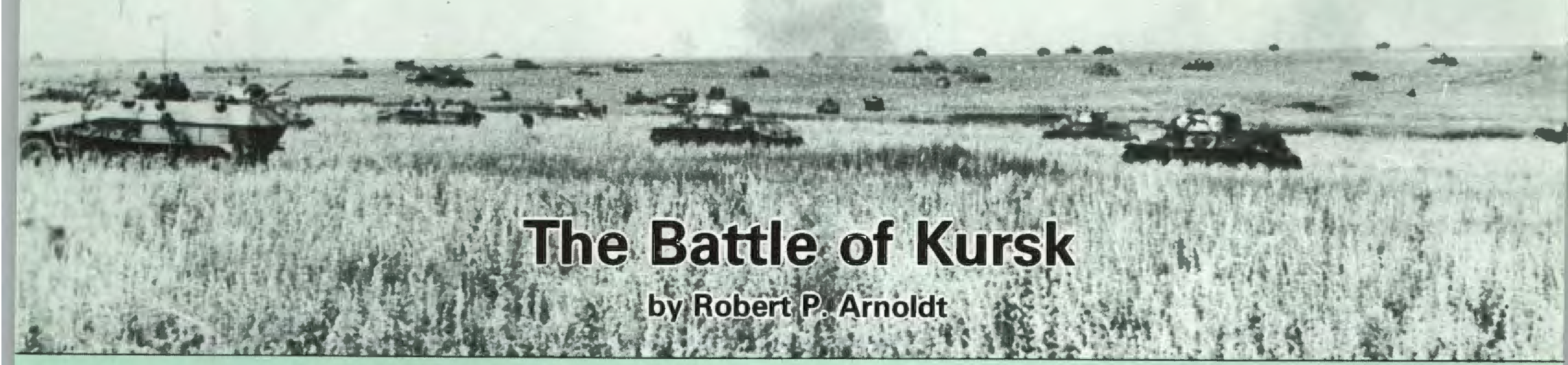
The Department of Armor Aviation covered the ongoing helicopter development programs that include the Army Helicopter Improvement Program (AHIP), the *Cobra 2000* Program, the AH-64A *Apache* Program, the Light Helicopter experimental program, and the Light Combat Helicopter (LCH) Program.

The TRADOC System Manager, *M1* covered the outcome of the OT III of the *M1 Abrams* tank conducted at Fort Knox, KY, and Fort Hood, TX. (See *The Best Tank Ever Built, ARMOR*, Jan-Feb 1982.)

The Directorate of Training Development and the instruction departments detailed training improvements in their areas.

The Directorate of Combat Developments detailed the AirLand Battle concept (See *Armor in the AirLand Battle*, Jan-Feb 1982 *ARMOR*.) The Office of Armor Force Management covered Special Proponency that has been detailed in "Commander's Hatch," May-June 1982 *ARMOR*.

Major General Fred K. Mahaffey detailed the challenges of integrating the *M1 Abrams* tank into the 3rd Infantry Division in Europe.



The Battle of Kursk

by Robert P. Arnoldt

Following the Stalingrad disaster, the German armies on the southern front in Russia were driven back under renewed Russian pressure. One German success during this period was the recapture of Kharkov on the River Donetz in March 1943. However, this victory created an easterly pointing salient north of Kharkov approximately 15-20 miles deep and running some 120 miles north to south. Near the center was the city of Kursk.

In April 1943, Hitler had proposed a massed armor and infantry attack to eliminate the Kursk salient and the Russian armor and infantry units there. The plan was to be a typical double envelopment with General Model's IX Army striking from the north and General Hoth's IV *Panzerarmee* from the south. They were to meet east of Kursk. Elite SS and Panzer units were involved—the cream of the *Wehrmacht* offensive forces. The troops were willing, the armor available, the plan good, but delay and procrastination foredoomed Operation *Citadel*. General Heinz Guderian epitomized the operation as a "Death Ride." He was correct.

This account will examine the German motives, planning and execution of Operation *Citadel* and the Russian counter-measures.

German Preparatious. The spring of 1943 saw the *Wehrmacht* and the *Luftwaffe* recovering from the first major Russian winter offensive. Losses in men, aircraft, tanks and supplies had been enormous, and the knowledge that they were still retreating weighed heavily on soldier and general alike.

With the spring thaw, however, the situation improved somewhat. General Erich von Manstein's masterful recapture of Kharkov, and his rout of Russian units there, were a needed tonic. Manstein's Army Group Don had performed a near miracle.

A comparative lull which was to last through April, May, June and into the first days of July, settled on the front. During this period, the German High Command was pondering a plan proposed by General Zeitzler, Chief of the Army General Staff; a plan introduced to implement Hitler's request for further offensive action to follow up von Manstein's Kharkov victory. The overall concept was to eliminate the Kursk salient created by the Kharkov success, and initial staff meetings began in April, 1943. Such notables as Albert Speer, Reich Minister of Production, Generals Heinz Guderian, and Erich von Manstein and Hitler attended. General Guderian, then Inspector-General of Armored Troops, outlined the staff problem:

"*. . . The problem under discussion was the extremely important one of whether Army Groups Center and South would be in a position to launch an offensive on the Eastern Front in the foreseeable future – that is to say, during the coming summer of 1943. This had arisen as a result of a proposed operation by the Chief of the Army General Staff, General Zeitzler, who envisaged a double envelopment attack against the big Russian salient west of Kursk; such an operation, if successful, would destroy a large number of Russian divisions, would decisively weaken the offensive strength of the Russian Army, and would place the German High Command in a more favorable position for continuing the war in the East. This question had already been eagerly discussed in April; but in view of the heavy blow suffered so recently at Stalingrad, and of the consequent defeat of the whole southern flank of the German Front in the East, large-scale offensive operations seemed scarcely possible at the time. But now the Chief of the General Staff believed that by employing the new* Tigers *and* Panthers, *from which he expected decisive successes, he could regain the initiative.*"[1]

Hitler, as usual, dominated the meetings. The problem was that he was beginning to lose his touch for quick, decisive, action. After receiving the opinions of those present, Hitler deferred a decision and left the others with nothing gained. Time was running out, and Guderian, von Manstein, and the others directly involved, were painfully aware of that fact, even if Hitler chose to ignore it.

On 10 May, General F. W. von Mellenthin, then a staff officer at headquarters, 48th Panzer Corps, reported that Guderian, after attending half a dozen pointless meetings, realized that the Kursk operation was pointless and a waste of the crack Panzer troops committed. General Guderian begged Hitler to give it up. The optimum time for the offensive, code-named Operation *Citadel,* had passed with the first spring rains. Each day brought more Russian strength to the salient. Hitler, von Mellenthin states, replied:

"*. . . you're quite right. Whenever I think of this attack, my stomach turns over.*"[2]

And yet, Hitler acquiesced. Under pressure from hawks such as Goring, Zeitzler and Field Marshal Keitel, and other General Staff officers, and ignoring the saner advice of generals such as Guderian and that of Albert Speer, Hitler consented to the commitment of 36 Panzer, Panzer-grenadier, and infantry divisions to an operation more risk-prone than any other taken by the German forces in World War II: for if *Citadel* failed, there would be no second chance.

The basic plan was simple, as are all good military plans. Two Panzer armies, the IXth and the IVth, were to advance toward each other across the base of the salient and meet east of Kursk. The combined armies would then advance north and east into the Russian heartland, capturing Moscow in the process. The plan offered the Germans, at least in April and into May, the opportunity to use their superior training and tactics to the best possible advantage. As time passed, the positive factors of surprise and local superiority faded and then died.

Hitler's indecision in choosing a D-Day for *Citadel* was cloaked by the excuse of waiting for *Panther* and *Tiger* tank units to join those preparing for the offensive. As of May, none of the 200 *Panthers* or 94 *Tigers* were ready; nor were they ready for action in July.

The operational plan went full ahead, even though the D-Day date was continually moved back.

The IXth Army, commanded by Colonel-General Walther Model, would attack from the north with seven Panzer, two Panzer-grenadier and nine infantry divisions. Colonel-

General Herman Hoth, in command of the IVth *Panzerarmee,* was to move from the south with 10 Panzer, one Panzer-grenadier and seven infantry divisions. Nine hundred thousand men and 2,700 tanks and assault guns were committed. Two thousand combat aircraft were to provide close support.

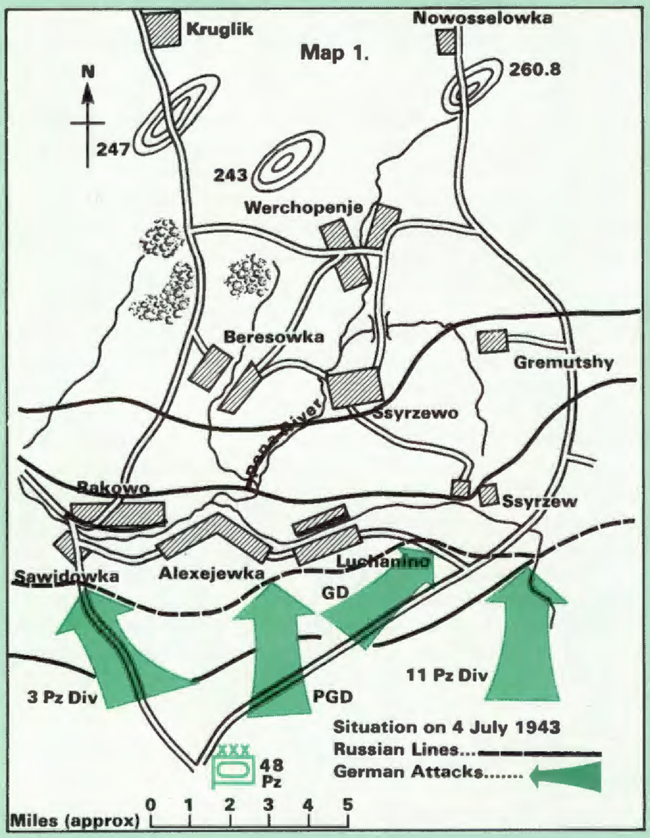
In addition to the Panzer and infantry units committed, several special units and new weapons were brought in. One unit in particular was singled out for the most involved and dangerous assignments. This elite organization was the Panzer-grenadier division, *Gross Deutschland.* This specially equipped, highly motivated, force was put under command of the 48th Panzer Corps of the IVth *Panzerarmee* and would fight with two hardened, veteran Panzer divisions, the 3d and the 11th. (Ed. Note: German Army units with a name instead of a number were considered 'elite' units.)

Among the new, untried special weapons to be used was the *Panther* tank. The *Panther* was to be Hitler's 'wonder weapon', but due to haste in design and manufacture, the Mark V had a miserable baptism of fire. Many of the tanks never saw action, having broken down in the staging areas. The vast majority that did see action were destroyed. The few survivors were withdrawn until major design changes could be made. They later proved formidable opponents in Western Europe.

Even more discouraging for the Panzer forces was the poor performance of the giant Porsche-built *Elephant* assault guns, 90 of which were in the battle.

The *Panther* and the *Elephant* did not accomplish what had been hoped for, and their failure to influence the battle underlined the serious situation faced by the Germans after Kursk.

The passage of time and the massing of men and materiel did not escape the Russians' attention, and the secret gradually leaked out through the inevitable cracks in the mantle of security. Russian patrols captured information concerning German units, movement timetables, supply dump locations, and even the proposed D-Day date . . . 4 July.



The Germans were committed, even though the cat was out of the bag. The *Wehrmacht* had prepared as well as it could. Nothing remained except to attack.

Soviet Preparations. The Russians used the pause in operations following the German victory at Kharkov to regroup and make general preparations for the expected German spring offensive. Marshal Khukov, commander of the Russian southwestern front, and the Russian General Staff, had a fair idea of German intentions in southern Russia, especially in view of the increased German activity around the Kursk salient.

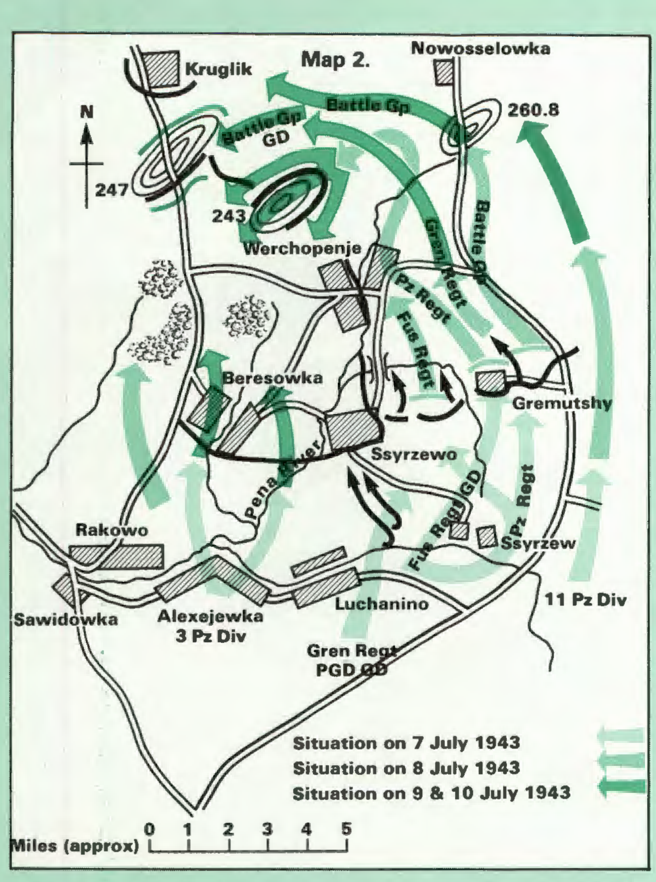
Since German tactical objectives were generally known, the defense was organized to absorb and blunt the Panzer spearheads as they advanced into the salient. The Russians not only planned a massive in-depth defense, but also massive armor, artillery and infantry counterattacks after the German offensive had been halted. The key to the Russian defense plan was the mass destruction of German tanks and assault guns. This strategy was based on the known difficulties the Germans would have in replacing such losses because of the disbursement of factories and the lack of raw materials. Zhukov was also aware that Panzer and Panzer-grenadier units had been withdrawn from other parts of the front, along with the majority of the German armor reserve, for committment to the Kursk assault.

The Germans had taught the Russians many lessons, not the least of which was the art of antitank defense. The classic German antitank defense, the *Pakfront,* was employed against them at Kursk. *Pakfront,* basically, was the placement of 10 to 12 antitank guns under command of one officer who could mass their fire upon one or more enemy vehicles. Additionally, the Kursk terrain, rolling plains, dotted with ravines and stands of timber and cut by many small streams, made the *Pakfront* extremely effective.

More than 20,000 artillery pieces and rocket launchers were emplaced, and Zhukov's plans called for a major air bombardment of German staging areas just prior to the German thrust. In addition to the massed artillery, 3,600 tanks and assault guns, including the *T-34/76,* the *KV1,* the *SU85* and the new *T-34/85,* were moved into the salient. Many of these vehicles dug-in to serve as bunkers and strongpoints. Up to eight separate defense lines were thrown up around Kursk and millions of antitank and antipersonnel mines were sown through the defenses. The Red Air Force fielded 2,400 planes, mostly fighters and fighter-bombers that were given a primary role of antitank fighting. One million, three hundred thousand Russians manned the defenses.

The Assault. The German pincer attack opened on the southern flank at 3 p.m., 4 July, as combat engineers, aided by infantry and assault guns, penetrated and began to open up the primary defense line. Mines and antitank barriers were removed and strongpoints, bunkers and dug-in tanks, were destroyed by direct cannon fire and flame throwers. Casualties were heavy on both sides. (Map 1.)

On the northern perimeter, Russian artillery opened fire at 10:30 p.m., 4 July on the known staging areas of General Model's 18 divisions. Hand-to-hand fighting erupted on the north flank at 2:20 a.m., 5 July. The Panzers pushed forward and drove some 10 kilometers into the Russian defenses.[3] This penetration, however, marked the limit of the northern attack. The 90 *Elephants* were shot up, along with hundreds of German assault guns and tanks. Intense Russian defensive fire and dense tank traps, coupled with mechanical breakdowns in the untested tanks, accounted for the bulk of the German losses. The northern force was eliminated as the spearhead for the massed infantry poised to assault on the heels of the armor, and Model's attack bogged down.[4]



The southern flank saw the heaviest fighting of the entire battle. Elements of the *Gross Deutschland* division with tanks of the 3d and 11th Panzer divisions, attempted to drive between the villages of Sawidowka and Ssyrzew. The Panzer-grenadier's objective was to cross a small stream and gain control of high ground north of the villages. Blinding rain, mud, and massed artillery blunted their advance. Rocket and cannon-firing Russian planes accounted for many tanks, and the attack wavered until 7 July. Panzer and infantry units sustained heavy casualties. Two to three hundred tanks and assault guns were lost and infantry casualties were enormous.[5] Russian losses were as severe, but the Red Army could replace tanks and men; the *Wehrmacht* could not. (Map 2.)

In the desperate fighting around Heights 243.0 and 247.0 the *Luftwaffe* achieved local air superiority and gave excellent support to the ground units.

Six days of bitter fighting passed and German losses soared as Marshal Zhukov committed more and more reserves to the battle. Von Mellenthin noted in his diary:

". . . By the evening of 14 July it was obvious that the timetable of the German attack had been completely upset."[6]

Zhukov notes:

". . . Those days marked the turning point in fighting in the Belgorod direction (southern attack). Bled white and demoralized, the Nazi troops gradually assumed the defensive. On July 16 the enemy completely ceased attacks and began to withdraw his rear echelons to Belgorod."[7]

The Russian defenses improved with the massive inflow of new men and materiel, and mass attacks of tanks and men against the German positions were begun and carried out regardless of losses.

The most telling blow of all to the Germans came in the southern sector on 12 July. General Hoth, realizing his Panzer units were taking unacceptable losses, gathered over 600 tanks, including 100 *Tigers,* and attempted to break through the Russian defenses on the flat lands outside the village of Prokorovka. Hoth gambled that his tanks, operating in open country, could out-maneuver and, perhaps, outflank the Russians. His main objective was a lightning blow to capture Kursk and cut off the Russian forces in the ensuing pocket.

He did not achieve his aim.

More than 600 Russian tanks and assault guns met the Panzers in an unprecedented tank battle. More than 1,200 German and Russian armored vehicles were in action. Zhukov committed his finest reserve troops, the Fifth Guards Tank Army. When night fell, more than 350 vehicles had been destroyed. Once again, the Russians had proven that they could absorb such shattering blows and the Germans could not, and the German Kursk Offensive had come to an end. Eight hundred tanks, hundreds of assault guns and support vehicles, 750 aircraft and thousands of troops—the cream of the *Wehrmacht,* were lost.

Summation. Had the Germans attacked in May, the Russian defenses would not have been in existence and victory would have been within the German's grasp. Also, original plans had called for two smaller operations, code-named *Panther* and *Hawk,* which were designed to supplement von Manstein's Kharkov victory, but they were scrapped when the big push was proposed.[8]

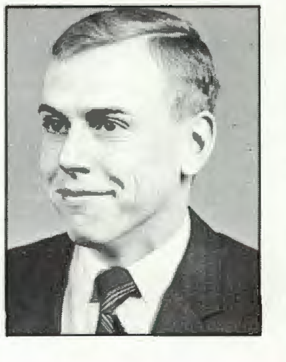
The Russians reaped great profits from the in-depth preparations made prior to the German assault. The planned counterattacks; in the north, aimed at recapturing Orel and pushing the Germans back to Bryansk and beyond; and in the south, directed at Belgorod and the rich Ukraine farmlands, were launched on schedule and carried through with devastating results. German defenses, weakened by the withdrawal of many prime units for the Kursk offensive, could not stem the Russian tide.

And so it ended. By 23 August, all the ground gained in the Kursk offensive had been lost, as had thousands of additional square miles to the Red Army's counter moves. The initiative was now in Russian hands, never to be regained by the *Wehrmacht.*[9]

Footnotes

1. Heinz Guderian, *Panzer Leader,* trans. C. Fitzgibbon. E.P. Dutton & Co., N.Y., 1952. p. 306.
2. F.W. von Mellenthin, *Panzer Battles,* trans. H. Betzler, ed. L.C.F. Turner. University of Oklahoma Press, Norman, OK., 1956. Ballantine Books, 1971. pp. 251-253.
3. G.K. Zhukov, *Memoirs of Marshal Zhukov,* trans. Novosti. Jonathan Cape, Ltd., London, 1971. p. 434.
4. Guderian, *Panzer Leader,* p. 311.
5. Zhukov, *Memoirs of Marshal Zhukov,* p. 460.
6. von Mellenthin, *Panzer Battles,* p. 276.
7. Zhukov, *Memoirs of Marshal Zhukov,* pp. 461-462.
8. Albert Seaton, *The Russo-German War 1941-45.* Praeger Publishers, N.Y., 1970. p. 354.
9. Guderian, *Panzer Leader,* p. 312.

ROBERT P. ARNOLDT, a former enlisted man in the U.S. Army, served in Vietnam as an infantry soldier with the 1st Air Cavalry Division and at Sixth Army Headquarters in California. A supervisor in the international banking department of Continental Illinois National Bank and Trust Company of Chicago, Mr. Arnoldt is a graduate of Elmhurst College and holds a Master's Degree in history from Northeastern Illinois University, where he is a part-time instructor.



Combat Service Support

by Captain Douglas E. Lute
and Master Sergeant Edmund L. Devereaux, III

For a novice commander and his first sergeant (1SG), the problem may seem insurmountable. What techniques should be used to accomplish the combat service support (CSS) of a maneuver company? The current series of "How To Fight" manuals and FM 17-19Z *Soldier's Manual* offer only limited guidance.[1] Existing standard operating procedures (SOPs) are often vague and largely a description of required reports. Throughout the Army's maneuver units, there is an absence of standardization of CSS techniques.

Plagued by these generally nonexistent answers to the problem, we resorted to the following process of securing valid answers: carefully identifying the problem, gathering alternatives, mixing and balancing these options to most precisely fit our environment and, finally, exercising and refining our system.

This procedure took place over a period of eighteen months which included a set of live-fire, free-maneuver platoon ARTEPs, two troop ARTEPs, a corps maneuver exercise, numerous FTXs, three gunnery exercises, and nearly four months of active border surveillance duty. We do not suggest that our particular CSS system is appropriate for every unit. Rather, we hope to offer the armor/mechanized community techniques which are founded on several basic assumptions and have been field tested. This is a CSS system not of theorists, but of concerned practitioners.

Basic Assumption. In order to define the environment in which these techniques were developed, the following assumptions are important:

- Combat capability is directly related to today's training, so we must train precisely as we expect to fight, and without making weak exceptions for combat service support tasks. For example, we should feed our troops, recover inoperative vehicles, and practice medical evacuation as we would in combat, not "semi-administratively."
- The complexity of the modern battlefield requires a *definitive* division of labor at the company/troop level. The executive officer (XO) is located forward, prepared to assume command, responsible for directing combat support (CS) efforts, and maintaining the flow of combat information. The 1SG has primary responsibility for *all* combat service support.
- Company/troop leadership must be *flexible* and *innovative* to develop a system of CSS best suited to their mission. Do not hesitate to reallocate personnel and equipment to accomplish the mission.
- Trains will routinely be echeloned to include combat and field trains, with the combat trains comprised of armored vehicles located just behind the combat elements.

Techniques. Over a lengthy trial and error period, we developed certain "nuts and bolts" techniques which proved successful for providing CSS.

The most responsive service support to the combat platoons will come from the company/troop trains. This element, led by the 1SG, is comprised of the medical evacuation *M113*, the armored vehicles of the maintenance section, and perhaps an *AVLB*, and is located approximately 1,000 meters, or one terrain feature behind the platoons. The separate elements of the combat trains must be capable of independently maneuvering forward in response to a situation monitored on the command net. For example, a report from a platoon leader to the XO of a mired tank during a movement to contact should cause the 1SG to issue the *M88* crew a brief order, including a route, to move forward to assist in returning the tank to action. The remainder of the combat train continues to support the company/troop.

In order to achieve such responsiveness, significant training of the combat trains element is required. The 1SG must ensure they are capable of navigating and driving cross-country under blackout conditions, operating their radios, and conducting a myriad of other survival skills. Now is the time to begin such training and to evaluate it in conjunction with the FTXs and ARTEPs. This training is especially relevant to the medics who will often be moving independently on the battlefield. A technique which has shown promise is for one medic team to be attached to each line company/troop in garrison as well as the field. In garrison, the medics serve to screen sick call, administer the overweight program, participate in all live-fire and maneuver exercises, and meet medical platoon commitments. This technique provides ample opportunity for them to train on those combat skills essential to their role as part of the combat trains. Such frequent contact between the medics and men of the unit serves to build mutual confidence among both parties, a combat morale factor which is not to be discounted.

Maintenance support must be well forward to best maintain the operational status of our companies/troops in combat. One of the keys to quick return of inoperative vehicles is early problem diagnosis. Also, experience has indicated that many routine mechanical problems are relatively simple and require little time to repair. In light of these observations, a mechanic can serve with greater advantage attached to a particular platoon. This is best done on a basis of merit, with the three best mechanics being so assigned. He may ride in a tank (and double as a loader), or in a platoon leader's *M113*. His equipment includes his assigned tool box, organizational-level manuals for the vehicles, a heavy-duty tow bar, and set of slave-start cables. We found the platoon mechanics to be a proud bunch, who contributed significantly both in garrison, where they verified crew preventive maintenance checks and services (PMCS) and requisitioned platoon repair parts; and in the field, where they provided the platoon with quick-fix capability and the motor sergeant an early warning of major problems.

The maintenance section *M113* and *M88* in the combat trains require the same additional tactical skill training as the medics. A turret mechanic and communications repairman should be riding in the *M113* to facilitate early response to problems. As much as possible, critical repair parts of the prescribed load list (PLL) should be loaded on these two vehicles. A new firing circuit relay is of little use when located in the field trains. In the combat platoons, each vehicle *must* carry the requisite tools and vehicle track components (end connectors, center guides, *M113* pins, etc.) to allow minor repairs without support from the combat trains.

The role of the motor sergeant is too situational and personality dependent to prescribe. He requires the flexibility to position in several different locations and therefore should be assigned the *M151* normally allocated the XO. He can then serve as the 1SG's chief assistant, the master mechanic, or in place of the supply sergeant, as the situation demands.

Analysis of Threat doctrine reveals an intent to maintain constant, unrelenting pressure on our combat forces. This will minimize our chances for resupply. It is critical therefore, that the fleeting opportunities for resupply be optimally used by simultaneously providing fuel, ammunition, food, and water. To do so calls for a well-conceived, well-executed plan at company/troop level, controlled by one man, the 1SG. Resupply should be conducted under limited visibility whenever possible with the 1SG responsible for positioning the assets to facilitate rapid response to resupply opportunities. He must anticipate both demands and resupply opportunities through a complete understanding of the commander's battle plan and an ongoing effort to remain abreast of the situation by "eavesdropping" on the command net. He may require occasional situational updates from the XO. While the 1SG is thus scheming in the combat trains location, the supply sergeant controls the fuel and ammunition trucks within radio range (AN/PRC-77) behind the combat trains. This may mean that he displaces forward of his field train's location to maintain radio contact. Resupply is effected as the supply sergeant is directed by the 1SG to move forward to issue proportioned quantities to each platoon to ensure at least partial resupply of all platoons. It is of little use, for example, to top-off one platoon and leave the others at one-quarter tank. The 1SG also prescribes to the supply sergeant the sequence of platoons to be resupplied and the priority of resupply materials. In other words, "who needs what most". The supply sergeant then contacts the platoon sergeant on the platoon net (to reduce command net traffic) and effects link-up. The platoon sergeant is responsible for distribution within his platoon. As one platoon is resupplied, the supply sergeant contacts the next platoon on its platoon net to effect link-up with the platoon sergeant. When the resupply is complete, the supply sergeant pre-arranges an estimated return time with the 1SG, then heads for the field trains to be replenished. He will often transport lightly wounded personnel and prisoners of war to the rear on these return trips. A final tip concerning ammunition resupply is to ensure that appropriate wire-band cutting instruments are on each vehicle.

The modern battlefield will seldom allow for distribution of hot rations from a central point, so it is time to train as we will fight: with C-rations distributed from the outset. This frees the 1SG to manage more critical CSS matters. If hot rations are feasible during a lull, then try distribution using "platoon packages": a mermite container per platoon with inserts of meat, vegetable, and starch, supplemented with bread, fruit and milk. This allows for decentralized feeding by the platoon sergeants and does not tie down the 1SG as a "mobile mess line." Water is best distributed by the exchange of five-gallon cans during resupply.

Throughout the combat operations, the company/troop field trains comprised of the unit's wheeled vehicles are co-located with the battalion/squadron field trains and function as a link to higher levels of CSS. From the field trains, the motor sergeant interfaces with direct support maintenance units and the supply sergeant receives resupply materials.

Requirements. Practically, the 1SG with responsibility for CSS requires assets exceeding those he has traditionally been allocated, needs an *M113* with two-net capability to control CSS from the combat trains. He must monitor the company/troop command net to remain abreast of the tactical situation and also communicate requirements to battalion/squadron on the admin/log net. He must, as a minimum, have an operations assistant to provide 24-hour capability.

Early Division 86 Tank Battalion concepts stress habitual support, but call for maintenance assets to be consolidated at battalion, with teams then allocated to units.[2] This concept needs to be carefully reevaluated in terms of time and space requirements for battlefield quick-repair capability and for problems inherent to transitioning from garrison activities to combat. It severely reduces a company commander's ability to tailor his CCS to his mission. The tank company needs to retain an organic maintenance section.

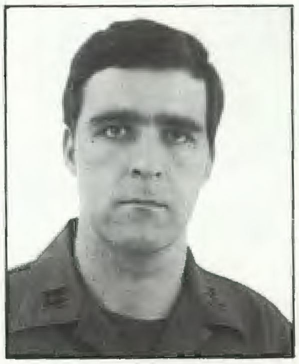
As mentioned earlier, any flexible company/troop commander can and should reallocate existing resources and tailor his CSS to his mission. The greatest single requirement, however, is to conduct training as we expect to fight. This is certainly as true for CSS elements as for the combat platoons. For example, just as tactical plans in USAREUR are organized using platoon and company/troop "battle books," 1SG's should likewise develop and maintain CSS battle books. These should reflect the commander's battle plan and include such details as supply routes, company and battalion combat and field trains locations, collection points and pre-stock information. Noncommissioned officers must then be allowed the time to refine battlefield CSS procedures.

Summary. Combat service support responsibilities should be returned to the noncommissioned officers corps, culminating with 1SG's who are dedicated CSS battlefield leaders. As such, the 1SG's expertise is a valuable asset to the unit. The techniques comprising the CSS system described here are not really extraordinary, but reflect a devotion to training to fight. We, as commanders and first sergeants, must accept no excuses for doing otherwise.

Footnotes

[1] Based on review of *How To Fight,* FMs 7-20, 71-1, 71-2, 17-95, 71-3, 71-95, 71-100 and *Armor Senior Sergeant,* FM 17-195Z

[2] U.S. Armor Center and Fort Knox, *Operational and Organizational Concepts,* Division 86 Tank Battalion, October 1980, p. 14.



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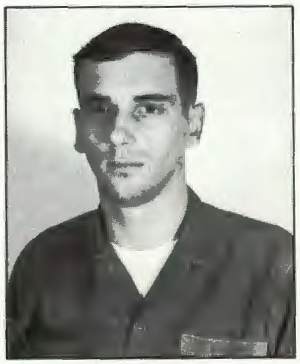

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The Armor Force's Manpower Bank

by Captain Lee F. Kichen

Many articles appear in professional journals describing the Reserve Component (RC) side of the Total Force equation. Such articles have focused on the National Guard and Army Reserve Troop program units as "The RC Armor Force." Two overlooked, but significant, variables of the Total Force equation are the Individual Ready Reserve (IRR) and the Retiree Mobilization Program (RMP).

Individual Ready Reserve. The IRR consists of some 220,000 reservists in one of the following categories: annual training, reinforcement, and individual mobilization augmentees (IMA). These categories provide personnel administration and training opportunities for RC personnel who are not assigned to the National Guard and Army Reserve troop program units.

The annual training control group includes 30,000 reservists who are serving their initial statutory obligation and normally have less than three years' active duty. These troops are subject to two weeks' mandatory annual training.

The USAR reinforcement control group, at 170,000, is composed of reservists who have completed three years' active duty and are completing their six year statutory obligation or who have completed their obligation but have agreed to serve as "citizen-soldiers."

The individual mobilization augmentee (IMA) control group includes approximately 7,000 reservists who are preassigned to authorized key positions with DOD and active component (AC) agencies and units. The bulk of these positions are at the TRADOC serivce schools, FORSCOM installations, the CONUS Armies, DARCOM, selected overseas commands, and Headquarters, DA. Reservists in this control group will report to their pre-assigned organization and position upon mobilization. IMA personnel serve two weeks annually in their "go to war" positions.

The Armor Force's post-mobilization requirements for the IRR are scenario-dependent. Based upon full mobilization, IRR personnel will be assigned to forward-deployed units as well as deploying, and non-deploying, CONUS units, active and reserve. In many cases, IRR personnel will report to their mobilization stations earlier than many National Guard and Army Reserve troop program units.

Currently, there are approximately 2,300 IRR officers with Armor as their skill specialty indentifier, and approximately 4,400 enlisted personnel who are managed within the Armor career management field (CMF). Personnel management officers (PMO) and personnel management noncommissioned officers (PMNCO) at the Reserve Components Personnel and Administration Center (RCPAC) in St. Louis are responsible for the pre-mobilization career management and training placement of the tankers and cavalrymen in the IRR. The mission of the Armor PMO/PMNCO is to provide timely counseling on career development and training opportunities, and to monitor the reservists' duty performance.

The cornerstone of the IRR's personnel management system is counterpart training. The counterpart training program was developed to enhance the reservist's military skills through intensive training with AC organizations. For the tanker and cavalryman, counterpart training means attachment from two to four weeks to an AC armored or armored cavalry organization to perform SSI 12 or CMF 19 functions. Attachments range from the bridade/regimental level for field grade officers, to the crew level for junior enlisted reservists. Training in an AC environment provides the reservists with the necessary exposure to modern armor weapons systems and current tactical doctrine. The underlying principle is that meaningful pre-mobilization training will help in the post-mobilization transition from civilian to fulltime soldier.

Over 90 percent of Armor counterpart training placements are with AC organizations. The reservist is usually attached to the AC armor/armored cavalry unit closest to his home. Every effort is made to place reservists in units that are training intensively; e.g., gunnery, ARTEPs, CPXs and FTXs.

It is incumbent upon host AC unit personnel to provide rigorous training for their RC counterparts. Nothing is more disconcerting for the reservist than to find himself working as an A&R officer when he expected to serve as a counterpart S-3. The reservist must have the opportunity to train with and learn from his AC counterparts. Upon mobilization, reservist and active duty soldiers will be functioning as equals within the total armor force. The AC commander is doing himself and the reservist a disservice if he fails to utilize the reservist in a meaningful position during counterpart training.

Another facet of the IRR professional development is institutional training. The IRR tanker is afforded the same schooling as his active counterpart. The reserve officer, while on active or reserve status, pursues the Armor Officer Basic and Advanced Courses, the Combined Arms Staff Service School, the Command and General Staff Officer Course, and both the Junior and Senior Officer Preventive Maintenance Courses. The enlisted armor reservists follows an educational track prescribed by the Non-Commissioned Officers Education System. Selected Armor Reserve NCOs may also attend the Sergeants Major Academy. As a result of the Armor reservists' military education, the AC commander is assured of receiving RC personnel with training commensurate with their grade.

Retiree Mobilization Program. The other element of the armor force manpower bank (AFMB) is the retiree mobilization program (RMP). In full mobilization, the Army would face a personnel shortfall. To counter this problem, retirees are considered key mobilization assets by virtue of their numbers and their relative youth and broad military experience.

The recall of retired personnel to active duty at CONUS stations in the event of full mobilization will insure efficient operation of these installations and allow the reassignment of active duty personnel for the performance of other tasks. Approximately 800 SSI 12 positions have been identified for fill by retired armor officers. Over 700 retired armor enlisted personnel have been issued preassignment orders by RCPAC designating their duty stations upon full mobilization. Some 2,700 NCO positions have been identified for fill by the armor career management field.

At this time, only selected Regular Army retirees are being issued preassignment orders. These orders are automatically validated upon mobilization. Reserve component (AUS/USAR) and regular army retirees who are not selected for mobilization assignments may volunteer during peacetime for any unfilled positions for which they are qualified. Current policy also authorizes installation/activity commanders to recruit volunteers to fill vacant positions.

Selected RC retirees who are not volunteers are scheduled to be issued contingent preassignment orders prior to mobilization. These orders will designate their post-mobilization duty station in the event of national emergency. Upon Congressional declaration of war or emergency, and concurrence by the Secretary of Defense and the Secretary of the Army that retired reservists are needed, mobilization orders will be published establishing a reporting date and confirming the location stated in the previously published contingent preassignment orders. If proposed legislation becomes law, AUS officer retirees (Reserve officers with 20 or more years' active duty) will also be eligible for preassignment orders which become valid upon mobilization. Contingent orders would still be issued to selected USAR retirees.

Army retirees are classified in three categories. Category I: those personnel retired less than five years who meet age and grade criteria, and are physically qualified for recall to Active Duty. Category II: those individuals who have been retired five years or more, and who meet age, grade and physical criteria. Category III: individuals who do not meet age and grade criteria, or are physically disqualified for recall to active duty, or are exempt by DA policy. Only Category I and Category II retirees have received preassignment orders. Age ceilings, for grades other than general officers, have been established as follows: warrant officers—62; all others—60. General officer assignments, regardless of age, will be determined on a case-by-case basis by the Chief of Staff, Army.

Typical retiree mobilization assignments include TRADOC/FORSCOM installations which will operate under a post-mobilization surge. Other positions are those found on the TDAs at various directorate or special staff levels. Installation commanders may assign retirees to civilian positions for up to 90 days (and beyond 90 days with the approval of HQDA). The installation/activity commander has the latitude to cross-level assignments as needed.

The individual ready reservists and the retiree are valuable assets to the Army and its Armor Force. In the event of mobilization, today's AC officers and troopers will find themselves augmented by both reservists and retirees. The success of this augmentation lies in part with the type of peacetime training provided to the IRR by its active counterparts as well as the post-mobilization utilization of the retiree by the AC commander.

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PROFESSIONAL THOUGHTS

Doctrine Is Needed for Light Cavalry

Within the next few years many armored and mechanized divisions will have a new, tankless, cavalry squadron. This light cavalry squadron will have less combat power, but more reconnaissance and liaison capability, than the existing armored cavalry squadrons organized under the H-series tables of organization and equipment (TO&E). These significant changes were inspired by the U.S. Army and Doctrine Command's (TRADOC) comprehensive Division and Corps 86 studies. To implement these changes, TRADOC and Army tacticians will have to make a continuous, critical review and revision of cavalry employment doctrine.

Instead of the old, controversial *Sheridans* and the new *M1 Abrams* tanks, the light cavalry squadron will have the new *M3* cavalry fighting vehicle (CFV) along with attached scout and attack helicopters, motorcycles, a nuclear, biological, and chemical (NBC) reconnaissance platoon, a sensor platoon, and six 81-mm mortars. Certain revisions will have to be made in current doctrine to enhance the intended capabilities of the new organization and its equipment and to minimize confusion over the meaning of division operation orders.

If recent Armor School guidance is taken at face value, the only intended function of the new, light cavalry, squadron will be to provide timely battlefield information to the heavy division commander so that he can react quickly to and offset superior Threat forces. If this operational concept is to be implemented in both theory and practice, he will have to understand that certain capabilities now assigned to existing armored cavalry squadrons in the armored division (TO&E 17H) and mechanized division (TO&E 37H) will not exist in the altered cavalry organization. For example, he must appreciate that the new, light cavalry, squadron should not be used in an economy of force role during offensive, defensive, or delaying actions. He should also realize that guard or protect missions would also be beyond its capabilities. Accordingly, he would not use the new cavalry squadron to protect the flank(s) of the division; to act as a division covering force, even if reinforced; to perform damage control operations; to provide forces for rear area security; to exploit the success of other units and the effects of mass destruction weapons, or to provide armed air escort for airmobile operations.

The heavy division commander should also recognize the change in the reconnaissance mission of the new cavalry squadron. Instead of conducting ground and air reconnaissance over wide fronts and to extended depths, the new squadron will operate closer to division control; it will conduct *detailed* ground and air reconnaissance within, to the front, on the flanks, and to the rear of the division. Therefore, its surveillance tasks should concentrate on lines of communication within and through the division's area of operations in order to assist troop movements therein, to facilitate rear area combat operations and planning, and to maintain a positive command link by means of helicopter or motorcycles between the division commander and the brigade commanders, especially in a electronic warfare or NBC environment.

Although division and squadron commanders should acknowledge that the light cavalry squadron is not intended to function as a combined arms, combat maneuver force, it will still be expected to find and maintain contact with the enemy in order to prevent the friendly main body from being engaged under adverse circumstances and to provide, within its capability, security for the main body. In other words, the traditional fundamentals of reconnaissance and screening missions will still apply. Yet, with the new operational concepts and equipment, combat action should no longer be the preferred way to develop the situation rapidly, or to accomplish other cavalry missions. While always ready for battle, the light cavalry squadron will have to become even more adept at keeping its mobility and still be capable of completing its tasks.

But what new tactics or techniques will be designed so that the new light cavalry squadron can develop the situation rapidly and provide reaction time and maneuver space for the division without fighting? These are problems that will have to be solved through a close and continuing working relationship between the writers and users of doctrine. A start in the right direction can be made if field commanders increase the use of surveillance and maneuver with existing equipment and reduce the use of firepower to accomplish cavalry missions. If, however, by habit or otherwise, they favor the use of firepower over visual or mechanical surveillance, stealth, and movement as the means of either developing the situation or providing reaction time and maneuver space, they could quickly and irrevocably degrade the new squadron's ability to accomplish its primary reconnaissance and command and control missions.

The screening mission, the one security mission still compatible with the new operational concepts, will also present problems for those revising employment doctrine. Even under Armor School guidance, a light cavalry unit on a screening mission will still be expected to impede and harass the enemy, preferably by long-range fires. And, within its capability, it will also be expected to destroy or repel enemy reconnaissance units. Thus, as in the case of developing the situation on a reconnaissance mission, the cavalry squadron on a screening mission can quickly become engaged in a immobilizing fire fight. Therefore, those who are revising employment doctrine should find ways for squadron commanders to accomplish their reconnaissance and screening missions at even greater distances and with less revealing methods than those used in the past. And, certainly, once the new equipment arrives, these commanders should be able to perform these basic cavalry missions without the need for combat.

In the meantime, division and cavalry squadron commanders can immediately help influence the revision of cavalry employment doctrine by testing the new operational concepts with existing equipment and organizations. In their training and field exercises, commanders can start to reduce some traditional, combined arms armored cavalry missions, such as guard or protect missions, economy of force assignments, and covering force tasks. In the course of this testing process, field commanders should also encourage their cavalry units to avoid the use of organic firepower and to rely, instead, on stealth, maneuver, and surveillance as the preferred means of developing the situation during reconnaissance missions. Screening missions should be substituted whenever possible for traditional protect missions so that cavalry leaders will think in terms of multiple observation points rather than the more static, combat-oriented, battle positions. In all of these situations, cavalry commanders would use their current fighting vehicles as pure scout or cavalry fighting vehicles (CFV's), instead of deploying them as part of a miniature, but increasingly vulnerable, combined arms team.

As the organizational and operational concepts for the Division 86 cavalry squadron are gradually implemented by the Army, squadron and troop commanders should start to see some changes in division operation orders. Even the model operation orders published by the Army schools will begin to change. For example, orders for a mechanized division offensive operation will no longer require the cavalry squadron to protect a division flank by occupying certain battle positions, and on order, to secure a certain objective. Even orders to maintain contact with divisions on the flank(s) may be beyond the capabilities of the light cavalry squadrons, as this mission may entail more than screening and would be incompatible with the new operational concepts. Certain standard "be prepared" orders, such as "release a troop to brigade to clear Threat forces in zone" or "Division Support Command for rear area security," would start to disappear as they are also incompatible with the new concepts. One will still see, of course, screening missions, and in place of the inappropriate missions, there will be more specific liaison with surveillance missions. And division commanders will soon have to look elsewhere, to corps or the brigades, to find the units that can perform the minicombat tasks normally assigned to the armored cavalry squadron.

To survive on the chaotic, nonlinear battlefield of the future, heavy divisions need the capability to observe the entire battle area 24 hours a day. The new Division 86 cavalry squadron is designed to provide this all-round capability. But old habits and doctrine must change if this light squadron is to be used properly. This squadron cannot be used for, or wasted on, combat-type missions that may have been suitable for the armored cavalry squadron. It is therefore important that cavalry employment doctrine for the new heavy divisions be revised to emphasize the concepts of reconnaissance and command-control as the proper, primary, missions of the new light cavalry squadron.

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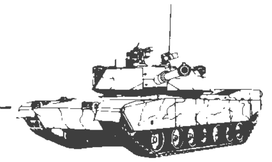
(Coordinating draft of TT 17-95-1. "Divisional Cavlary '86" was sent to the field in April. Ed.)



Leadership Visibility

As a junior lieutenant I was taught the Fourteen Leadership Traits (tact, integrity, loyalty, etc.) that one must possess to be an effective leader. Since then, I have discovered that it takes a lot more to be a good leader than merely attempting to emulate those noble traits. That list is only a starting point.

In Korea with the 2d Infantry Division and, later, at Fort Bliss, Texas with the 3d Armored Cavalry Regiment, one additional trait continually struck me as being critical to good leadership. The best leaders (in the eyes of the soldiers) always seemed to exercise a kind of *leader visibility*. Their physical presence extended from the motor pool to the barracks and from the training areas to the sports fields. But what made such an impression on me was that wherever the good leaders were *they were always with their soldiers*. Now, you may ask, what is so significant about that? Look around your unit. The truly effective and respected leaders are those who insure that they spend as much of their time as possible with their subordinates; they definitely are not the lieutenant or sergeant (or captain or first sergeant, for that matter) who remains well-hidden doing other *important* things. Nothing is more important to the company-grade officer or NCO than exercising leader visibility to the utmost if one is to gain the respect, confidence, and response of subordinates.

Lieutenant Colonel (Chaplain) Harold Alexander explains the principle of visibility thusly: "The troops will trust those leaders whom they see regularly in their own territory."[1] Today, many of our junior officers and NCOs are succumbing to a 9-to-5 syndrome, leaving the unit area and their soldiers as soon as possible at the end of the normal garrison duty day. Rarely do the soldiers see their leaders after duty hours. This, I feel, has a profoundly negative and potentially dangerous effect on the morale, cohesiveness, and discipline of a unit. It fosters a kind of subculture within the unit that imposes its own chain of influence (if not of command). Chaplain Alexander calls this "horizontal leadership"[2] as opposed to the normal superior-subordinate form of vertical leadership. With leaders seemingly so anxious to get away from their jobs and their soldiers during and after duty hours, and with soldiers left to the negative influences of horizontal leadership, how can a unit be expected to develop the cohesiveness so necessary for success in combat? It can only be accomplished through leader visibility—being where the action is, whether it be a training site, motorpool, basketball court, or even the 3d floor of the barracks at 2100 hours.

As a young platoon leader in Korea I didn't understand why my first company commander forced the lieutenants and sergeants to perform additional duties after normal duty hours. But now I know he did this for two reasons. First, to force us to spend time with our soldiers during their work day. And second, to make us visible in the company area in the evening. Most soldiers appreciated our presence on their turf and would more readily open up to their leaders about problems and suggestions. Upon returning to the U.S., I found unit-level, team sports competition to be an excellent forum for developing cohesiveness and leader-subordinate respect. I don't believe that team sports are just for the troops. It is my experience that soldiers expect unit leadership to participate. But participation must be on an equal basis, without rank. Here, soldiers can be shown the leaders are as much a *part* of the group as they are leaders. This has been a particularly effective means for me to demonstrate leader visibility and to promote confidence.

Frequent after-duty hours visits to the barracks are also a good way to make leaders more visible to their subordinates. This enables the leader to become a recognizable part of the soldier's surroundings, helps break down the "us-them" attitude, and can help in identifying potential unit problems. Confidence is built when such visits are not viewed by the soldier as harassment or duty-oriented, and can be enhanced by wearing civilian clothes and engaging in casual conversation.

When a leader can work his way into the confidence of his subordinates he becomes much more effective in understanding them as soldiers and as people. By becoming a fixture in a soldier's environment, the leader is not perceived as some kind of menacing threat that some of the more negative influences in a unit might wish to prepare. Together, these two points enable the true leader to develop discipline and cohesion without appearing to be some sort of tyrant. It is when a leader is standoffish to his soldiers that he has difficulty in gaining confidence and in building a disciplined organization. The soldiers will only obey such a leader because he is in a position of authority. The true leader who exercises his leader visibility, on the other hand, will be regarded as a significant part of the group and his orders and instructions will be obeyed because his soldiers have developed a reliance on his presence and judgment in all situations that the group encounters. His authority lies not alone in his rank but in the confidence and respect that he built within his organization.

I've found that my being there with my soldiers when things were rough, when the situation was a difficult one, enabled me to nurture the respect of my subordinates. I like to think that they did what I told them to do because they looked up to me as a leader rather than as a lieutenant or a captain. This is a very satisfying personal feeling and keeps me conscious of the effects of leader visibility. I submit that this should be the goal of all leaders.

I must, however, add that mere physical presence is not enough. Leader visibility is only a vehicle for conveying to subordinates the other twelve leadership traits I referred to above. You can possess all of these traits and characteristics you want, but unless you make them apparent to your soldiers through words and actions you will never be a truly-effective and respected leader.

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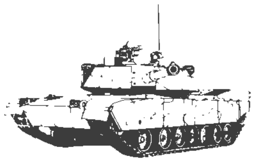

Training A Support Platoon

Officers and NCOs who supervise support personnel are constantly faced with the dilemma of how to train them while still meeting the support mission. Frequently, officers come straight from a combat arms platoon and have little or no sense of what training service support soldiers need. After a very short tumultuous time, the requirements imposed from battalion or squadron force the platoon leader into a crisis-reaction situation, from which he may never recover enough to establish a good training program. When this is not the case, the officer is there 3 to 6 months, then is replaced by another officer for the same time frame, *ad infinitum.* This lack of leadership stability in the job graphically reveals to the soldiers the low level of importance placed on their commander's position by the battalion or squadron commander.

Both cases not only undermine the start of a good training program, but also serve to demoralize these service support soldiers.

The specific example of a hypothetical support platoon in Europe will be used to illustrate the problem and to provide some suggestions for a solution.

Transportation requirements for daily administrative garrison operations, coupled with the travel distances involved in both, serve to constantly tax the platoon's men and equipment.

Present service support fleets are old and barely sufficient to sustain a battalion or squadron in extended operations. If you add a chronic shortage of personnel to the situation, the supervisors are invariably put into a never-ending state of crisis management. Proper maintenance becomes an unrealized dream, work days are to be endured, weekends frequently are nonexistant, morale is low, and good training is a joke. The rest of the battalion sees ammunition, fuel, and transportation requirements sometimes not met, often met late, rarely met on time, and the support vehicles invariably in poor condition. Support platoon personnel, gain the unwarranted reputation as the battalion or squadron "duds."

Thus begins a vicious cycle. The troops do everything in their power to leave the outfit, whether it be by reenlistment to change station, "pulling strings," retirement, or, in extreme cases, AWOL. NCOs are usually the most successful at leaving or avoiding the assignment, which causes a severe gap in leadership and practical experience throughout the platoon. The battalion or squadron commander directs line company or troop commanders to fill the critical shortage of truck drivers in the platoon. Invariably, the worst soldiers are assigned. An assignment to the support platoon in the above situation would be the 'kiss of death' to the career of any good soldier. Given this, the platoon will eventually level out as a self-perpetuating legacy of bad news. And someday it will pull the rest of the battalion or squadron down to disaster when a truck breaks down with the fuel or ammunition needed to complete an army training and evaluation program.

Hopefully, not all these problems exist in any real unit at the level described. It is quite probable, though, that they exist somewhat in every support platoon. It takes firm leadership at the platoon level to correct the situation along with firm assistance from the company or troop level, and a large amount of patience and support from battalion and higher levels or command.

The following actions must be taken by the battalion or squadron commander and his staff.

- The battalion or a squadron commander must select a platoon leader with good leadership skills and a strong personality.
- The lieutenant must remain there for a minimum of 1 year.
- Line units must realize that while the platoon is there to support them, it should not be constantly on call to fulfill

last-minute requirements that result from the failure to coordinate requests for service support.

- A strict suspense system for coordinating Class III, V, and/or transportation support must be established and enforced by the S4, with full approval of the commander. This would allow the support platoon leader to plan for the commitment of his assets in a timely manner, and begin to break the cycle of crisis management. He could begin budgeting his time to meet the unit mission, his maintenance requirements, and training his platoon.
- The S1 will have to bring the platoon up to strength with quality personnel. If this can be accomplished by obtaining the authorized number and grades of 64Cs, excellent. If not, then the establishment of a 6-month rotation system is one way to solve the problem. By rotating combat arms soldiers for 6 month periods, minimal damage is done to their career progression while fulfilling the service support platoon's personnel requirements. This would also provide these soldiers an opportunity to experience what the service support personnel must do to successfully complete their mission.
- Depending on the truck fleet state of repair (or disrepair), the battalion or squadron commander might have to order an intense 1- to 2-week period of catch-up maintenance. Nothing but two or three essential missions would be handled by the support platoon while the equipment was being serviced. This would likely cause a short period of stress to the battalion or squadron training program, but would pay future dividends in consistent support.

The brigade commander may need to assist his battalion commanders in accomplishing some of the above, particularly if the condition of the truck fleet is poor. Rotating the support platoon's committments among battalions for a while might be considered. This concept is already applied in training and post support schedules. Its application to support platoons throughout the brigade would allow battalions the time to intensely maintain their truck fleets for at least 1 week per month. When the maintenance situation has stabilized, each battalion could again handle its own support.

Furthermore, the headquarters unit commander must also do several things. First, he must insure an equal distribution of extra duties throughout the unit so that no one group is carrying more or less than their fair share of the load. Second, all maintenance assistance possible must be rendered to the truck fleet. During a special maintenance period, he should ask the battalion or squadron maintenance platoon for assistance and consider temporary shifting of extra duties to allow personnel to work on their vehicles during this period. Additionally, the commander and S4 can provide guidance and assistance to the platoon leader in planning and executing training. They also can insure that the training schedule is adhered to, and that the platoon is sheltered from unreasonable last-minute requirements that disrupt the training schedule.

Once the system for tasking platoon assets, receiving maintenance support, and the personnel situation are resolved, the platoon leader must use his planning and training skills to structure a viable maintenance and training program that can be executed by his NCOs. When he does that, half of his job is done.

The support platoon's training problem becomes more difficult when the platoon leader addresses some specific skill qualification test 64C/(SQT) task for which the equipment required is unavailable, or finding time for the ammunition sergeant or specialist to maintain his 19E MOS skills. This training must be coordinated with higher level support units for their assistance and the time set aside to accomodate these requirements.

The platoon leader needs to have the training make sense. A truck driver may not see the necessity of knowing how to read a map, but place him in the situation of leading a convoy of trucks cross-country and he will rapidly understand.

Despite all possible steps taken to prevent them, situations will arise to disrupt training. If this happens, the platoon leader must adjust to the circumstances. He must never forget that his mission is battalion or squadron support, and this will, at times, require last minute changes.

Regardless of the difficulty of managing this platoon, it does not warrant exempting platoon members from duty. Special situations might warrant the temporary shifting of duties. However, all members of any organization, especially a headquarters and headquarters company or troop needs to shoulder its fair share of the duty load based on the commander's guidance. If any one element is singled out as more important than another, a seed of resentment is planted within the rest of the soldiers, causing more problems.

While setbacks will occur and the work will be difficult, the soldiers will rapidly see that the platoon leadership is looking out for their welfare by doing everything possible to prepare them for survival in combat. Morale will improve, and the willingness to work will increase. Eventually, battalion or squadron operations in general will run smoother as a result, serving to justify the efforts expended.

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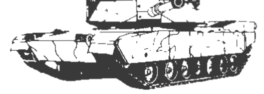
Captain, Armor
Fort Knox, KY



Lessons In Leadership: The Legacy of Kursk

The Battle of Kursk, the most massive tank battle in history, decided the final outcome of the savage fighting on World War II's Eastern Front. This pivotal battle ended Germany's last offensive in the East and marked the beginning of the Red Army's unending drive to Berlin. This decisive fight across the steppes left us numerous lessons that can be applied to the modern battlefield. These lessons, as well as the end of the German onslaught, were a portion of the Legacy of Kursk.

When the 4th and 9th Panzer Armies attacked the Kursk salient on 4 July 1943, they became embroiled in a gigantic Soviet ambush that cost them 500,000 casualties and the loss of 2,000 tanks and 3,000 guns. That would have been tragedy enough, but from the German point of view, the greatest tragedy was that it should never have happened. The blame for this faulty decision lay directly on higher headquarters. Hitler, backed by his rear echelon puppets, ignored the advice of his frontline commanders. Hitler felt he had a better grasp of the situation from behind his desk 3,000 miles distant, than his combat commanders at the scene. Most of the latter firmly opposed the plan for Operation Citadel. When Hitler ordered the operation despite these voices of protest, it was not the first time, nor would it be the last, that a senior commander erred by failing to listen to his subordinates.

The *Wehrmacht* was an excellent military tool in 1943. It was armed with the finest weapons available and led by experienced combat commanders. The Germans had developed a superior system of command that did more to produce the stunning victories early in the war than any alleged materiel superiority. The leaders in this system were a far cry from the American movie stereotype of the heel-clicking puppets who followed orders regardless of the consequences. In reality, the Germans expected far more individual initiative than did any of the Western armies. Junior leaders were given great flexibility and were encouraged to exploit local advantages. They were *not* given precise orders, but were assigned tasks. The execution phase of operations was left to their discretion. They were supported by an efficient general staff organization. This staff was expected to anticipate problems and have proper solutions ready when a particular problem arose.

The most important principle of leadership was that the unit commander, at all levels, led from the front. The commander was located as far forward as possible. This position allowed him to make a correct decision immediately. It was a greater sin to delay a decision than to make a poor one. By being at the front, the commander was able to smoothly adapt to local problems. It must be noted, however, that senior commanders had to refrain from playing "platoon leader."

The Germans realized that a superior could not tie himself down to one sector by becoming too closely involved with a single unit. They also knew that junior leaders learned nothing when a senior staff officer interfered. Although junior officers made mistakes, individual initiative was not to be stifled. When a leader was not up to the task, he was relieved on the spot and another leader appointed.

These were the hallmarks of the command system: initiative from junior leaders, a staff that supported but did not dictate, and senior leadership from the front. The troops learned to recognize and trust leaders whom they knew could perform well. They saw their unit commander daily and realized that he shared their risks. If the commander was at the front, they knew that maximum support from the rear could be expected. They viewed their leaders as individuals, not power-hungry martinents that created useless orders from safe rear areas. The result was superior individual performances by ordinary soldiers, even against tremendous odds. Hitler's concept of Operation Citadel violated each one of these principles. He allowed no tactical flexibility to subordinate commanders. He personally interferred in the most minor details. The result was disaster.

Even though three decades have passed, the lessons of Kursk can still be applied to the battlefield. The German system of leadership was an excellent one. Had Hitler not desecrated the system, history might well have taken a different turn. Modern commanders should give subordinates tasks, not specific objectives that allow no latitude. Junior officers and NCOs must be free to conduct their own operations. The commander should provide direction and support, but allow the lower level leaders to make their own decisions.

The modern commander must be careful not to become a slave of technology. The radio-telephone (RT) and the helicopter are excellent machines. However, care must be taken to ensure they remain tools and do not become crutches. The leader's position is still at the forward edge of the battle area (FEBA). Leaders can direct their units and talk to their leaders on the RT, but they cannot be seen by their troops. The job of the leader is to see (terrain, weather, morale, fatigue, etc.) and to be seen by the troops. The RT must be used properly. Stay off the platoon net; let the platoon leader handle his troops. He will report or request help when necessary.

Too often in Vietnam, the company grade officer spent valuable time answering the same repetitive questions to successively higher commanders. The radio nets frequently became jammed with useless information, while important traffic was delayed. Stick with proper procedures.

The helicopter is fine transportation, use it that way. Use the chopper to go from unit to unit, or get to the trouble spot quickly. Don't allow it to become an "ivory tower" in the sky. Put your S-3 in the command-and-control bird, let him advise you. You should be on the ground to give your orders face-to-face. You owe it to your subordinates to realize you understand their situation and are making a sound decision. Visit every unit every day. Know all your leaders at least two levels below you. Do these things, and your troops will gladly follow where you lead.

RONALD J. BROWN
Captain, USMCR
Novi, MI

Recognition Quiz Answers

(All vehicles are in service in the Swedish Army)

1. **Pbv 302** (APC). Crew: 2 plus 10; weight: 13,500 kg (29,767 lbs); power-to-weight ratio: 20.74 hp/ton; maximum road speed: 66 km/hr; maximum road range: 300 km; armament: 1 x 20-mm cannon.

2. **IKV-91** (TD). Crew: 4; weight: 16,300 kg (35,941 lbs); power-to-weight ratio: 21.5 hp/ton; maximum road speed 68 km/hr; maximum water speed: 7 km/hr; maximum road range: 550 km; armament: 1 x 90-mm gun, 1 x 7.62-mm machinegun (coaxial), 1 x 7.62-mm machinegun (AA).

3. **Strv 103B** (S-Tank). Crew: 3; weight: 39,000 kg (85,995 lbs); power-to-weight ratio: 18.7 hp/ton; maximum road speed: 50 km/hr; maximum water speed: 6 km/hr; maximum road range: 390 km; armament: 1 x 105-mm gun (autoloader), 2 x 7.62-mm machineguns (coaxial), 1 x 7.62-mm machinegun (AA).

4. **BV-206** (Snow Vehicle). Crew & passenger capacities: 6-front, 8-11-rear; amphibious; maximum speed: 55 km/hr; variants-basic cargo, command & electronics, AT 90-mm gun, AT TOW.

5. **Strv-102** (Centurion). Crew: 4; weight: 50,813 kg (112,042 lbs); maximum road speed: 34.6 km/hr; maximum road range: 184.4 km; armament: 1 x 83.4-mm gun, 1 x 7.62-mm machinegun (coaxial), 1 x 7.62-mm machinegun (AA).

6. **155-mm Bandkanon 1A** (SP Gun). (Photo shows prototype chassis. Production chassis is S-Tank type). Crew: 6; weight: 53,000 kg (116,865 lbs); maximum road speed: 28 km/hr; maximum road range: 230 km; armament: 1 x 155-mm gun, 1 x 7.62-mm machinegun (AA).

(Prepared by SSG David L. Merryman, Intelligence NCO, DCD, Threat Branch, USAARMC, Fort Knox, KY.)

news notes

AM General Awarded Truck Contract

AM General Corporation has been awarded a $130 million contract for 2,511 6x4 line-haul trucks for hauling bulk cargo. The new trucks are similar to the current 6x4 tractor. They are designated M915A1 and weigh 14 tons.

WASP II Demonstrated At Ft. Benning

The WASP II, a turbine-powered individual lift device, has been successfully flown at Ft. Benning, Georgia by GIs who had no prior flight experience. The turbofan engine will enable a man to fly for 30 minutes at speeds up to 60 mph and with no wings or rotors, WASP II can fly under or between trees, close to buildings, and reach areas that helicopters cannot approach.

Marine Mk19 Machingun Unveiled

Marine infantry battalions will receive a new machine gun by the end of FY 1983. It will be the Mk19 Mod-3, an air-cooled, blow-back operated machine gun firing 40-mm grenade cartridges at a cyclic rate of 350-400 per minute.

The 75.6 pound weapon can be fired electrically or manually from a ground tripod or a vehicle pedestal. The Mk 19's extended range (1,600 meters) and high rate of fire will add to Marine battalion's antiarmor capabilities and provide antipersonnel coverage beyond the M79's range.

Night Vision Goggles Update

New night vision goggles for use by ground troops, vehicle (tank) drivers and others who need nonrestricted night vision capabilities are being developed by the Baird Corporation of Bedford, Massachusetts.

The new goggles use passive image intensification tubes which amplify the small amount of light available so that the user can see almost as well as he can during daytime, without giving any signals to the enemy.

New Cold Weather Diesel Fuel Specs

The Fuels and Lubricants Division of the U.S. Army Mobility Equipment Research and Development Command's (MERADCOM) Energy and Water Resources Laboratory at Fort Belvoir, Virginia, is developing new specifications for cold weather diesel fuel.

Diesel fuel contains paraffinic hydrocarbons which form wax-like crystals at low temperatures, causing hard starting and stalling. One solution is the blending of kerosene-based JP-5 aviation fuel with diesel fuel. Another solution under development specifically for the *M1 Abrams* tank is the use of ribbon heaters to be wrapped around fuel lines and filters to warm the fuel. Better filters to separate water and other fuel contaminents are also under study.

Laser Target Designator Delivered

A new hand-held laser target designator (LTD), developed by Hughes Aircraft Company, is now being delivered to US combat troops.

It resembles a short-barreled rifle and is capable of marking targets for any of the service's laser-homing weapons. Sample LTD's, taken at random from the production line, proved the new designator's reliability with over 20 million laser firings without failure.

New Armor Reference Data

The Armor School has published a revised edition of ST 17-1-1, Armor Reference Data. It is in three volumes and contains data on H-Series TOEs as well as Corps 86 Maneuver Battaltions and Corps 86 Armored Cavalry Regiment. ST 17-1-1 may be ordered from: Commander, US Armor Center, ATTN: ATZK-TD-EM, Fort Knox, Kentucky 40121.

BOOKS

INTRODUCTION TO BATTLEFIELD WEAPONS SYSTEMS & TECHNOLOGY, by R.G. Lee.

Brassey's Publishers, Oxford, England. $29.50 Hardbound; $15.00 Softbound.

The Royal Military College of Science, UK, conducts a series of military technical specialist courses for the British Army and Lee's book serves as the introductory test to those courses. This volume is to be followed by a nine-volume series keyed to chapters in this book.

Introduction to Battlefield Weapons Systems & Technology is a conventional textbook with self-test questions after each chapter and the answers at the end of the book. The chapters cover armored fighting vehicles; logistic vehicles and bridging; guns, mortars and rockets; ammunition; NBC; small arms and cannons; control and communications; surveillance and target acquisition; and guided weapons, including light antiarmor weapons.

Lee's book is not only easy to read, but also interesting. There are plenty of diagrams and illustrations. It has commendably few errors.

The strong point is Lee's illuminating discussions in each chapter defining the systems and how the military plans to use those systems.

Any serious student of the military arts should read this book and the following volumes. Any officer with a speciality in research and development should buy those parts that pertain to his, or her, area of interest.

GERALD A. HALBERT
Captain, Military Intelligence
Fort Knox, KY

THE LIBERATORS: INSIDE THE SOVIET ARMY, by Victor Suvorov

(Psued.). Hamish Hamilton Co., London. 1981.

This fascinating account of life in the Soviet Army is written by a defector who served as a young officer in tank and mechanized units from 1967 through the early 1970s. He graduated in 1967 from the Kiev Tank-Technology School and trained on the then new T-64 tank, took part in the famous 1967 Operation Dnieper summer manuevers (see "Ivan Has Training Problems" May-June 1982 ARMOR), and participated in the 1968 invasion of Czechoslovakia.

The general trend of the book will be familiar to readers of literature written by the growing body of Soviet defectors. What makes this account of interest to the armor community is not so much the portrayal of the stupidly brutal life of the Soviet soldier and the corruption of the officer ranks, but rather the details and opinions of the author regarding the operational capabilities and shortcomings of the units in which he served.

According to "Suvorov", the T-64 was a failure due to severe engine problems, a fact confirmed by other defectors.

His account of the Dnieper maneuvers is particularly intriguing, and he also points up several of the operational entanglements of the Czech invasion, especially when two Soviet divisions nearly came to blows because the planners had inadvertently assigned both units the same objectives, the same maps and the same routes.

STEVEN ZALOGA
Greenwich, CT

THE JEEP, by J.G. Jeudy and Marc Tararine.

Violo, Inc., 1981. 272 pages. $21.95.

Three books have been printed in France dealing with specific American trucks used in Europe during World War II. The first was on the 2-ton, 6 ×6 GMC model CCKW. The second related to the ¾-ton 4 ×4 Dodge WC series. The third volume covers the ubiquitous Jeep. Jean-Gabriel Jeudy, author of the first two volumes, joined with M. Tararine to produce an exceptional history of the Jeep. It has over 500 illustrations, is carefully researched and well written. The coverage includes the subject vehicle as well as its predecessors and successors. There are a few errors of fact: e.g., it was the Dodge car that achieved fame with Pershing in Mexico and Europe, not the Ford. The Ford Model T cross-country car of 1923 was not a 4 ×4. The Howie "belly flopper" had rear axle drive, not front axle. This is perhaps the best pictorial-historical review of the MB/GPW series Jeeps so far published.

F.W. CRISMON
Major, Ordnance
Fort Knox, KY

AT THE GOING DOWN OF THE SUN, by Oliver Lindsay.

Hamish Hamilton, N. Pomfret, VT. $25,00

At The Going Down Of The Sun details the situation faced by Allied prisoners of war held by the Japanese in an overall view rarely, if ever, before presented.

Allied prisoners were subjected to a wide variety of treatment ranging from relatively good through neglect to intentional brutality. Poor nutrition, nonexistent or rudimentary medical care, beatings, "refined" interrogations, overwork, and moves from camp to camp in old, overcrowded, transport were their general fate. Conditions in captivity were grim, and first-hand accounts of prisoners graphically portray their existence under the Japanese.

Included in the work are descriptions of the Japanese occupation policy in Hong Kong and the activities of British intelligence efforts in China which had some support from within POW camps near Hong Kong until the Japanese penetrated the organization and executed the members.

Lindsay admits that there can be no strict comparison between Allied POWs held by the Japanese and those held by other Axis powers. European POWs were often in a better climate, better fed, not as overworked, and had a greater life expectancy after release than did those held by the Japanese. He does, however, draw some conclusions based solely upon the Japanese experience. Frequently British and Canadian POWs fared better than their American counterparts and this is attributed to the British regimental system with its traditions and esprit de corps which made discipline easier to enforce and made teamwork for survival possible. Second, the role of British and Commonwealth NCOs has always been one of unquestioned authority and since officers were frequently separated from their men, everything depended upon the NCOs doing their job. And they did it superbly. The benefits that come from a strong NCO corps are made quite clear.

This book is an excellent study of leadership and the effects of stress on individuals and groups.

ROBERT STACY
Marlborough, MA

MIXED COMPANY: WOMEN IN THE MODERN ARMY, by Helen Rogan.

G.P. Putnam's Sons, N.Y., 1981. $14.05.

Few issues in the Army spark emotions more than the controversy over women in the Army. Studies have been made and more will follow and one can guarantee that they will generate more controversy and resolve few issues.

The same can be said of Ms. Rogan's book. But she did her homework, which is more than most who involve themselves in the debate.

She followed a coed basic training unit through its course at Fort McClellan, Alabama and she went to West Point to interview the first female cadets. She talked with women veterans of both World Wars, including some female Army nurses who endured capture in the Phillipines and imprisonment by the Japanese.

The book is well-documented but probably will not alter one's opinion on the subject.

Her accounts of women in the military services of different countries is very revealing.

Read the book, even though you may not agree with Ms. Rogan. A clearer understanding and appreciation of the role of women in the Army is essential for Army leaders, regardless of rank and sex.

FREDERICK W. SHIRLEY
Lieutenant Colonel, Armor
Ft. Knox, KY

STEEL ON TARGET

Thirty nine years ago in July, 1943, the Battle of Kursk demonstrated that mobile, protected firepower embodied in the tank was the wave of the future for victory in land warfare. Yet, it was not too long ago with the improvements in antitank guided missles, that the prophets of doom were forecasting the demise of the tank. They compared it to the dinosaur, the Edsel, and other extinct creatures whose time had come and gone. In grand headlines they declared it dead!

The tank, however, is alive and well, having risen like a Phoenix from the fires of more recent conflicts. Few at the Battle of Cambrai in 1917, when tanks were used to breach heavy defenses, could have foreseen the extraordinary mobility and armor protection of the modern main battle tank. Twenty-six years later, at the Battle of Kursk, few could have predicted the awesome firepower, speed and agility that enables today's tanks to lead lightning thrusts against deep objectives. Far from extinction, the tank has become the primary land combat weapons system around which the modern mechanized army is built. Its dominance as the key to land combat power is evident from continual technological struggle between the forces of penetration and those of protection focused on the tank.

The effects of technology go far beyond the penetration-protection struggle, however. It is offering the prospects of truly integrating the man with his machine by enabling the machine to extend the crewmen's senses beyond their natural limits. It is offering the prospects of gathering and collating battlefield and system information that assist unit and crew leaders to fight more efficiently.

And it is improving maintenance through improved diagnosis and soon, prognosis capability.

Like those at Cambrai and Kursk, few of us today can predict the evolution of armor. What we can be assured of however is the survival of the tank and its dominance on the battlefield for the foreseeable future. The tank will not follow the path of the dinosaurs. Despite their size and ferociousness, those terrible beasts that dominated the swamps and jungles of their primeval world, perished because their brains didn't match their brawn, while less hearty species survived. Such will not be the fate of the tank, for technology will provide the means for the tank to adapt to future battlefield environments however land warfare may envolve in the course of history. Good shooting!

35th Armor

(To Conquer Or Die)

Lineage and Honors

Constituted 13 January 1941 in the Regular Army as 5th Armored Regiment and assigned to 4th Armored Division. Activated 15 April 1941 at Pine Camp, New York. Redesignated 8 May 1941 as 35th Armored Regiment.

Regiment broken up 10 September 1943 and its elements reorganized and redesignated as follows: Regimental Headquarters and Headquarters Company and 2d Battalion as 35th Tank Battalion, an element of the 4th Armored Division; 1st Battalion as 771st Tank Battalion and relieved from assignment to 4th Armored Division; 3d Battalion as 8th Tank Battalion, an element of the 4th Armored Division; Reconnaissance Company as Troop D, 25th Cavalry Reconnaissance Squadron, Mechanized, an element of the 4th Armored Division; Maintenance and Service Companies disbanded.

35th Tank Battalion relieved 1 May 1946 from assignment to 4th Armored Division; concurrently, converted and redesignated as 35th Constabulary Squadron and assigned to 5th Constabulary Regiment. Inactivated 20 September 1947 at Augsburg, Germany. Converted and redesignated 11 December 1951 as 35th Tank Battalion and relieved from assignment to 5th Constabulary Regiment. Assigned 25 February 1953 to 4th Armored Division. Activated 15 June 1954 at Fort Hood, Texas. Inactivated 1 April 1957 at Fort Hood, Texas, and relieved from assignment to 4th Armored Division.

771st Tank Battalion (less Company D and Service Company) converted and redesignated 1 May 1946 as 71st Constabulary Squadron and assigned to 10th Constabulary Regiment. Inactivated 20 September 1947 as Hessenthal, Germany. Converted and redesignated 11 December 1951 as 771st Tank Battalion and relieved from assignment to 10th Constabulary Regiment. (Company D, 771st Tank Battalion, redesignated 1 May 1946 as Light Tank Troop, 10th Constabulary Regiment. Inactivated 28 February 1947. Disbanded 25 February 1953. Reconstituted 1 April 1957 in the Regular Army.) (Service Company, 771st Tank Battalion, redesignated 1 May 1946 as Service Troop, 10th Constabulary Regiment. Inactivated 20 September 1947. Disbanded 25 February 1953. Reconstituted 1 April 1957 in the Regular Army.)

8th Tank Battalion relieved 1 May 1946 from assignment to 4th Armored Division; concurrently, converted and redesignated as 8th Constabulary Squadron and assigned to 5th Constabulary Regiment. Inactivated 20 September 1947 at Landshut, Germany. Converted and redesignated 11 December 1951 as 8th Tank Battalion and relieved from assignment to 5th Constabulary Regiment. Redesignated 25 February 1953 as 508th Tank Battalion and assigned to 4th Armored Division. Activated 15 June 1954 at Fort Hood, Texas. Inactivated 1 April 1957 at Fort Hood, Texas, and relieved from assignment to 4th Armored Division.

Troop D, 25th Cavalry Reconnaissance Squadron, Mechanized, redesignated 15 September 1945 as Troop D, 25th Mechanized Cavalry Reconnaissance Squadron. Relieved 1 May 1946 from assignment to 4th Armored Division; concurrently, converted and redesignated as Troop D, 25th Constabulary Squadron, an element of the 11th Constabulary Regiment. Inactivated 20 December 1948 in Germany; concurrently, converted and redesignated as Company D, 25th Reconnaissance Battalion, and relieved from assignment to 11th Constabulary Regiment. Assigned 25 February 1953 to 4th Armored Division. Activated 15 June 1954 at Fort Hood, Texas. Inactivated 1 April 1957 at Fort Hood, Texas, and relieved from assignment to 4th Armored Division.

35th, 771st, and 508th Tank Battalions; Company D, 25th Reconnaissance Battalion; Light Tank Troop, 10th Constabulary Regiment; and Service Troop, 10th Constabulary Regiment, consolidated and redesignated 1 April 1957 as 35th Armor, a parent regiment under the Combat Arms Regimental System (Headquarters and Headquarters and Service Company, 35th Tank Battalion, redesignated as Headquarters and Headquarters Company, 35th Armor).

Campaign Participation Credit

World War II
- Normandy
- Northern France
- Rhineland
- Ardennes-Alsace
- Central Europe

Decorations

Presidential Unit Citation (Army), Streamer embroidered *ARDENNES* (35th and 8th Tank Battalions and 25th Cavalry Reconnaissance Squadron cited; WD GO 54, 1945)

French Croix de Guerre with Palm, World War II, Streamer embroidered *NORMANDY* (35th and 8th Tank Battalions and 25th Cavalry Reconnaissance Squadron cited; DA GO 43, 1950)

French Croix de Guerre with Palm, World War II, Streamer embroidered *MOSELLE RIVER* (35th and 8th Tank Battalions and 25th Cavalry Reconnaissance Squadron cited; DA GO 43, 1950)

French Croix de Guerre, World War II, Fourragere (35th and 8th Tank Battalions and 25th Cavalry Reconnaissance Squadron cited; DA GO 43, 1950)

Symbolism

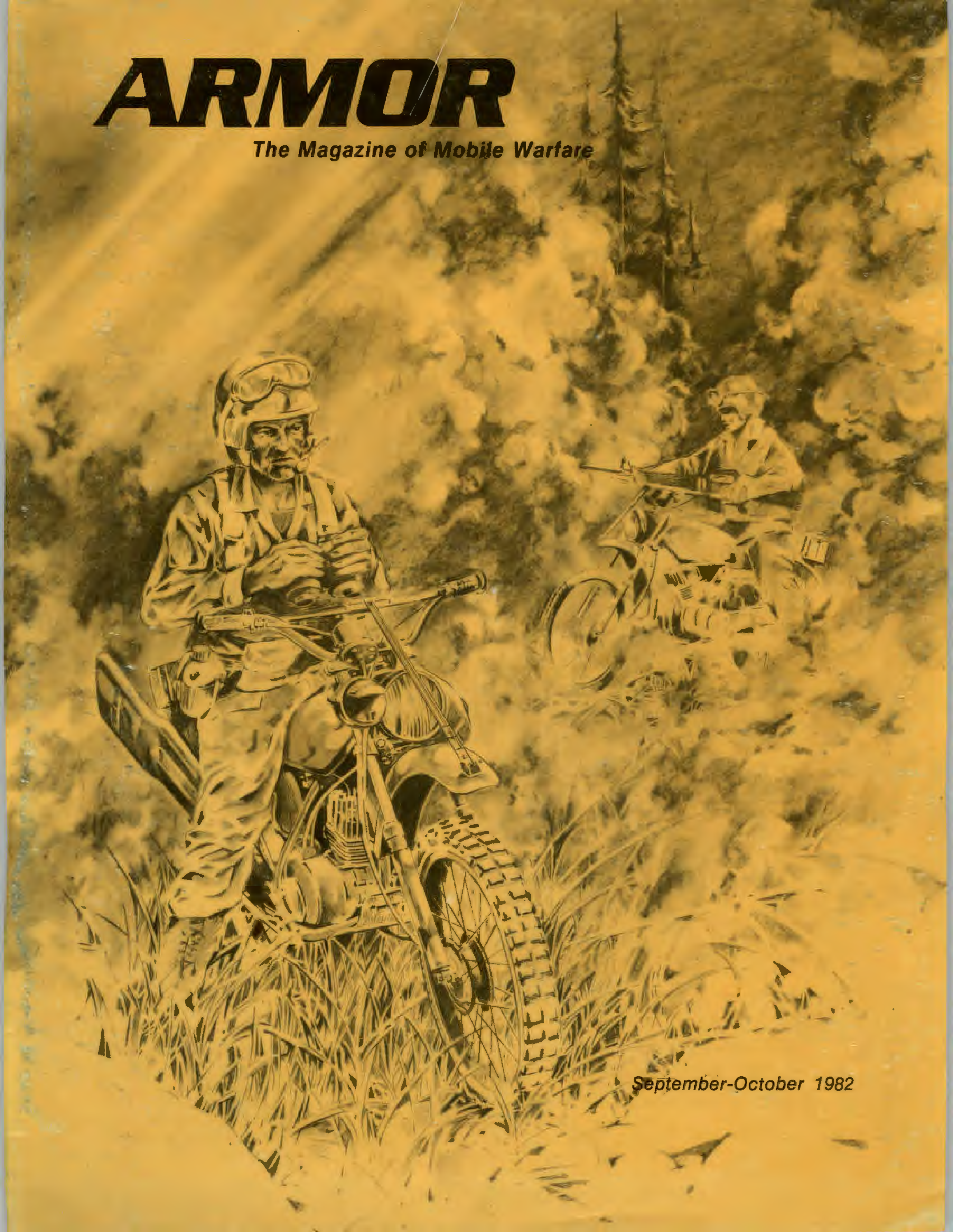
The shield is green, the color of the Armored Force. The armadillo, being characterized by the qualities of invulnerability, protection, and cunning endurance, alludes to the elements that are vital if the organization is to pursue successfully its duties. The palm is for military victory. The fleur-de-lis commemorates World War II service in France. The color red symbolizes courage.

Distinctive Insignia

The distinctive insignia is the shield, crest, and motto of the coat of arms.

ARMOR

The Magazine of Mobile Warfare



September-October 1982

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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FEATURES

DEPARTMENTS

COVER

The motorcycle is back in the Army! It will soon take its place in combat operations along side the Abrams tank and the Bradley fighting vehicles. Captain Sigl details the new equipment and its variety of uses on page 26.

LETTERS

A Letter From The Editor

The results of our reader survey (March-April 1982 issue) are pouring in. We are pleased that so many readers are responding. And, we are even more pleased that so many have taken the opportunity to provide us with their written comments as well.

These comments have shown some misconceptions existing about *ARMOR* that need to be clarified for our readers.

Many have suggested that *ARMOR* use full color photos and illustrations. We would like to do so, but are restricted to using two colors by Army Regulations. Usually that means black for the type face and one other color. Special permission was obtained from DA to print the full-color centerfold on the Soviet T-72 tank in the November-December 1981 issue.

ARMOR did not arbitrarily reduce its pages from 64 to 56. But, along with most every other government periodical, was forced to do so by policies imposed on the Army Periodical Review Committee by the Office of Management and Budget as a means to save money. *ARMOR* offset the page loss by tightening the copy.

The statement below "Old Bill" in each issue best describes the purposes of *ARMOR*. It functions as the primary medium available to Armor professionals in the field to express their unofficial opinions. *ARMOR's* constituency is, therefore, extensive, encompassing active and reserve military, officer and enlisted, veteran and retired; civilians, both DA and private industry, as well as many for whom armored vehicles and activities are a consuming interest. In serving these many and varied interests, we actively pursue the best articles and professional thoughts available, *irrespective of their source*. Consequently, we do not levy Armored Officer Advanced Course students for articles, nor reject out of hand those by new lieutenants without experience. Nor, do we accept, out-right, articles by senior officers. Neither do we reject articles because they dissent, nor, do we accept articles to "punch someone's ticket." The vitality of *ARMOR* as a thought-provoking journal and its credibility among our constituents are the results of that policy.

A criticism that has been noted is that some of our articles are too technical. We agree, and will attempt to simplify those articles consistent with the technology involved. We can't escape the fact, however, that the future of armor is coupled to the revolution in armor and weaponry technology and we feel the obligation to keep our readers informed of trends in that field.

So far, the responses to the survey are overwhelmingly positive. We are pleased about that because, while published by the Armor School, *ARMOR* does not belong to the School, but, rather, to you in the Armor Force whom we serve. It has been so since 1888 when its predecessor was first published as the *CAVALRY JOURNAL*. And it will remain so in the future. We on the staff will continue to do our best to serve your interests.

CHARLES R. STEINER, JR.
Major, Armor
Editor

German Tank Gunnery Lauded

Dear Sir:

The article, "German Tank Gunnery," by Lieutenant Colonel Georg K. Schulze-Buettger, was a superb, in-depth, and chronological assessment of an extremely successful gunnery program. (March-April 1982 *ARMOR*). My personal thanks to Lieutenant Colonel Schulze-Buettger for responding to my request for this analysis.

The pertinent points that came through clearly to me are the stabilization of crews, crew and leadership training, and total command involvement at the battalion level in planning and conducting tank gunnery.

Stabilization of crews in the U.S. Army has normally been a problem recognized, with very few satisfactory solutions forthcoming. At present, the Army is attacking the problem by fielding COHORT companies. The Department of the Army can only solve part of the problem, the battalion, company, or platoon must look to itself to cut the majority of turbulence.

The German method of training beyond advanced individual training (AIT) appears to be similar to ours; i.e., progressive, with crews attaining and mastering each level before moving to the next. Of course, our lack of stabilization prevents most crews from moving through a yearly gunnery program that includes a combined arms table as the same crew. Hopefully, standardization will be helpful in improving this area. It also should be noted that the COHORT companies have taken AIT to the field for testing.

It appears that both countries are heavily committed to the master gunner program, with the U.S. tables of organization calling for a fill in two of three platoons and the Germans placing one in each platoon. My feeling about the master gunner program is that it is the best school the Army has. The graduates of this program are the most technically proficient NCOs I have had the opportunity to work with. I feel that every NCO should be required to pass this course to hold the MOS. Probably should be substituted for Armor NCOES.

Again, my thanks to Lieutenant Colonel Schulze-Buettger for a professional article that should provoke much thought in the Army community.

JERRY A. THOMAS
Lieutenant Colonel, Armor
Fort Sheridan, IL

Israeli Armor

Dear Sir:

I have been reading and enjoying *ARMOR* for some years and I now have a pertinent question that perhaps you can answer.

Recent media coverage of the Israeli invasion of Lebanon has uncovered a very interesting modification to the U.S.-supplied *M60* tanks...the glacis and turret sides are covered by some sort of boxes, either ammo, storage or a form of spaced armor plating. Also, the mantlet has frontally arranged plates. The *M48*, the captured *T-55* and *T-62* and, until recently, the *Centurion*, have had no such changes or additions to their basic armor. However, the *M60* has so many of these 'boxes' attached as to be almost unrecognizable. Are these 'boxes' equipment storage, or increased armor protection, and what need are they fulfilling?

As a military vehicle enthusiast and modeler, I find this question highly interesting. The American armor vehicle crews should find it a basic matter of survival.

RICHARD W. ZAPH
Charleroi, PA

See letters concerning "Applique Armor" and "Israeli Add-On Armor" in this issue. Ed.

YPR-765 Armament

Dear Sir:

In your Recognition Quiz in the May-June 1982 issue of *ARMOR* Magazine, you included the YPR-765. Your description of this vehicle could lead to the (false) conclusion that the AIFV is solely equipped with a 12.7-mm machinegun.

Although some variants, like the command vehicle, the mortar vehicle, etc., mount a 12.7-mm machinegun, the basic AIFV mounts a 25-mm cannon in a two-man turret.

PETER A. FERRIG
Colonel, Royal Netherlands
Army, Liaison Officer
HQ TRADOC

Armor Officers Miss A Bet

Dear Sir:

The Armor School was founded after WW II on the concept that: Armor is more than a branch. It is a state of mind whereby a balanced team of arms and services work together in a climate of equal importance and equal prestige.

More than any other branch school, the Armor School is based upon a combined-arms approach. This requires armor officers to become *generalists* earlier in their careers than officers of other branches. Thus, the term "combat commander" was coined by the chief of the armored force in

1940. It has less one-branch connotation than "brigade."

I believe I read that only one-third of armor officers subscribe to *ARMOR* Magazine. If this is true, it is disappointing, because I consider it to be a very professional magazine.

My army schooling ended with a short course at Command and General Staff School, but I do not believe my professional studying and education stopped on 1 February 1940.

BRUCE CLARKE
General, USA
Retired

Vehicle Misidentified

Dear Sir:

While looking through the answers for the Recognition Quiz in the May-June 1982 issue of *ARMOR* Magazine, I found several errors in the description of #3, the LVTP. This is the LVTP-7 with a range of 300 miles, road speed of 45 mph and a water speed of 8.4 knots. These figures differ from the description's which give the maximum range as 260 miles, 35 mph road speed and 7 mph water speed. The biggest error, however, is that #3 is not even an LVTP, it is an LVTC-7A1, landing vehicle tracked, command.

BRUNO A. deHARAK
PFC, USMC
Camp LeJeune, NC

Whither Airborne Armor?

Dear Sir:

As a former battalion XO of 4-68 Armor, I read with interest Captain Bob MacKenzie's article (*ARMOR* September-October 1981) about the battalion, and Captain Guy Swan's letter (*ARMOR* January-February 1982) concerning the demise of airborne armor.

Although Captain Swan's predictions are logical, I do not welcome them. The Armor School no longer teaches the employment of airborne armor, nor does Fort Knox train *Sheridan* crewmen or turret mechanics.

In order to fill personnel requirements, the battalion had to have a recruiter at Fort Knox trying to encourage newly-enlisted soldiers to volunteer for airborne duty and eventual assignment to 4-68 Armor.

Obviously, DA personnel managers were not interested, nor could they focus their interests on one battalion's problems, no matter how unique the unit was, doctrinally.

Moreover, the battalion's consistently high availability rate of over 90 percent was seldom easy to achieve.

On one occasion, I remember sweating out a dearth of sprocket bolts that threatened to deadline half the fleet because bolts provided during the Product Improvement Program (PIP) were defective, which caused them to shear off during field operations.

Captain MacKenzie's article emphasizes all of the benefits the active force receives from the airborne armor capability. So, why hasn't the Army seen fit to nurture this capability and follow MacKenzie's logic? Why can't its use be projected into the future?

The answer lies in our philosophy of arming the force and a shortage of money. Airborne armor is not cost effective. Rapid deployment force (RDF) planners see the use of limited airframes best suited to deploy light infantrymen and other equipment. There are no extra bucks allotted to build additional transport aircraft to move specifically a light airborne armor force. Even if there were sufficient funds, one experienced in airborne armor employment gets the distinct feeling that the generally-held low opinion of the *Sheridan* among armor knowledgeable officers would prohibit greater use of the battalion by top-level planners.

I wonder if anyone thought of using an evolutionary approach to improving the much maligned *Sheridan*? Certainly, the aforementioned PIP did much to improve the vehicle mechanically. Mounting a high-caliber main gun on a light chassis, combined with the more sensitive missile system, caused most of the vehicle's problems over sustained periods. Few efforts to resolve fire control problems generated by the *Sheridan's* extraordinary mix of weapons were noted at unit level. Something more cost effective could have been accomplished to improve the vehicle's potential worth to the Army rather than issue this light tank to the Arkansas National Guard, sell it to the Koreans, or strip it down for use as an opposing force vehicle at the National Training Center. I'm not sure our nation has the money for the type of weapons development that features a requirement to demonstrate a remarkable technological advance everytime off the drawing board, instead of fine-tuning the rolling stock already in the inventory and developed at substantial costs.

Although Captain MacKenzie's article demands the ear of high-level planners, it is the reality of Captain Swan's comments that have been heard.

In spite of the special qualities inherent in the concept of airborne armor, it seems destined to remain a novelty to our top planners and, as such, will not receive a fair share of the budget to insure its survivability.

THOMAS V. FLORES
Major, Armor
USMAAG, Lima, Peru

Applique Armor

Dear Sir:

I am inclosing a picture from my local newspaper (Ventura, CA) of an Israeli *Centurian* tank with applique armor and triangular slugs of plating in the shot traps along the top of the hull and at the turret ring.

Additionally, "spacing plates" have been applied to the gun mantel and in front of the telescope opening and more applique armor is shown along the frontal portion of the turret.

Presumably the purpose of this additional armor is to counter chemical energy weapons through providing standoff distance.

I recall that in WWII the Germans had a similar program for their *PkWIII* and *PkWIV* tanks and some of their *Tigers* to counter the effects of shaped-charge ammunition.

I also recall that there was a sandbagging program popular with U.S. tankers using *M4 Shermans* to thicken up inadequate armor of that tank. I also recall that General Patton forbad the use of sandbags or any other type of add-on armor on the premise that it put unwarranted stress on the suspension system and generated a lack of confidence on the part of crewmen in their equipment.

The Israeli Army does not, apparently, agree with General Patton.

I must wonder whether or not the tank force managers have made any plans to obtain some sort of applique kits for the M60 series. Although the Chobham armor on our new *M1 Abrams* is quite effective against chemical energy rounds, the *M60s* could apparently stand a little help in this area.

JAMES SPENCE
Major, Armor
Ventura, CA

Density Altitude Typos

Dear Sir:

In reading my article which you published in the May-June *ARMOR* Magazine, I discovered the following typographical errors:

(1) On page 8, column 2, line 5, the last sentence should read, "This method is useful to altitudes of 3,000 meters (10,000 feet)."

(2) On page 10, column 1, line 9, the line should read : "...of just more than 3,000 meters (10,000 feet)."

Hopefully, those in a position to understand the article will realize that the errors are typos and that the message will get through.

EMIL M. DULAR
Master Sergeant, Armor
Wausau, WI

Israeli Add-On Armor?

Dear Sir:

The cover of *Time* magazine for 21 June shows an Israeli tank in Lebanon. The tank appears to be an American *M60* series, or an *M48A5* . . . What is interesting about the picture is what appears to be add-on armor. It would be interesting to know the background and the performance of this armor. Anything that can improve battlefield survivability should be of interest to the armor community.

The Israelis have also added side skirts to many of their American-made tanks. Fortunately (and unfortunately for American tankers) the Israelis do not seem overly concerned about how something looks on a vehicle, as long as it helps protect the crew.

Combat is an unforgiving teacher. When I viewed that cover, I had visions of WW II *Shermans* covered with sand bags and Vietnam armor festooned with sand bags and chain link fencing. If a viable, effective and cost-efficient add-on armor is available, shouldn't we have it on our vehicles?

ROBERT W. MIRELSON
Captain, Armor
Alexandria, VA

IFV-BMP Comparison

Dear Sir:

We read with interest Captain Halbert's explanation of why the U.S. Army is procuring the Bradley Fighting Vehicle (BFV) for the infantry and cavalry roles. Although entertaining, his constant weaving between the IFV and CFV to produce the best performance picture for the latter compared to the current Soviet "threat" necessarily proves his statement that one-on-one comparisons ". . . can be misleading," and prompts us to respond by offering an alternative view to the development of the BFV family and some considerations for future developments. In general the captain has developed his argument along the lines of size, firepower, armor, mobility and employment. We will respond in a similar order. We will compare the IFV to its counterpart, the BMP, while concentrating on the comparison of the CFV to the *BRDM-2* and the *BMP-2*.

Size. The captain correctly notes that cavalry was forced to accept a vehicle for reconnaissance missions which was through sheer hull size less than ideal. What he fails to mention is that Congress was so miffed with the Army's inability to coordinate programs and control costs that a demand was made of the Army to combine the two dissimilar vehicles into one basic vehicle.

The height required for the 95 percentile American soldier necessitates a combat compartment larger than Soviet vehicles (designed for occupants of up to only 5'6" in height), but is uniform for vehicles developed by the US and NATO countries. The problem with the CFV is the two-man turret, designed for a small three-man reconnaissance vehicle, now mated to the hull of an armored personnel carrier (APC) not designed for such purposes. Necessarily, adding a turret to a hull in being as an afterthought has resulted in a vehicle considerably larger than first planned.

That the CFV is smaller than the *M60* is correct, but even having to compare such vehicles for justification of continued procurement is highly questionable.

Firepower. In his article the captain notes the BMP ". . . is less tactically flexible" than the CFV (and IFV) due to: the limited main gun depression, the 40-round main armament load, and, the limited number (40 maximum) of targets that may be engaged compared with the number of (3-5 round burst) targets that may be engaged by the CFV (IFV). Although a good comparison, it does not consider the design concept of the Soviet vehicle or its current development in the field.

The Soviets developed the BMP in direct response to the need to provide antiarmor capability to infantry units immediately after a river crossing when friendly tanks were not available as much as for an infantry combat vehicle for combat assaults. The hull was constructed in the "strange" shape to promote good "swimming" ability while the upper deck, flush and mounting a turret with 360° traverse, was designed low enough to promote rapid hull down emplacement after an assault or crossing. At this point it would be a mobile weapons pit. There is little need for a 10° depression when the hull is at ground level. Therefore, we do not see the BMP suffering from the 4° depression limit.

The 40-round basic load of the BMP is obviously not as great a value compared to the 900-round load (300 ready) of 25-mm ammunition for its IFV counterpart. Note that this is *less* than the 1,500 rounds of the CFV. Although this would substantially reduce the IFV/BMP firepower ratio to only 22.5:1, the more important point is that the Soviets have perceived this weakness and have recently been seen fitting what appears to be 23- or 30-mm rapid-fire cannon to the *BMP-R, BMP,* and *BMD*.

Also, the number of targets to be engaged seems somewhat unrealistic. While it is true that 3-5 rounds *may* disable or incapacitate a vehicle, it is highly unlikely.

This brings us to the expensive dual-plane stabilized cannon in the BFV. This weapon system is the "best in the world," but it is expensive, and on the IFV is only an extravagance.

A further concern is the employment of ATGMs on the vehicle. The BMP carries five SAGGERs (one externally mounted and four internally stowed) while the TOW numbers seven at a maximum in the IFV or 12 in the CFV, but at a cost of thousands of dollars per missile.

They are expensive to the point of prohibiting fire against other than armored targets and are difficult to learn to employ efficiently, it is a weapon too few in numbers to be driven around the battlefield as an "afterthought" or "add-on" weapon. Infantrymen and 25-mm guns are designed for close work, while scouts are tasked with observing. Therefore, employment of the TOW, which is already fielded in the thousands on the *M901* antitank vehicle, on the BFV is inefficent and costly.

Finally it is important to note that the CFV carries 4,400 rounds of 7.62-mm ammunition, the IFV carries only 2,200 rounds for *twice* as many men. If such a number is sufficient for infantrymen 2,200 rounds should be more than sufficient for any cavalry function.

Armor. The armor envelope for the BFV series presents another interesting paradox in development. Although the armor is designed to be proof against 14.5-mm ammunition, we would point out that the BFV family is hardly expected to set a new standard in armor protection, even in the face of the old argument about the BFV being armored to survive "91 percent" of the firepower of a Threat motorized rifle division. We submit that the survival of the vehicle hinges on the ability to defeat antiarmor weapons.

As a side point, we must take issue with the statement that the BFV is better armored than all other infantry carriers. Although it is better protected than the 12.7-mm armor of the *M113* and BMP, the 14.5-mm armor of the BFV falls short of the armor envelope design of the West German MARDER which is proof against 20-mm fire.

Mobility. The BMP and BFV are relatively equal in mobility. Although the suspension of the BFV has been designed to yield a smoother ride, specifically to assist the gun stabilization system, it is doubtful whether, in the heat of combat, one suspension would be selected over another by the crew. Under fire, it would seem most important to move quickly. Here track width compared with engine power to vehicle weight is very similar between the two vehicles.

Agility, considered simply as a power-to-weight ratio, slightly favors the BFV. Although the BMP has the greater "flat-out" speed, we may presume that at any speed over 15 mph, it may be only moving tactically to displace. The hydromechanical transmission on the BFV delivers an impressive performance but results in a very high power drain, thus reducing the "agility" rating closer to that of the BMP. We are skeptical about claims that the BFV transmission requires less maintenance when the most important factor to consider is agility. The BMP was designed to accompany the upcoming "fast" tanks of the *T-64* class and shares many of its attributes and design features. Therefore, the BFV and BMP are equal in such cases.

Employment. The role of the combat scout is an exceedingly difficult one and the duties may well number more than those of even the infantry. We can well appreciate the concern of division commanders, especially in Europe where our forces are heavily outnumbered, to want a cavalry squadron strong in antiarmor capabilities as a divisional reserve and powerful reinforcement for successful drives; but this skirts the main issue of a shortage of troops.

Stopping Threat combat elements is the mission of infantry, armor, and artillery not the cavalry. The cavalry's mission is to be the "eyes" for the "mailed fist" of the task force. Given the unpredictable development of firefights during reconnaissance missions, a fully stabilized turret would be quite a plus in the corner of the scouts when fighting outnumbered three to one. We would like to move at 30 mph cross country firing perfectly aimed shots at rapidly closing BMPs and BRDMs, and at no time would we consider halting to fire a TOW at an advancing Threat main battle tank.

The CFV doesn't cut it, and the IFV has missed its mark as an *infantry* vehicle. Now perhaps we should get down to work on a group of vehicles which will meet the requirements on their own merits, and stop justifying poor designs.

PAUL A. HOVEN
Owatonna, MN
JOSEPH R. BURNIECE
Minneapolis, MN

COMMANDER'S HATCH

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

M1 Unit Commanders Face Challenges

Army equipment, organizations, and doctrine are changing at an accelerating pace. New, more lethal and mobile equipment, such as the *M1* tank, *M2* infantry fighting vehicle, *M3* cavalry fighting vehicle, and the *AH-64* attack helicopter, are providing an extraordinary increase in firepower and mobility. Simultaneously, new organizations—streamlined to fight the combined arms battle—are enabling us to fully use the capabilities of these weapons. Emerging tactical doctrine is emphasizing continuous operations and maneuver on a nonlinear, integrated, and greatly extended battlefield to take advantage of the mobility of our new equipment and flexibility of our new organizations. While these changes improve our capability to fight, each places new demands on leaders. What does this mean to commanders of *M1 Abrams* tank units? Let's start with the tank.

The *M1* has greater mobility, firepower, and survivability than any tank in the world. Its mobility has two significant aspects: agility and speed. Agility allows the tank crew to move quickly from position to position or to rapidly change direction to preclude being acquired, tracked, and hit by enemy gunners. Therefore tank commanders must think ahead and be constantly aware of the next several hide positions while their crewmen observe likely enemy locations. Tanks reacting individually to various situations and threats pose command and control problems for platoon leaders; therefore, platoon battle drills must be practiced until they become second nature.

The *M1s* greater cross-country speed allows commanders to rapidly concentrate combat power at the critical time and place and to increase shock effect. It also creates additional leadership challenges. To take advantage of the *M1's* mobility, commanders must train crews to operate at higher speeds. This does not mean we can now become careless with our soldiers' safety during training, it simply means we must plan training more thoroughly and innovate ways to train our crews to operate the *M1s* at their full potential. Commanders must think three, four, and five terrain features ahead, and organize and train their staffs to plan ahead in time and space. Everyone must be more alert and more proficient at map reading and terrain appreciation. No one can afford to move to a position only to find that it is in a valley surrounded by enemy emplacements.

In combined arms operations, careful consideration must be given to the employment of attached *M113s*, *M109* howitzers, or *DIVAD,* which are less mobile and survivable. If the *M1* battalion is to conduct a high-speed move, attached infantry trail the *M1* column in their *M113s* and catch up when they are able; or are moved by helicopter with the *M113s* catching up later; or are detached to be replaced by another infantry unit at the release point. Engineers may be task organized into "on call" packages to be delivered by aircraft or other means. Combat support and combat service support may be provided on an area basis by units occupying the sectors through which the *M1* unit passes. In a movement to contact, the *M1s* may use bounding overwatch to reduce the overall speed of the operation, which enables the remaining elements to keep up using traveling overwatch. Logistical support, too, must be planned for in advance, because our less mobile combat service support equipment can not keep up with the *M1s*. So, to take advantage of the *M1's* mobility, commanders at all levels must think faster, plan ahead, simplify operations, and anticipate logistical requirements.

The *M1's* fire control system with its digital ballistic computer, laser rangefinder, and improved stabilization system greatly improves firing on the move; therefore, more vehicles can be used in the maneuver force and less in the overwatch element. More ammunition may be consumed by *M1* units, which will create a logistical burden. The *M1's* thermal sights enable it to fire in darkness and through fog, rain, snow, and smoke. Although some of these conditions degrade the sight's capabilities more than others, it is still a superb new capability. Commanders must be thoroughly trained in the *M1* and its capabilities, and ensure their crews are trained to employ the *M1* to its full potential.

The *M1's* low profile, special armor, improved fire control system, greater speed and agility, turbine engine, automatic fire detection and suppression system, and compartmented fuel and ammunition, all add up to an unprecedented degree of survivability. But again, crews and units must be trained to take advantage of these capabilities or the *M1* will perform only marginally better than the *M60*-series tank.

The Division 86 tank battalion is designed to enable the battalion commander to integrate and fight the combined arms battle, and the company commander to fight weapons systems. Four companies give the battalion commander greater flexibility to defend on two avenues of approach or attack on two axes. This means the brigade commander must analyze the situation to determine if the task force should fight pure, balanced, or heavy in tanks or mechanized infantry. Task organization based on the factors of METT will often be accomplished at no lower than task force level where there is a staff and logistical organization adequate to employ and support a mix of weapons systems. The task force commander who task organizes to team level must ensure that his subordinate units are adequately trained and supported for the employment of combined arms.

Doctrinally this means the company commander is a leader-fighter, is less encumbered with the logistical effort, and is totally familiar with the weapons systems of his company. Because of this additional flexibility, the company commander must now know all aspects of the plan in a level of detail that previously was known only to the battalion commander. He must understand the battalion commander's intent and be prepared to continue the mission if communications are lost. The tank company is smaller, which increases the leader-to-led ratio, and is often employed without attachments. The tank platoon is also smaller (four tanks vs five) and organized to fight as an entity, splitting into sections only when absolutely necessary. The platoon leader is also a leader-fighter who, in the absence of other orders, leads his platoon using the wingman concept, meaning "follow me and do as I do."

Continuous operations will strain command and control to an unprecedented degree. That's why it may often be necessary for the S3 to remain with the command post and to work closely with the S2, FSO, and other staff officers. Commanders must ensure that necessary cross-training is accomplished to allow personnel to relieve each other for rest during continuous operations. To accomplish this we have a fighting executive officer at battalion and company level. For example, during critical periods, the battalion commander must be forward, of course, and mounted in his tank to personally control the battle; but, by being in the second-most critical location on the battlefield, the battalion executive officer can relieve the commander during lulls to ensure that he doesn't become ineffective from a lack of rest. Therefore, the headquarters company commander and battalion staff must take a more active role in supervising logistics operations, especially when the executive officer is forward assisting the battalion commander in controlling the battle.

The Airland Battle, which employs the Army and other services in the attack against enemy second echelon forces to disrupt his command and control, delay him, and destroy his logistics support, is another aspect of emerging doctrine that requires considerable thought by commanders of *M1* units. To attack deep, commanders must have an effective plan for relaying communications and providing logistical support over long distances, possibly by aircraft, with both aircraft and *M1* tanks rearming and refueling at a forward area rearm and refuel point.

With the introduction of more sophisticated night vision devices, we have a much greater capability to operate at night. Commanders must conduct reverse cycle training and practice night operations to become proficient in the best tactics and techniques. We can also take advantage of our improved optics by using smoke more often. With the proliferation of smoke grenade launchers and the advent of vehicle self-screening smoke systems, we can now conduct smoke operations concurrently with any other operation and suffer little or no degradation in our own capabilities. However, using smoke at the wrong time or place, or in the wrong weather conditions, can be disastrous. Therefore, commanders must be proficient in planning and conducting smoke operations and soldiers must be well-trained to maneuver in and fire through smoke.

Staffs must anticipate requirements and push supplies forward based on the commander's intent, with emphasis on arming, fueling, fixing, and manning the systems forward. The logistical and operational planning are accomplished concurrently; therefore, if a portion of the operational plan cannot be logistically supported, the commander can decide to alter the plan or accept the risk. The tactical operations center and the S1/S4 (Admin/Log Center) must communicate more often to ensure adequate logistical support is available and is being provided to the companies.

The changes I have mentioned give us a much greater capability to conduct highspeed, offensively-oriented operations; but they also bring greater challenges in planning and execution. All leaders must be thoroughly familiar with their weapons systems and support operations to achieve the best results during continuous operations. We must all seek new ways to operate—not just transfer old ideas and techniques to the new equipment and organizations. TRADOC Training Text 71-1/2, *The Abrams Battalion,* was mailed to all active duty tank battalions in April of this year. In it we express much "how to" for the *M1* tank and the Division 86 tank battalion. However, don't take it completely at face value. Challenge us and be innovative. Tell us how *you* do it so we can get your good ideas to others in the field and make changes in manuals during draft stages. Mail your comments to:

Commander
U.S. Army Armor Center
ATTN: ATZK-CSD-D
Fort Knox, KY 40121

DRIVER'S SEAT

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

First Formations

In August 1975, I was assigned as the Command Sergeant Major of the 3d Squadron, 8th United States Cavalry, Coleman Barracks, Manheim, Germany. Soon after, I held my initial meeting with the unit's five first sergeants. As they sat around my desk waiting to hear the first "words of wisdom" from the "new guy on the block," I handed each a copy of FM 22-5, *Drill and Ceremonies,* with the advice to become familiar with it (if they were not already) as, starting the next day, all first formations would be conducted "by the book," including an inspection of each soldier.

Shortly thereafter, the squadron commander initiated a written policy wherein I would inspect, unannounced, at the first formation, a troop of my choice at least once every 30 days. He would do the same at least once every 60 days.

What did this accomplish? Everything you would expect. The "gathering of soldiers" in one place first thing in the morning just so they could go to duty somewhere else changed into a productive military formation. The 15 minutes scheduled on the training schedule for the first formation was used for exactly that. Soldiers no longer wandered into the formation after the first sergeant ordered "Fall in." All the soldiers were there. All were inspected. None went to their duty sections or the next scheduled training until their deficiencies were corrected. Training took place as the entire leadership of the troop had to learn how to do it "according to the book." Discipline was reinforced. The soldiers' appearance improved. Self pride and unit pride were further developed. There was a sense of order at the beginning of the duty day that helped to establish a stable and organized climate of command. All of this and much more occurred simply because the decision was made to start each duty day with an *Army Standard.* That's what FM 22-5 is, an Army Standard.

There are a couple of interesting points about this. Nothing I have stated could be called new and, while most would agree with all the benefits derived from properly conducting the first formation, most units still do not take the time to do so. The first formation without the company commander and platoon leaders, with the first sergeant not doing much more than giving the order to "Fall in," closely followed by "Take charge of your platoons," has become the Army's routine.

It is rather amazing that while appearance of soldiers still is important in the Army, and the hue and cry to make on-the-spot corrections is still heard, the first formation, which would have the greatest positive impact in both of these areas, is relegated to a position of unimportance.

The other point of interest is how far we have drifted away from the standards found in FM 22-5. From the loss of interest in properly conducting the first formation grew the loss of the standard in our ceremonies. Without going into great detail, let me suggest that you discover for yourselves just how far we have drifted from the ceremony standards found in the manual. Watch what the platoon sergeant without a platoon leader does when the first sergeant turns the company over to the commander at the next company change of command you attend. Will he take three steps forward? Probably not. While all participants are supposed to be in the same uniform, observe the Color Guard and reviewing party at the next battalion or brigade change of command you attend. There is at least a 50/50 chance that one or the other will be in a different uniform. The Color Guard will probably be shoulder to shoulder, despite the standard being "formed and marched at close interval." Watch the command sergeant major when he passes the Colors to the outgoing commander. It's a good bet that he will do it prior to the *completion* of the reading of the assumption of command order. There are many other examples that could be given.

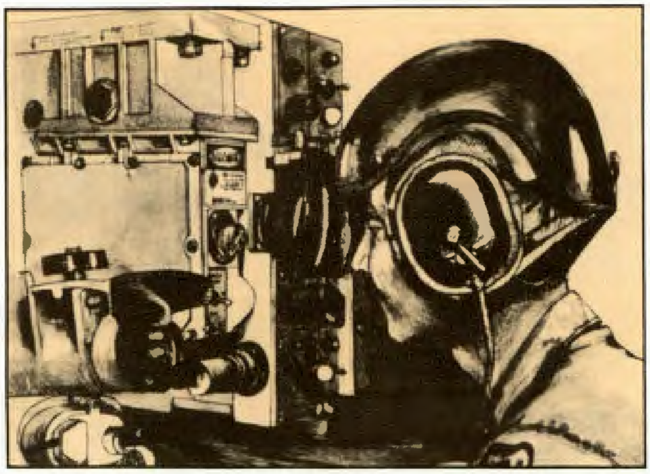
The question that now must be asked is "Why did this all occur?" How did FM 22-5, *Drill and Ceremonies*, become the "forgotten manual"? I guess we could fall back on the phrase "A commander is responsible for everything his unit does or fails to do," and thus blame the commander. But that is not the answer! The fact of the matter is that the noncommissioned officers have the responsibility to be the experts in drill and ceremonies. We are supposed to train and to demand the standard for formations. We are supposed to be the "experts on the ceremony practice field." The commander may *choose* to be an expert in drill and ceremonies, but it is the noncommissioned officer's *duty* to be that expert.

My experience has been that the noncommissioned officers who took this duty seriously were listened to by their commanders, and the standard prevailed.

John W. Gillis

MASTER GUNNER'S CORNER

Major Robert Heritsch
Project Manager
Test Measurement and Diagnostic Systems
Fort Monmouth, N.J.



TV and Integrated Gunnery Training

Integrated, crew gunnery training is one of those areas that is difficult to monitor and evaluate short of live-fire exercises, which are normally rare. Yet, crew effectiveness is a major cornerstone of unit readiness.

The concept described here is an application of standard, normally available, unit training aids and equipment that enables the trainer to challenge tank crews with realistic gunnery training and evaluation under the typical restrictions of garrison training facilities.

This training uses components of the ½- or ¾-inch portable videotape system, a *Brewster* mount, and 500-mm TV lens. With the camera and lens mounted on the main gun, an assistant instructor (AI) can easily, and much more accurately, monitor the integrated efforts of the entire tank crew, record their activities, and illustrate the effects of crew error on main gun accuracy.

The major advantages and capabilities of this system include a:

- Precision, real-time knowledge of the strike point of each simulated tank round as it passes by or through the target.
- Real-time visual display that shows any error made by crew members or by the fire control system as a target "hit" or "miss."
- Capability to train all crew members in an operational vehicle, performing almost all their assigned daytime firing duties.
- Capability to tape record the simulated strike of the round and all crew conversation on the intercom. The recording can be used immediately for crew debriefings.

The concept can be used anywhere without requiring range facilities and can "engage" targets at realistic ranges. Tanks with laser rangefinders would either not use the laser or would require appropriate laser-safe training areas.

Major Components. The technique uses off-the-shelf training equipment available through the Army Training Aids Support Center (TASC). However, a few additional inexpensive devices must be fabricated locally. All major functions are performed with the following equipment:

Brewster mount. The top part of the coax mount is not required since the bottom half of the mount provides a flat, stable mounting platform for the TV camera and lens. Spacers used to reduce parallax when firing the coax are not required.

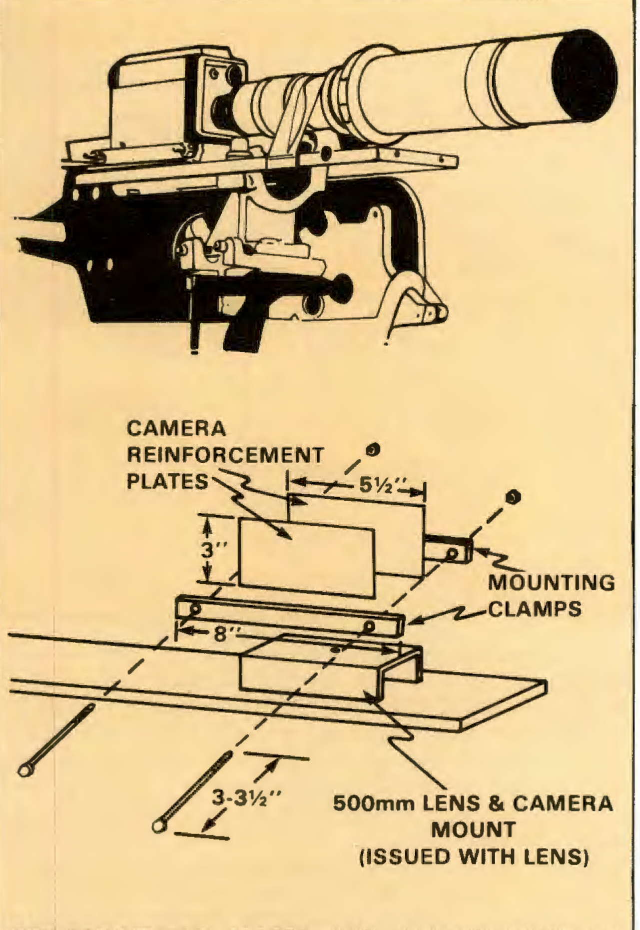
TV lens and mount. The 500-mm lens that is available through the TASC can be mounted and used with the ½- and ¾-inch videotape cameras. Two holes must be drilled in the lens mount at its balance point for attaching the camera and lens mount to the coax mount (figure 1). The camera body is normally attached to the lens mount by one bolt. This does not provide adequate stability and a simple reinforcement has to be fabricated to prevent any movement of the camera.

Videotape recording system. The recorder is placed on or in the turret. The system is powered by a separate 12-volt vehicle battery secured in the bustle rack.

TV receiver. A portable television is used by an AI on the turret. It is connected to the recorder and monitors main gun orientation. The TV is powered by the same 12-volt battery mentioned above.

Audio monitoring line. This is fabricated locally with enough wire and a minijack to connect the tank's *AM-1780 VRC* intercommunication system with the videorecorder (figure 2).

Battery. Though available TV systems come with small rechargeable batteries, a vehicle battery is required for operation for more than 1-2 hours.



REINFORCEMENT PLATES AND CLAMPS MUST BE LOCALLY FABRICATED TO ELIMINATE SYSTEM ERROR CAUSED BY ROTATIONAL MOVEMENT OF THE TV CAMERA DUE TO VIBRATION.

Figure 1.

Proper assembly requires that the *Brewster* mount, TV camera, and lens be very tightly mounted. Due to the magnification of the lens and the additional magnification of the projection on the TV screen, movement of 1/5 mil or less is readily visible on the TV.

Operation. The TV camera and lens mounted on the main gun operate in much the same way as the *M105D* telescope. Once the camera is firmly attached to the main gun, it moves in unison with the main gun.

The camera is simply another sight *firmly* attached to the gun tube. The TV screen is similar to the gunner's eyepiece without the reticle. Before evaluating crews, the AI determines the ranges to each target as accurately as possible (figure 3) and draws a special reticle on the TV screen that reflects the exact aiming point for the selected ammunition to be fired at each target. With the turret operating properly, and the camera and lens firmly mounted, the following procedures are followed to construct the reticle.

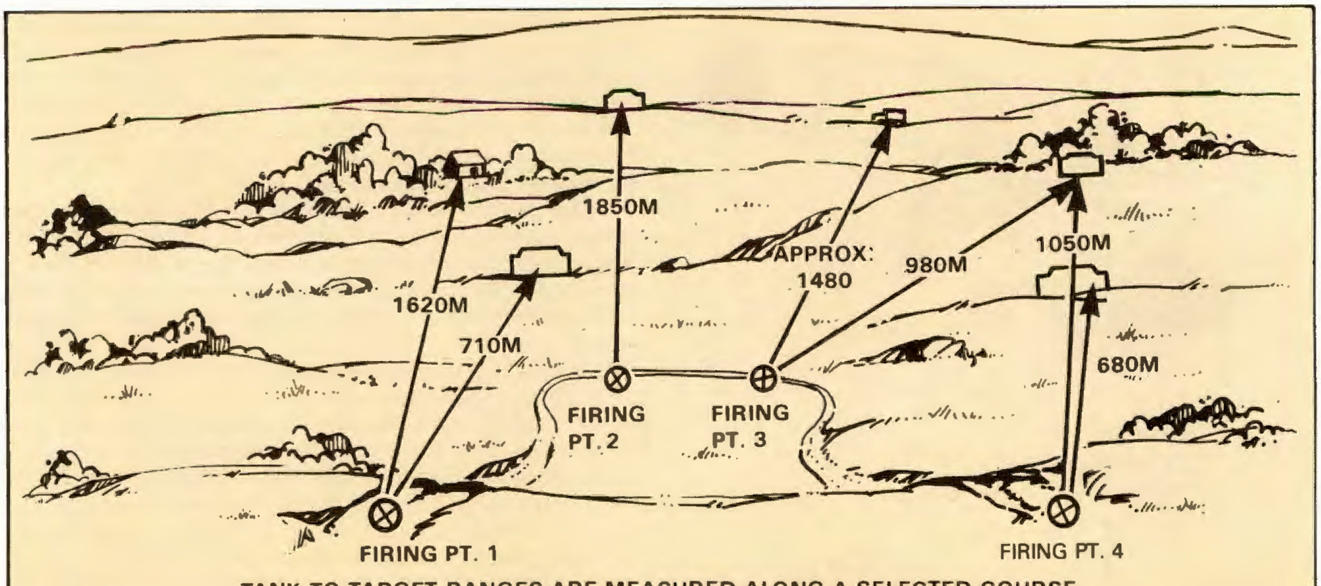
- The AI or gunner picks any distant, sharp aiming point to use as a reference point. Since the parallax between the TV lens and the gunner's sight is minimal, it is not necessary to use more than one reference point, or move the tank while marking all required target ranges on the TV screen.
- With the *M105D*, the AI or gunner uses the appropriate reticle and range line for the selected ammunition and very carefully lays on the reference point. This point should then be visible on the TV screen. A mark is made on the screen and identified or numbered to correspond to the selected target or range (figure 3). This process is repeated until all known target ranges are marked on the screen (figure 4). If the crew being evaluated has the option of selecting more than one type of ammunition (e.g. APDS or HEAT), then known target and range aiming points must be recorded to correspond to each type of ammunition.
- If the *M32* is used to construct the AI's TV reticle, the known range is indexed in the computer, and the *M32* crosshair is placed on the reference point. The result is a visual record on the TV screen of where ideal rounds will be as they pass by or through the targets at the known tank-to-target ranges.

When training begins it is important to recognize that the points on the TV screen represent the *round* and not the *gunner's sight picture*. The *M32* periscope in particular has many factors that will cause the crosshair in the gunner's sight picture not to correspond with the actual position of the round as it passes the target. Human errors include improper range, wrong ammunition, or a different sight picture from that used to zero the weapon. Add to this any slack or error in the fire control system and it is easy to understand that what the gunner sees is not always what he gets. This is verified on live tank ranges. Although the gunner may be looking at or close to his target, the TV camera is looking very precisely at whatever the main gun may be pointed at. Once again, the mark on the TV screen represents an actual round at a particular range and not a sight picture.

During an exercise the AI can immediately sense "the round" and visually or orally relay this information to the TC to use in his subsequent fire command. There is no practical way for the AI to provide the gunner with visual feedback with which he can make his own adjustments. This is not a serious fault because experience has shown that due to blast and obscuration, and the speed of HEAT and APDS, the gunner frequently cannot sense APDS within 1,500 meters and HEAT within 1,000 meters and make his own adjustments.

Limitations. Testing of the TV gunnery training device disclosed some system limitations and critical tolerances. When training on a stationary tank, no amount of traversing or gun tube movement can induce error into the mounted equipment. With the engine running, some vibration is transmitted through the gun tube to the camera with a slight decrease in TV picture sharpness. Yet, only once in 4 months of testing under various light and weather conditions were the conditions so poor that targets were not visible to the trained eye.

When the vehicle is in motion, targets can not be recognized on the TV. Stabilized gunnery cannot be monitored. After movement, a slight random error appears in the system. Normally after 2-4 miles of tank crew proficiency course (TCPC) exercises, the random error is within 1/5 mil. And it never varies more than ¼ mil from the original reticle markings. When an error is recognized, it is easily nulled out immediately by referring to any good distant target point (regardless of range), indexing any selected range and ammunition corresponding to one of the TV reticle points, and having the AI talk the gunner into moving the main gun until the AI sees the selected target point coincide with the corresponding TV reticle aiming point. The gunner then uses his boresight knobs to refer his reticles(s), and the entire fire control system is again synchronized with the TV reticle. This procedure takes less than 2 minutes and is a good practice at the beginning of each TCPC run. Often the AI will find that no adjustment is required. The most annoying potential error can be eliminated from the very start by insuring that the camera and mounts (total of 10 bolts) are firmly fastened when the equipment is mounted.



TANK TO TARGET RANGES ARE MEASURED ALONG A SELECTED COURSE.
Figure 3.

Application to Training. A trained individual, who has mounted the equipment 3 or 4 times, can mount the system and prepare the TV reticle in approximately 15-30 minutes with the help of an untrained crew. This technique can be used under a variety of training conditions depending on the trainer's objectives. Under the most limited objectives it can be used in a motor pool to "fire" at buildings or other distant objects to simply analyze or exercise the gunner's hand and eye coordination.

On the other hand, under most realistic conditions, the system can be used in conjunction with a challenging TCPC, including full-scale Threat panel-targets at normal engagement ranges. A cross-country route can be followed to negotiate the course, using concealment and hull-down firing positions, etc. The AI analyzes crew activities, including target acquisition, engagement times, fire commands, route selection, firing positions, and the selection of the correct ammunition. (If APDS and HEAT inert training rounds are available, the AI senses target hits based on the actual ammunition loaded and not that announced in the fire command.) Coax gunnery can also be easily evaluated. Most importantly, the TV accurately indicates whether or not the target was hit.

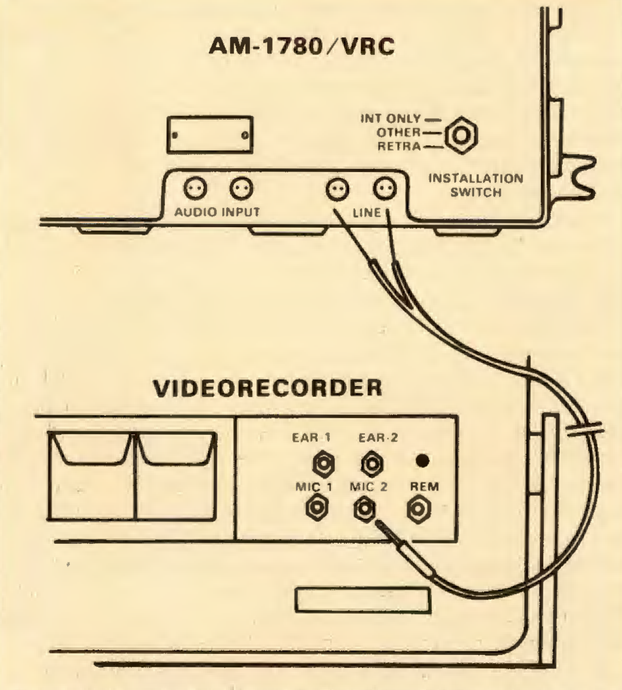


Figure 2. A locally fabricated audio wire with a minijack can be used to connect the recorder with the intercom system.

The equipment can be weather-proofed by covering the camera, lens, and recorder with plastic bags. A cover, such as a cardboard box, not only protects the TV from moisture, but also shades the screen from excessive glare and makes it easier for the AI to see the picture if the sun is shining from behind him.

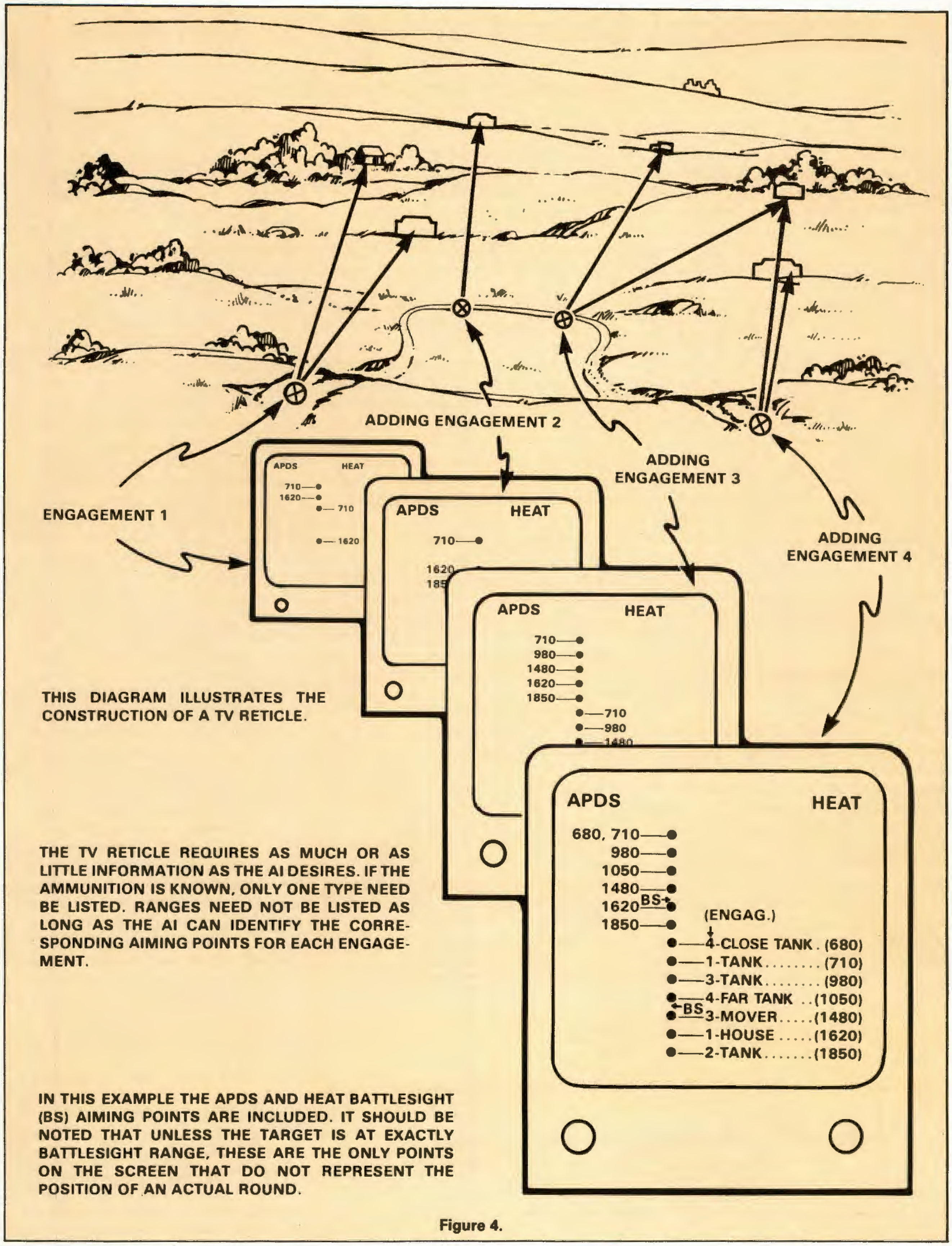
Summary. This TV gunnery training device was briefly tested in an armor battalion leading up to, and during, a level II gunnery exercise at Grafenwöhr. At the home station, three soldiers received minimum necessary training on turret operation and safety. None had any experience as a tank gunner. One was a 19E, E5 who had not been on a tank for three years; another was a 19E, E3 who had been a loader, and the third man was a support platoon truck driver who had never been on a tank. Rotating crew positions, each man spent from 1 to 4 hours in the gunner's seat training with the TVT under the supervision of a qualified AI.

At Grafenwöhr, these men fired one main gun familiarization round each and then negotiated a modified Table VII, each having the opportunity to perform as a gunner. Of 20 targets exposed (from 1,000 to 1,900 meters), 15 were first-round hits, 4 were second-round hits, and 1 was a third-round hit.

Undoubtedly, because of the uncontrolled nature of the test, the results would not constitute statistical evidence of training transfer. However, these men were isolated from all normal pre-gunnery training and yet fired for the first time on Table VII as a crew with impressive effectiveness. The results were very encouraging.

Current integrated crew training, short of live-fire exercises, leaves much to be desired.

The TV gunnery trainer exercises the entire crew and their integrated performance under field conditions to live-fire gunnery standards. Crew results are recorded and can be rerun for training and debriefing purposes or scored for evaluation purposes. Except for laser-equipped vehicles, no range facilities are required, and the system can be used



THIS DIAGRAM ILLUSTRATES THE CONSTRUCTION OF A TV RETICLE.

THE TV RETICLE REQUIRES AS MUCH OR AS LITTLE INFORMATION AS THE AI DESIRES. IF THE AMMUNITION IS KNOWN, ONLY ONE TYPE NEED BE LISTED. RANGES NEED NOT BE LISTED AS LONG AS THE AI CAN IDENTIFY THE CORRESPONDING AIMING POINTS FOR EACH ENGAGEMENT.

IN THIS EXAMPLE THE APDS AND HEAT BATTLESIGHT (BS) AIMING POINTS ARE INCLUDED. IT SHOULD BE NOTED THAT UNLESS THE TARGET IS AT EXACTLY BATTLESIGHT RANGE, THESE ARE THE ONLY POINTS ON THE SCREEN THAT DO NOT REPRESENT THE POSITION OF AN ACTUAL ROUND.

Figure 4.

anywhere. Perhaps the system's most important contribution is that it enables the commander or trainer to place his crews under the same demanding standards of performance and accuracy during home station training that they will experience on Table VIII. A weak crew or any member of the crew will be able to see the overall effects of his or their performance, on a hit-or-miss standard, before a main gun round is ever fired.

Aeroscout Operations in the Defense

by Captain Robert Johnson

The attack helicopter company (AHC) is one of the most lethal units on the modern battlefield. With its unmatched mobility and awesome firepower, an AHC can move over extended distances about the battlefield in a minimum of time and wreak havoc on the enemy.

A large part of the effectiveness of that AHC depends on the teamwork between the scout and attack crews. Obviously, the more efficient the teamwork, the more effective that unit is going to be in maintaining a high volume of fire on the enemy. The question here is how can the aeroscouts of an AHC be used best in a defensive operation? In answering this question, four items will be discussed. First, the role of the Air Battle Captain (ABC) and the aircraft he should be in. Second, a technique of using all the aeroscouts in your unit. Third, a discussion on conducting a relief on station and, fourth, using the limited number of aeroscouts that most units have to accomplish the same result. At this point, it is important to understand what aeroscouts do, and how they are task-organized within the company.

FM 17-50 *Attack Helicopter Operations,* states, "the primary mission of the aeroscout is to see the battlefield, acquire targets, and coordinate movement of attack helicopters." To perform these missions the aeroscout must perform many tasks. Some of them are to:

- Coordinate as necessary with the ground commander.
- Request and adjust indirect fire.
- Select battle positions for the attack helicopters (AH).
- Coordinate movement of the AHs around the battlefield.
- Acquire and identify targets.
- Hand-off targets to the AHs.
- Provide local security.
- Assist in moving AHs to subsequent battle positions, when necessary.

To accomplish all these tasks, the attack helicopter company is usually task-organized for combat into three teams with each team having a mix of 3 aeroscouts to 5 AHs. This task organization is based on mission, enemy, terrain, time and troops and equipment available (METT); The remaining aircraft in the company are undergoing scheduled and unscheduled maintenance or undergoing battle damage repairs.

The responsibilities of the individual scouts varies with each unit. These teams are then subdivided into a heavy section (3 AHs to 1 scout) and a light section (2 AHs to 1 scout) (figure 1). The remaining scout usually acts as ABC and controls the indirect fire, coordinates with the ground commander, sends and receives reports, and controls the overall flow of the battle between the two sections. Each aeroscout assigned to the section is responsible for:

- Selecting battle positions for their AHs.
- Providing local security.
- Coordinating the movement of their AHs about the battlefield.
- Assisting in moving the AHs to subsequent battle positions when necessary.
- Sending reports to the ABC.
- Assisting the ABC in sending reports and calling for fire, when necessary.

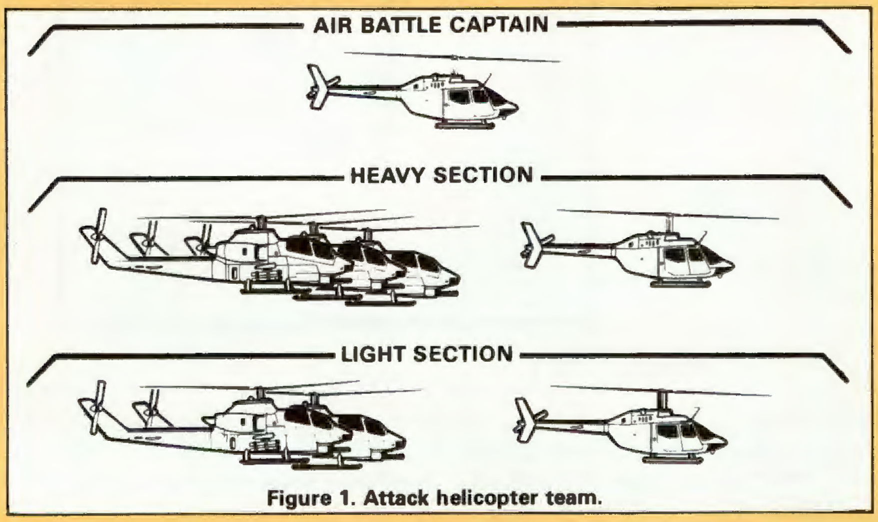


Figure 1. Attack helicopter team.

The Air Battle Captain. The ABC's role and the aircraft he commands from is often a controversial subject.

The ABC should ride in the third scout aircraft instead of an AH or UH because he must have access to all the radios (in an AH, he does not). Furthermore, his aircraft must be fast, agile, and small in order to move about the battlefield quickly with as small a signature and profile as possible. He must be able to land in tight places to coordinate on the ground. AH and UH aircraft are inadequate for this purpose. A scout aircraft can remain on station much longer than a loaded AH or UH. Furthermore, having an ABC situated in the front seat of an AH prevents the most efficient use of that weapon platform. If he is doing all the things that an ABC must do, he is not putting rounds down range to help maintain a high volume of fire. If he is, then he's detracting from his responsibilities as ABC.

Additionally, the ABC's aircraft must have two pilots (the ABC and one other) because the ABC has so many critical things he *must* do he cannot fly the aircraft and effectively accomplish these tasks at the same time.

The ABC's aircraft should not be used as a scout for one of the sections. When it is, even the most experienced scout pilots and ABCs (not necessarily the same) are quickly overworked to the point where they cannot do both jobs adequately; thereby decreasing the efficiency of the team. Many ABCs are AH pilots and are not aeroscout trained. This makes the ABC's scout aircraft a poor choice to effectively do the job of a section scout.

Aeroscout Technique. With these thoughts in mind, let's examine *one technique* in which the aeroscouts of the AHC can be efficiently employed during a defensive operation.

When the mission is received, an assembly area (AA) is identified and the company moves there. The company commander, or his representative, coordinates with the ground commander while the attack teams move to the AA. After coordinating with the ground commander (usually the brigade or task force commander, initially), he rejoins the company at the AA and briefs them on the situation and mission. When this is done, keeping in mind the one-third rule for applying continuous pressure i.e., one-third of force in contact, one-third refueling or rearming at the forward arming and refueling point (FARP), one-third in transit either to the FARP or returning to the battle area, the 1st Team moves forward to the battle area. Two section scouts from the 3rd Team move forward with the 1st Team (one 3rd Team scout going with each section). Each section now has two scout aircraft. These sections move to their respective holding areas and the ABC moves to contact the local ground commander for any updated information. At this point it is necessary to examine why the 3rd Team scouts accompanied the 1st Team.

When examining the various tasks that a section scout has to do, it is obvious that some tasks cannot be done simultaneously. For example, it is impossible to provide local security *and* reconnoiter subsequent battle positions *at the same time*. When the enemy has launched an attack across a wide front, it is imperative to provide local security because the depths of the penetrations of enemy reconnaissance and main forces on the flanks are constantly changing. A scout providing security can give the early warning necessary to prevent a surprise engagement.

However, it is also vitally important for the scouts to reconnoiter subsequent battle positions. When AHs move off their battle positions after an engagement, a certain amount of "*floundering time*" will exist. Floundering time is defined as the time it takes an AH crew to remask after an engagement, move off that battle position, reorient itself on the map, move to the next battle position, using a covered and concealed route, find an adequate firing position and then begin the next engagement sequence. Keeping in mind that it is imperative to maintain a high volume of fire, the more floundering time there is, the less effective the team is.

A mechanized or armor force can be expected to move about 300 meters per minute when engaged. Therefore, 2 minutes of floundering time allows the enemy to move about 600 meters, without being engaged. But, if a scout aircraft is waiting to immediately guide its AH section to the next battle position along a reconnoitered route and has already identified good firing positions at the next battle position, a large amount of floundering time can be eliminated. This allows the team to maintain a higher volume of fire.

It is also critical for the scout to maintain contact with the enemy. However, if he is leading the AHs back to subsequent battle positions he cannot do that.

Unlike the AHs who must frequently visit the FARP, during the course of battle, the scout aircraft can remain on station for extended periods of time. By using a straight 3-5 mix, the commander is allowing two-thirds of his available scout assets to remain idle during the battle. However, they can be used by the team in contact to increase the combat effectiveness of the unit. One solution to these problems of opposing tasks and idle scout assets is to use the 3d Team scouts in the role of "rovers" for the 1st Team in contact. The scenario for applying this solution follows:

After the ABC returns with the updated information and briefs his team, the section scouts move to their initial battle positions (figure 2). As soon as the covering force area (CFA) units pass back through friendly lines and before Threat forces reach the maximum effective range of the AHs, a sequence of events takes place. The ABC calls for the AHs to move into position (usually with a code word), calls for indirect fire on the advancing Threat, and then reports the contact to the ground commander.

Now, the AHs are brought forward by the rovers and put into their initial battle positions. The rover immediately departs to reconnoiter the next battle position. As the advancing Threat moves within the maximum effective range of the AHs, section scouts hand off the targets (unless the ABC directs otherwise) to their respective AHs and the engagement begins. After the target handoff, the section scouts provide local security and maintain contact with the enemy, pass reports to the ABC, and acquire targets of opportunity for the AHs.

As the enemy continues to move forward and the AHs are forced to relocate, they are assisted in moving to the next battle position by the rovers. Meanwhile, the section scouts are still in contact with the enemy, monitoring their movement and informing their section AHs of the enemy's movement and location so that the next engagement can begin as soon as possible. This technique of using rovers and section scouts significantly reduces floundering time. While this is taking place, the ABC is continuing to shift indirect fire on the enemy and reporting to his

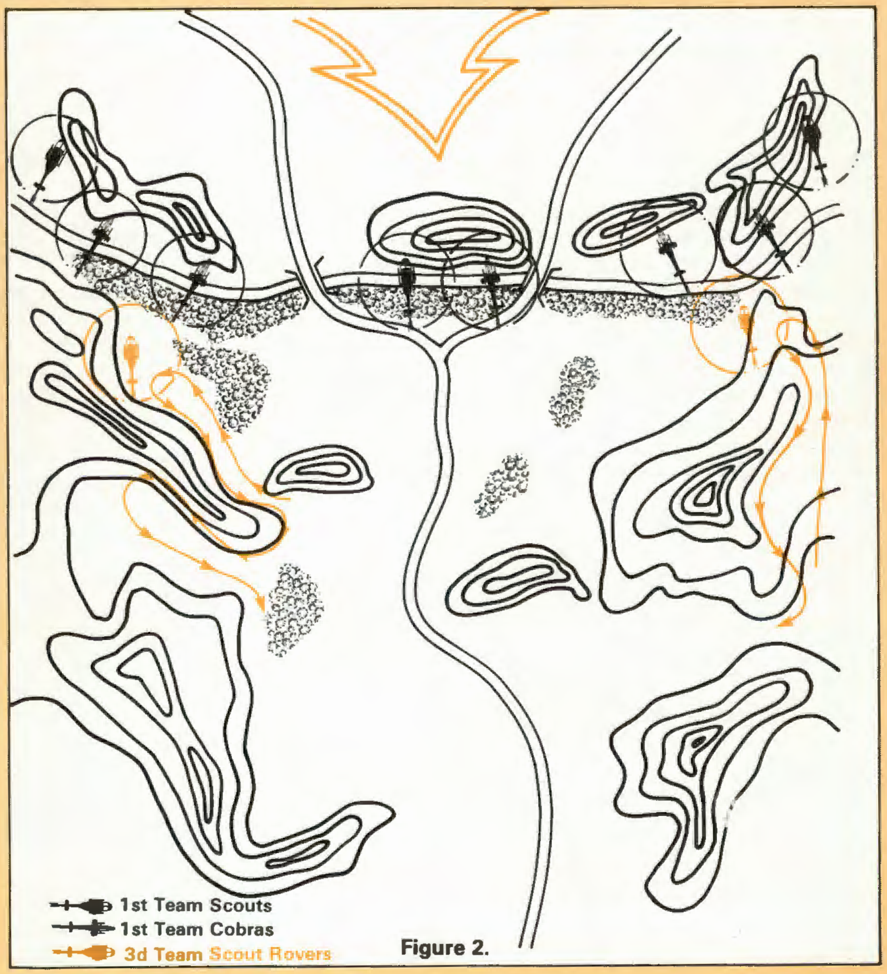


Figure 2.

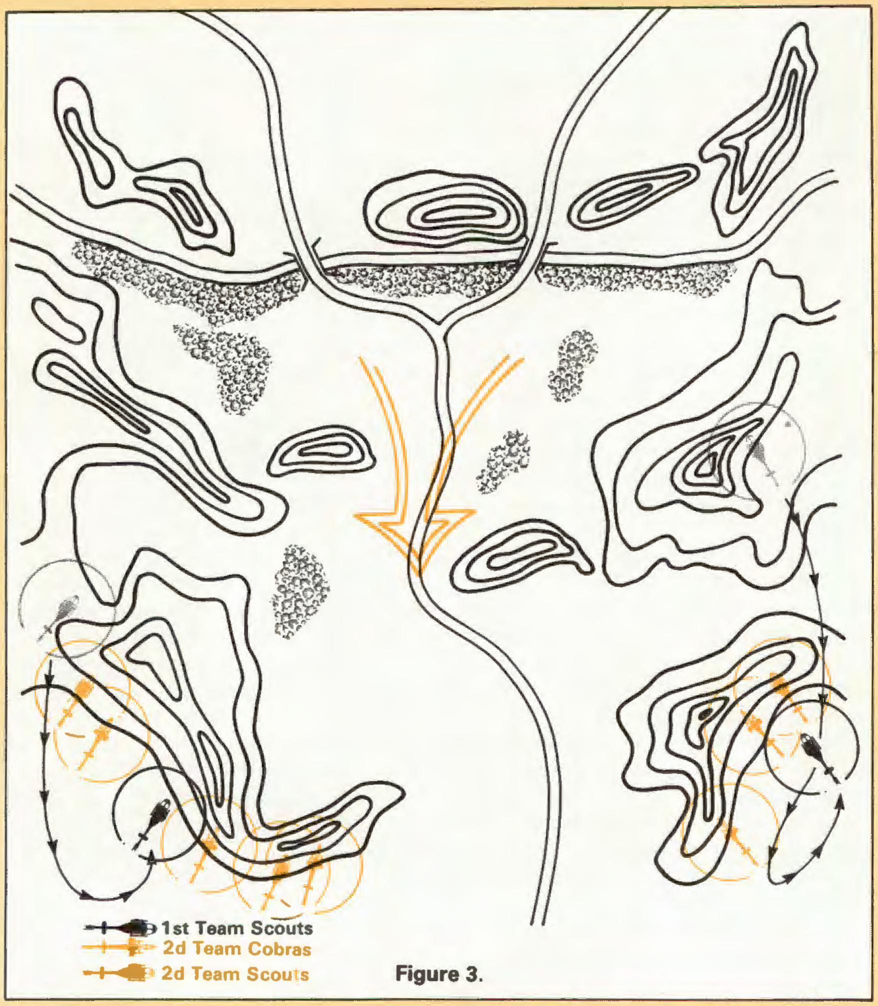


Figure 3.

higher headquarters.

As the 1st Team's AHs deplete their ammunition and/or fuel to a predetermined level (usually 50 percent) they inform their scouts who relay the information to the ABC who passes it to his tactical operations center (TOC).

Relief on Station. At this time, the company commander orders the 2d Team forward. The 2d Team moves forward and its ABC contacts the 1st Team's ABC for a situation update. The 1st Team's ABC informs the 2d Team's ABC which battle positions to occupy and where to expect enemy contact. Example: "X-RAY TWO ONE, THIS IS YANKEE FOUR THREE. OCCUPY BRAVO ONE FIVE AND CHARLIE TWO THREE. EXPECT CONTACT IN ENGAGEMENT AREA CHARLIE. OVER."

Once the 2d Team's AHs are in position, and the section scouts inform the 2d Team's ABC of such, the 2d Team ABC informs the 1st Team ABC that his team is in position. Example: "YANKEE FOUR THREE, THIS IS X-RAY TWO ONE. MY ELEMENT IS IN POSITION. OVER." When the 1st Team's AHs have expended their ammunition and the 2d Team is in position, the 1st Team ABC passes the battle off to the 2d Team ABC who now takes charge. Example: "X-RAY TWO ONE THIS IS YANKEE FOUR THREE. MY ELEMENT IS EXECUTING BINGO. OVER." In this case, BINGO is a code word meaning the team in contact is departing for the FARP and that the new ABC is now in charge. When the 1st Team ABC informs his team to execute BINGO the 1st Team scouts switch to the 2d Team's frequencies. Once the 2nd Team's scouts establish contact with the enemy, the 1st Team's scouts (who have been maintaining contact) become the 2d Team's rovers (figure 3). The 1st Team's AHs return to the FARP accompanied by the 3d Team's scouts and by the 1st Team's ABC. The 3d Team's scouts rejoin their AHs after rearming and refueling. This technique enables one-third of the AHs assets to remain in constant contact with the enemy to maintain a continuous volume of fire. It also allows the scout aircraft to rotate as scouts and rovers in an orderly fashion.

Limiting Factors. In reality, most units do not have enough pilots and trained observers to field nine scout aircraft. They also don't have many experienced scout pilots fully capable and trained to handle an AH section. This technique can be accomplished with only five scout aircraft. One aircraft for the ABC, two for rovers where the less experienced pilots and aerial observers are located, and two for scouts with experienced and trained pilots on board. Almost all attack helicopter companies can field five aircraft manned by this combination of pilots. The procedures for working the teams are the same. The only difference is that the scout aircraft remain on station when the *Cobras* are relieved. The five scout aircraft merely rotate back to refuel when necessary. Five aircraft provide maximum effective teamwork between the scouts and the AHs and decrease the AHs floundering time. This, in turn, increases the ability to maintain a high volume of fire on the enemy.

In summary, success in any defensive operation is dependent on a high volume of fire on the enemy. The more efficient the teamwork between the AHs and scouts, the more effective that unit is going to be in maintaining that high volume of fire. The technique discussed here is one of many which has proven successful and is one that any unit can use.

CAPTAIN ROBERT JOHNSON graduated from the USMA in 1975 and has attended the Armor Officer Basic Course, the Armor Officer Advanced Course, the Battlestaff Course, flight school, *AH-1G* course, and is currently attending the *AH-1* (MC) course at Fort Rucker, AL. He has served as a platoon leader and XO with the 1–67 Armor, 2d Armored Division, Ft. Hood, TX, and is a *Cobra* section leader, aeroscout platoon commander, and XO with Company D, (Atk Hel), 7th CAB, Fort Ord, CA.

Juno Beach, D-Day, 1944. Absolute, total confusion, but it put thousands of men and thousands of pieces of equipment over the beaches in record time. Note the steel matting in the foreground to support armored vehicles on the sand.

(All photos courtesy Canadian Ministry of Defense.)

A Jaundiced View of Tanks

by Master Sergeant (Retired) R. E. Rogge

The author served in the 3d Canadian Infantry Division in WW II. He later enlisted in the USAF and retired in 1968 after 27 years service. He now serves as ARMOR's assistant editor.

Today's tanker thinks that his heavily armored, horrendously-gunned behemoth is the greatest fighting machine on the face of the earth. However, as Bill Mauldin the tongue-in-cheek creator of "Willie and Joe" in WW II, said, "I'd rather dig. A movin' foxhole attracts the eye."

To the WW II infantryman, a tank was either a friend or a foe. There was no in-between. You either shot at it, or you ran from it.

Of course, this poor bloody infantryman's (PBI) experience with tanks is somewhat dated, and it's going to take some of you old-timers out there to recognize such things as *M4 Shermans* and the British *Churchills* and the German *Panthers* and *Tigers*. That's about 38 years ago. Still, I venture to say that today's grunt has the same jaundiced view of tanks that his foot-sloggin' old man once held.

When we went ashore on D-Day at Bernieres-sur-Mer (Juno Beach), we had *Shermans* and *Churchills* with us, among a lot of other vehicles, armored and soft-skinned. Some of the *Churchills* were called "funnies." That is, they were armed with immense stub-barreled mortars called *petards* that were the greatest things in the world for blowing holes in sea walls or simply devastating concrete strong points and pillboxes with one awesome blast. You could watch those huge mortar bombs flying through the air. A scared jack rabbit (or a scared Jerry) could outrun one of them, but they sure distributed the scenery when they hit.

Some *Churchills* were equipped with special bridging equipment and some were armed with flame-throwing equipment. Most of them, however, were straight-forward, cannon-shootin' tanks. They were immense things, on the order of 44-45 tons, as compared to the *Sherman's* little old 35 tons or so. The *Churchills* were proof against almost anything in the line of antitank (AT) weapons the Jerries could shoot at them except, of course, the famous (or infamous) 88-mm dual purpose gun. That was some shootin' iron, and none of our tankers cared one damn for it. It could "brew up" any Allied tank in existence, and what it could do to our *Bren* gun carriers and armored cars was a caution! The Jerry AT

Canadian *Shermans* lined up and firing in artillery support role for attacking infantry. Note applique armor on tank flanks and empty shell casings in foreground and fresh ammunition at rear of tank.

crews used to call the *Shermans* 'Ronsons' because they lit every time. The *M4* wasn't the best tank in the world, but we had plenty of them, and it was sort of comforting to be able to hunker down behind 35 tons of steel when the lead was flying.

We also had some pretty weird-looking *Shermans* on D-Day. They were called "DD" tanks and were equipped with two water props geared to their engines and were fitted with a canvas rig that completely enclosed them and was supposed to make them float. Some floated. Some didn't. When those that did float had churned their way to the beach, they blew off their canvas rigs with primacord and to us, in the sand and pebbles, it looked like the tank had taken a direct hit—from a 16-incher. But with the canvas rig gone, the *Shermans* settled down to earning their pay.

But, back to the lowly foot-slogger ("Queen of Battles," chum!) and his views on armor. (I ought to spell that *armour,* because that's the way we spelled it in the army I was in.)

In our first sustained action that began the day after D-Day and went on for 6 weeks in the same place, we had *Shermans* (Fort Garry Horse) attached to our Regiment. (We had Jerries romping past us on D-Day night, headed for the beaches, but they were discouraged by the welcoming committee and went back to where they belonged.)

The Fort Garry boys would move right up among our slit trenches when things got really hairy and close-in and they'd fire 75-mm canister and high explosive (HE) and a couple of zillion rounds of .30-caliber ammo into suspected Jerry positions.

If a *Sherman* was sitting right on top of your slit trench, that was just dandy. But if it was a couple of yards behind you, then you got the full benefit of its muzzle blast, and those 75s had some kind of muzzle blast, let me tell you! But that canister sure cleaned up those hedgerows! When all you had was a 10-round, bolt-action, .303 caliber Lee-Enfield rifle and, if you were lucky, a couple of Mills bombs, those *Shermans* were right welcome.

Of course, they would get the Jerries all riled up, and then the opposition would return the compliments. However, since most of that fire was AT stuff, it really didn't bother us infantry too much in our holes. Except for the "shorts." A "short" round would dig in about 4 feet and go bang! And since it dug in at an angle, it usually went bang near the bottom of somebody's slit trench and our padre had his business cut out for him that evening.

Later on, when things got a bit more fluid, (like after Falaise when we were chasing the Jerries out of France and hoping that we wouldn't catch up to them!), we went into several actions riding on *Shermans*. Talk about shake, rattle and roll! I'll bet those rides ruined more kidneys than any of that Calvados we used to drink. You know, there wasn't much on the outside of an *M4* to hang on to, but I'm sure we put a lot of fingernail dents into that armor.

Then the "back room boys" in England (they were the ones who dreamed up the "funnies" I mentioned earlier) came up with the bright idea of yanking the turret off the Canadian *Ram* tank (a version of the *Sherman*), sticking a .50-caliber on top, and cramming troops into the hull. It was from these cobbled-up vehicles that today's sophisticated armored personnel carriers (APC) and infantry fighting vehicles (IFV) have evolved.

It was better to ride in one of those things than it was to walk, especially when *MG-42* machineguns and mortars were working you over. But a direct hit into one of those personnel carriers would take care of everyone inside. Of course, a direct hit if you were walking did the same thing. However, no small arms fire or splinters could get to you inside one of those things, and that was nice.

We made several river crossings using our attached *Shermans* for artillery support. It always seemed that our brigade and divisional artillery (25-pounders and 155-mm *Long Toms*) was always somewhere else (probably whooping it up in Gay Paree!) when we needed them, so our *Shermans* were dragooned in to earn their keep as field artillery. They did good jobs, too, because they fired point-blank at the Jerries on the other side of the river, and a 75-mm shell fired slap into a machinegun pit did the job right nicely, thank you.

During the Scheldt estuary fighting we used light, armored vehicles that could swim to haul troops, ammo, chow, and visiting firemen (boy, *they* were few and far between, let me tell you!) from island to island. They were called *Buffalos* and *Weasels* and they weren't armored against anything heavier than small arms fire and shell splinters, but we used them for assault vehicles. We spent so much time wading around in that part of Belgium that there was some talk of nick-naming our division the *Water Rats*. But the brass hats took the shine off that one.

Our *Shermans* and *Churchills* were great as moving cover in an attack, and we used to crowd up behind them and let them just soak up all the machinegun fire and mortar frags. If one of them took a direct hit, however, the survivors (if any) bailed out, and the PBI led the foot race to the nearest ditch!

In a tank-against-tank battle we were decidedly mercenary and bet on the Jerries (it was a fact of life, man), unless our tanks outnumbered them something fierce. A *Tiger* could sit all day just like a chunk of solid steel, soaking up the punishment, and then blast off one 88 and put "paid" to the pestering *Sherman*, or whatever. One Jerry, with five *Tigers*, shot up a whole British armored division. Of course, he was Michael Wittman, the *Tiger* "ace" who had about 141 confirmed tank "kills."

Our brass hats (*every* army has brass hats, even the Jerries were plagued with them) used to say that if one *Tiger* was reported, send in at least four *Churchills* or four *Shermans*—and expect to lose three of them.

Tanks were a definite menace to the infantry. But you could always run from one; unless he got his hull machinegun zeroed in on you, and then it was good night, Irene! But a tank couldn't traverse its turret fast enough to keep a line on a running man (and when you were scared, you could make Jesse Owens look like a palsied cripple!), and if you got around to the side of the beast you were O.K. (great gasp of relief!) because some other knucklehead would start shooting at the thing and that would get the crew mad and they'd go gunning for him. *Then* was your chance (if you had the guts) to sneak up and slip a Mills bomb into the tracks.

A tank with a track off was a dead duck, so we aimed for the tracks with our PIATs (Projector, Infantry, Antitank). Sure, it could still make a lot of noise with its cannon and machineguns, but it couldn't move an inch, and the crew inside knew it. Most always, unless they were SS, they'd pop the hatch and do the white flag bit.

You could find all kinds of souvenirs in a surrendered tank from Lugers to P-38 automatics to medals and even Jerry chow. I got an Iron Cross and a "Frozen Meat" medal (a campaign medal for service on the Eastern front) from a couple of Jerry tankers.

We had *Shermans* with chain flails for wrecking mine fields, but the flails usually got blown to flinders in short order and then the tanks would revert to their shootin' roles.

When we came up against the Siegfried Line on the German border, our *Shermans* were the best bunker-busters we had. One 75-mm round would bust in the door and then we could discuss (with .303s) the advisability of the inhabitants surrendering.

Tanks were great for sleeping under. They kept off the rain and the snow—and the splinters. But, if a tank was parked on soft ground, the pooped-out PBI who bedded down under it stayed there the next morning when it moved off. The tank would settle down in the mud on top of him.

A tank track dropped into a slit trench and then spun like crazy took care of the occupants. In street fighting, the *Shermans* would fire canister into the ground floor of a building and then we could be reasonably sure of safe entry. Of course, they were vulnerable to a grenade down the hatch, if it was open, so they stayed clear of buildings that hadn't been completely cleaned out by the rifle toters.

We really appreciated having tanks with us in an attack because they were such good bullet sponges. And, if we needed some high-caliber assistance with a troublesome place, we'd just grab the phone on the rear deck and tell the TC all about it. And he would oblige with a couple of main gun rounds, or a spray of machinegun fire. Sometimes, he'd just take a run over and see for himself what all the fuss and furor was about. And he'd settle the argument.

All of which was a big help, but we preferred our mobility to being cooped up in an iron shell. A tank that took a direct hit was a goner, and so was the crew. If the shells began to find us, we could eat dirt and sweat it out, or we could haul buns out of there and go find a more compatible area.

Tanks were great machines. They were noisy, smelly, and dirty (but so were we), and they certainly played a big role in winning the war in Europe.

But, really, when you get right down to the hobnails, it was the flat-footed infantry that beat Jerry—and, coincidentally, his tanks. And that's a fact!

Tanks of the 2d Canadian Armoured Brigade lead the 3d Infantry Division in the attack on 14 August 1944. Left, a *Churchill* flame-throwing tank tows its trailerfull of flame fuel. Center, a camouflaged *M-10*. Right, a camouflaged *Bren* gun carrier.

The 120-mm Gun Improves Penetration

by Captain John W. Holly

The decision to postpone, by yet another year, the production of the *M1E1 Abrams* tank mounting the 120-mm smoothbore cannon will certainly resurrect the controversy surrounding the basic decision to deploy the 120-mm in future production models.

While many people view the production decision as motivated solely by logistical and NATO interoperability considerations, closer examination of the technical and performance capabilities of the *M1* versus the *M1E1* is warranted.

The 120-mm cannon will be produced under license from the German manufacturer Rheinmetall to replace the *M68E1* (105-mm) gun currently being installed in the production models of the *M1*. If the Rheinmetall weapon is to be installed, then certainly it should possess a performance capability and growth potential superior to the *M68E1* to offset the increased weight, decreased ammunition load, and increased overall cost. Of particular interest is a comparison of armor penetration capabilities of the 120-mm and 105-mm systems.

Caliber. The first question concerns the caliber of the weapons—is the 120-mm that much better? The implications of an increase in caliber are:

- An ability to increase the projectile size.
- An increase in the amount of propellant.
- An increase in the volume available for expansion of propelling gases, providing a significant potential for future growth.
- The disadvantages of increased gun mass and decreased ammunition stowage space.

An increase in projectile size can significantly increase the effectiveness of all types of ammunition. Yet, the high-explosive plastic (HEP) round is seeing reduced usage due to advancements in armor protection; while the antipersonnel (APERS) and white phosphorus (WP) rounds are likely to experience limited use as basic load mixes tend toward more antiarmor rounds. However, the 120-mm kinetic energy (KE), armor-piercing, fin-stabilized, discarding-sabot-tracer (APFSDS-T) projectile sees a 20-percent increase in penetrator mass over its 105-mm counterpart, thus enhancing the penetration capability of the 120-mm gun. Enlargement of the shaped-charge, high-explosive, antitank (HEAT) projectile allows for an increase in the diameter of the shaped-charge cone, and for more explosive material to be packed into the casing. The result is an exploitation of the fragmentation produced by the rupture of the shell casing through more efficient distribution of the high-explosive (HE) filler. This yields a multi-purpose round capable of defeating more armor while providing an additional fragmentation mechanism.

An increase in propellant loading increases the maximum range for a given projectile. In an environment where engagements at increased ranges are desirable, the selection of a larger caliber gun is the most logical approach. Another aspect of increased propellant loading is the accompanying increase in propelling gases, which combine with an increased chamber volume in the 120-mm system, to provide significant advancements in muzzle velocity. In this respect, the 105-mm system is approaching the limit of its growth, while the 120-mm system demonstrates a higher muzzle velocity (for a heavier projectile) than currently available from the 105-mm system, plus an impressive potential for future increases in even greater muzzle velocities. The net impact of increased muzzle velocity is seen in the increased penetration capability of KE projectiles, and an increase in range. During the 1976 NATO Comparative Firing Trials, the 120-mm KE projectile met and surpassed the calculated penetration capabilities of the 105-mm KE projectile.[1]

Installation of the 120-mm gun will result in a 65-percent increase in the weight of the gun system, plus a 27-percent decrease in the main gun ammunition stowage. These disadvantages inherent in the 120-mm system must be weighed against improvements in the ballistic performance. The resolution of this conflict must be a conscious decision that weighs tactical, logistical, and employment considerations with respect to the performance of the overall system.

Ammunition. Proponents of the 105-mm system are quick to note that the versatility provided by the six different types of ammunition available for the 105-mm gun is clearly superior to the 120-mm system, which has developed only two types of ammunition (a KE and a multipurpose shaped-charge projectile). This lack of versatility in the 120-mm system is said to curtail the ability to effectively engage targets of opportunity on a highly fluid and changing battlefield. Yet, one must consider that in such an environment, a tank would be prepared for a battlesight engagement by having chambered a HEAT or KE round and, most probably, would engage any target of opportunity with the round already in the tube. Hence, any ancillary tactical considerations must yield to the primary mission of defeating enemy armor, and the ballistic performance necessary to achieve this goal.

Recent advances in modern armor have combined with increased angles of obliquity to significantly constrain the effectiveness of HEP and high-explosive squash head (HESH) rounds by decreasing the spalling effect on the interior of the main armor. The immediate result of this technological advance has been the recognition that only two types of rounds currently exist that are capable of meeting the current and future enemy armor threat—APFSDS and HEAT.

A shaped charge uses a long narrow jet of metal particles traveling at very high velocities to penetrate armor. (See "Shaped Charges versus Armor," *ARMOR*, July-August 1980. Ed.) The large cone diameter of the shaped-charge and the greater volume of high explosive filler in the 120-mm round, result in a 1.7-inch increase in armor penetration at a range of 2,000 meters over the 105-mm system.[2]

In a KE projectile, penetration is achieved by a dense subcaliber projectile traveling at very high velocities. The depth of penetration is a function of the projectile mass and the velocity at which it impacts with the target (i.e. the projectile's kinetic energy). The 120-mm gun has already achieved a 10-percent increase in muzzle velocity for a KE projectile that weighs 20-percent more than the 105-mm cannon's projectile (tables 1 and 2). It is clear that the 120-mm projectile has surpassed the penetration performance of the 105-mm projectile as a result of the advantages inherent in the increase in caliber. However, an examination of the performance of the two guns is not complete until the method of stabilization is evaluated.

Table 1. Vehicle Characteristics

Primary Armament	***M1*** **105-mm Rifled Cannon (M68E1)**	***M1E1*** **120-mm Smoothbore Cannon (XM256)**
Weight of Gun (Complete)	2,492 lb	4,339 lb
Total Vehicle Weight (Combat Loaded)	60 tons	62.5 tons
On-Board Ammunition Storage (Main Gun)	55	40

Table 2. Ammunition Characteristics

Designation	***M735***	***XM827***[3]	***M456***	***XM830***[4]
Type Round	Kinetic Energy (APFSDS-T)	Kinetic Energy (APFSDS-T)	Shaped Charge (HEAT-T)	Multipurpose (HEAT-MP-T)
Calibre	105-mm	120-mm	105-mm	120-mm
Length of Round	36.6 in	35 in	39 in	38.6 in
Weight of Round	38 lb	43.5 lb	48 lb	51.7 lb
Penetrator Diameter	35-mm	38-mm	N/A	N/A
Penetrator Length	19 in	18.7 in	N/A	N/A
Penetrator Weight	8.2 lb	9.98 lb	N/A	N/A
Muzzle Velocity	1501^{m}/sec	1650^{m}/sec	1173^{m}/sec	1140^{m}/sec
Drag Coefficient (at muzzle)	.25	.30	.48	.48

DATA: 1) Courtesy Ballistics Research Laboraory, Aberdeen Proving Ground
2) *M1 and XM1E1 Characteristics and Description Books,* Prepared for PM XM1 Tank System, DARCOM Engineering Division, Chrysler Defense Inc.
3) U.S. Version of German designed DM13 KE round (U.S. will produce XM1829 improved KE round)
4) U.S. version of German designed DM12 HEAT round

Stability. If a projectile is to be effective against a target, it must traverse the distance between the muzzle of the cannon and the target in such a manner that its primary-effect mechanism is optimized. For KE and shaped-charge projectiles, this requirement necessitates in-flight stability. Stability may be achieved either by imparting spin to the projectile, or by the use of fins—hence, the smoothbore versus rifled bore controversy.

The *M68E1* (105-mm) rifled cannon fires two types of KE rounds and a single type HEAT round. The *M392A2* APDS (KE) round achieves in-flight stability through the spin imparted to the projectile by the rifled tube. The *M392A2* possesses little growth potential due to the length to diameter (L/D) limitations of rifling-induced spin stabilization (maximum L/D is 5 for spin stabilization), which prescribes an upper limit for projectile weight. The *M735A1* APFSDS-T (KE) and the *M456* HEAT-T rounds maintain stability through the use of fins. As such, a slipping obturator band attached to the projectiles seals the propelling gases while imparting minimal/optimal spinning effect, creating a quasi-smoothbore weapon. It should be noted though, that optimum accuracy requires some degree of spin stabilization regardless of the primary stabilization mode in order to adequately compensate for projectile irregularities caused during manufacture. (Canted fins provide stabilization.)

Fin stabilization allows for an increased L/D ratio (up to 12) which is vital to the long-rod penetrator concept. This type of penetrator possesses an increased length and mass, yielding a greater kinetic energy (penetrating ability) to defeat enemy armor.

HEAT projectiles must be fin-stabilized due to radial velocities inherent in a spin-stabilized projectile. If spin stabilized by tube rifling, the radial velocity component would result in a spreading and bending of the high velocity jet resulting in a reduction in penetration capability. The net result of this brief analysis of stabilization, techniques is that the primary anti-armor rounds must be fin-stabilizd regardless of the type cannon, thus making the smoothbore cannon the logical choice.

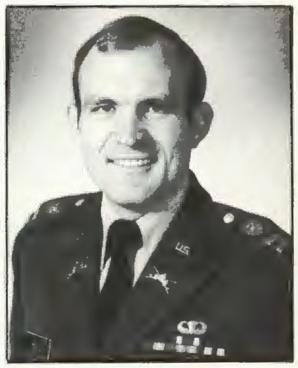
Summary. In the latter part of this decade, the German, Dutch, and American forces will all have main battle tanks that fire similar systems. This will definitely increase interoperability and the potential of simplified logistics in Europe.

However, the advantages gained through standardization efforts should not be the major consideration in procurement of any tank gun. The decisive edge in depth of penetration, which translates directly into increased kill probability, and the advantages provided by the current ballistic performance and the impressive growth potential of the 120-mm system, make it an attractive and desirable option—an advantage that transcends any other consideration.

Footnotes

[1] R. Meller, "Rheinmetall's 120mm Smooth Bore Gun-tank armament of the future", *International Defense Review,* Vol. 9, No. 4, 1976, p. 620.

[2] N. Hannig, "Can Western Europe Be Defeated by Conventional Means?" *International Defense Review,* Vol. 12, No. 1, 1979, p. 30.



CAPTAIN JOHN W. HOLLY was commissioned at USMA in 1973. He served as cavalry platoon leader, cavalry troop XO, squadron maintenance officer, assistant S-3 (Air) and cavalry troop commander in USAEUR from 1974 until 1977. He then attended the Field Artillery Advanced Officer Course and the USMC Amphibious Warfare School. He is presently assigned to USMA as an instructor in weapons system engineering.

An *AML-90* is offloaded at Beruit, Lebanon in 1978 as part of a 1,300-man French element of the United Nations Interim Force.

Armor In French Rapid Assistance Forces

by Colonel Andre L. Rilhac

In the current period of world unrest, international instability, and sudden crisis situations, France sees the possibility of serious threats against itself, its foreign interests, and to its allies. Additionally, these potential adversaries are envisioned as capable of being equipped by other nations with sophisticated weaponry of much higher caliber than that to which they would normally have access. With these two distinct possibilities in mind, France has evolved a twofold policy of providing assistance to areas under her jurisdiction, or that of her allies. These policies include direct military intervention/assistance by units of her armed forces, or technical and logistical support.

Under the former policy, direct military assistance or intervention would be provided by French forces already located overseas (map 1), or from home-based forces (map 2), or a combination. The use of armed forces would be promulgated on the following actions:

- Security or evacuation of threatened nationals
- Protection of national interests
- Intervention between belligerents to impose or enforce a cease-fire
- Retaliation against blackmail (kidnappings, holding hostages, etc.)
- A full commitment with friendly forces

Technical and logistical support may be supplied by forces permanently stationed overseas or by special teams sent to a particular area to provide either skilled technicians and advisors or military arms and equipment.

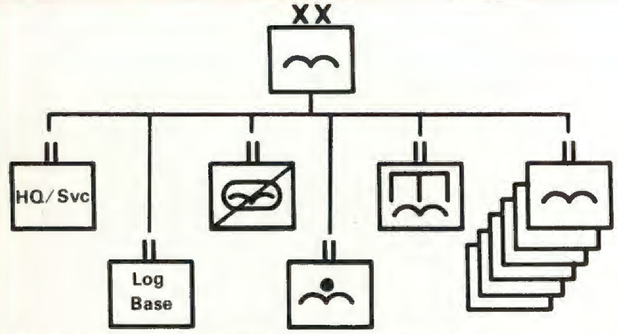
French Overseas Forces. In order to be fully effective in these endeavors, the requirement exists for a standing *overseas deployment* of forces of sufficient strength and mobility to react either covertly or overtly to any situation and be manned by personnel capable of immediate action under any circumstances. Such personnel include marines, engineers, airborne and armored cavalry troops, and the famous Foreign Legion.

French Metropolitan Forces. The possibility of political/military repercussions that may evolve from taking intervention/assistance actions outside of metropolitan France involves decisions at the highest political/military levels. By the same token, reaction efficiency in assistance/intervention deployments depends upon rapid reaction to the threat. In this context, overseas deployed forces play a vital role in the protection of local force reception and supply areas in addition to their other roles. They are, however, by their very nature, limited as to time of reaction, in their range of operation, and in their power. *France-based* forces must be capable of reinforcing the overseas units and be prepared to take part in unilateral or multilateral actions. Additionally, these home-based forces could be faced with rapid deployment to areas of difficult terrain and climatic conditions and be called upon to fight in conventional or guerilla-related atmospheres.

Forces Involved. The three major forces stationed in France that are involved in, and train for, rapid deployment to overseas areas are units of the 11th Airborne Division, the 9th Marine Division and the 31st Rapid Assistance Brigade. They are called the "Rapid Assistance Forces." These forces are composed of both draftees and volunteers. French law provides that only draftees and enlisted men who volunteer may be employed outside of French territory in armed conflicts. That's why these forces have a high rate of volunteers.

The 11th Airborne Division (figure 1) is stationed in southern France and consists of 6 airborne infantry battalions. It maintains a constant alert status, and within 24-hours can proceed to the Middle East of Africa. It has 14,000 men and is equipped with 250 LOHR (lightweight, infantry, wheeled vehicles), 150 VLRA (Jeep-type vehicles), and 40 AML 90 (light armored cars with 90-mm guns). Included in its armaments are MILAN antitank (AT) missiles, which can be vehicle or tripod-mounted, 120-mm mortars, 105-mm howitzers, and 20-mm antiaircraft (AA) weapons. The airborne armored cavalry squadron (figure 2) is equipped with Jeeps and AML 90s and armed with MILAN missiles and mortars.

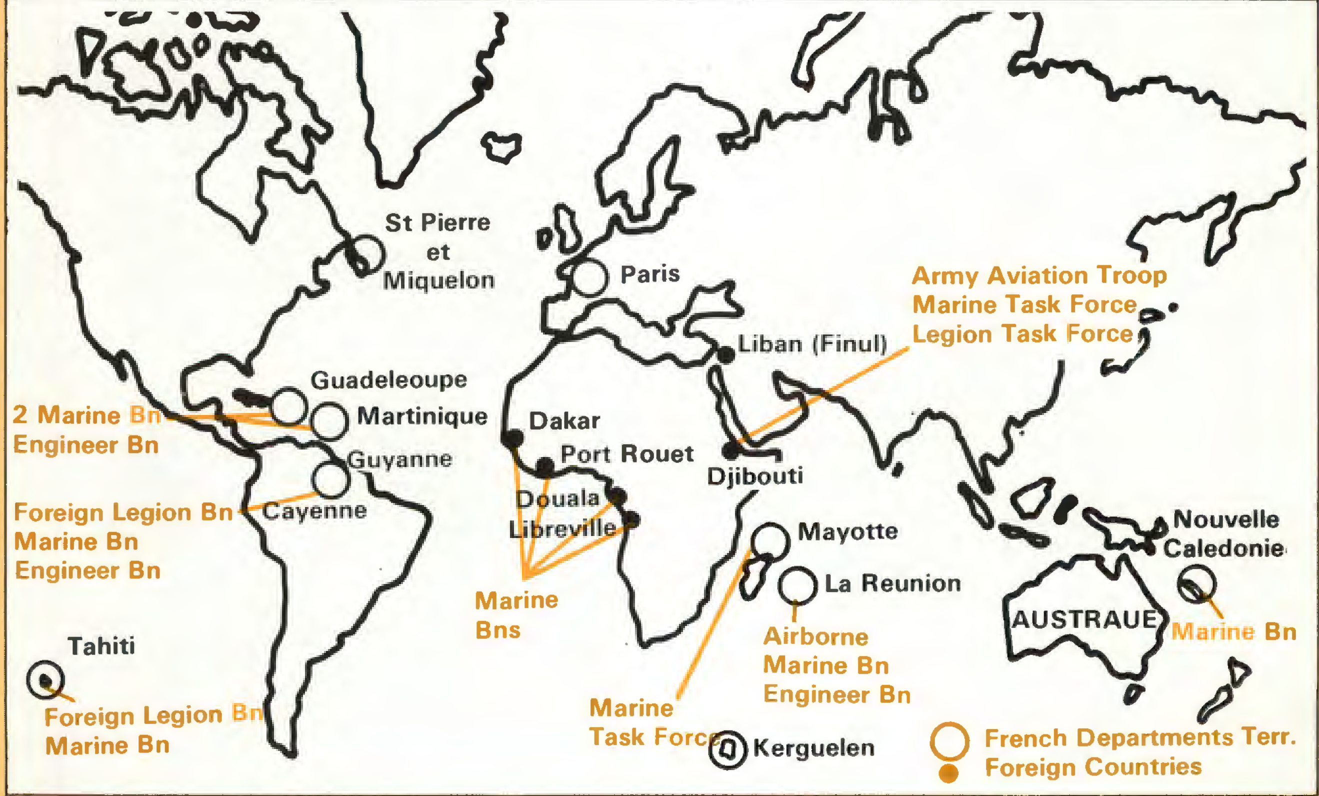
The 9th Marine Division (figure 3) is based in Brittany in northwest France and has several units in Lebanon in support of the peace-keeping efforts. It participates in assault landing exercises with the French Atlantic Fleet. It is equipped with 400 VLRAs and 52 ERC 90s (amphibious, armored car with 90-mm gun). Armaments include MILAN missiles, 120-mm mortars, 105-mm howitzers and 30-mm AA weapons. The one marine armored cavalry squadron (figure 4) is equipped with VLRAs and ERC 90s and armed with

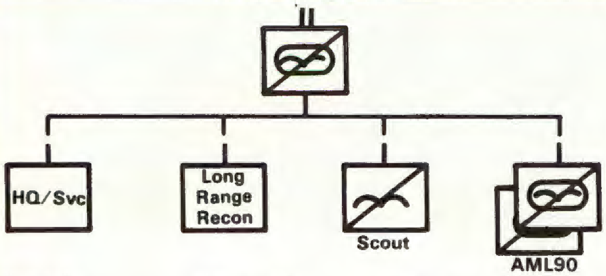


Vehicles	Strength	Weapons
250 LOHR 150 VLRA 40 AML90	14,000	180 MILAN 36—120-mm mortars 18—105-mm howitzers 58—20-mm AA guns

Figure 1. French Airborne Division

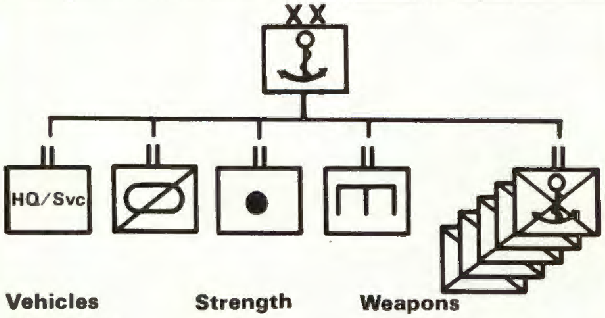
Map 2.





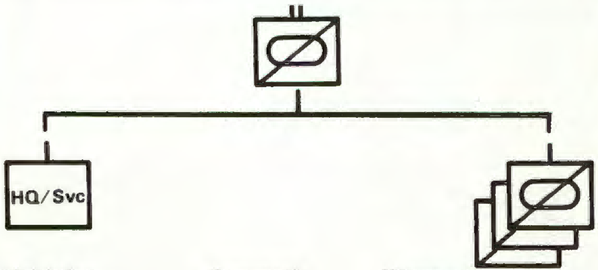
Vehicles	Strength	Weapons
105 JEEPS	800	24 MILAN
20 AML90		16—60-mm mortars

Figure 2. French Airborne Armored Cavalry Squadron



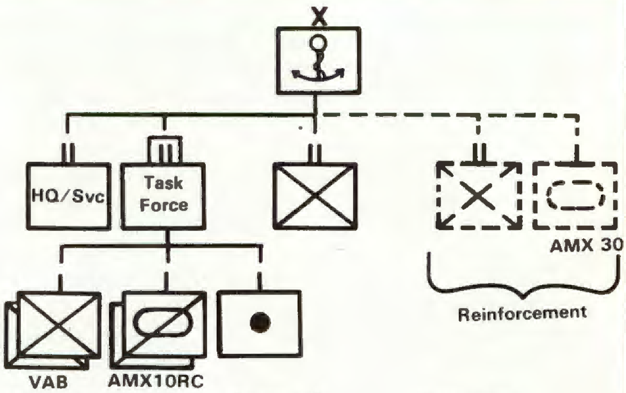
Vehicles	Strength	Weapons
400 VLRA	7,000	100 MILAN
52 ERC90		48—120-mm mortars
		15—105-mm howitzers
		30—30-mm AA guns

Figure 3. French Marine Division



Vehicles	Strength	Weapons
160 VLRA	700	20 MILAN
62 ERC90		10 30-mm AA guns

Figure 4. French Marine Armored Cavalry Squadron



Vehicles	Strength	Weapons
60 VAB	2,700	6—120-mm mortars
24 AMX10RC		6—155-mm howitzers
		10—30-mm AA guns

Figure 5. French Rapid Assistance Brigade

Milan missiles and AA weapons.

The 31st Rapid Assistance Brigade (figure 5 and map 2) is stationed in southern France and can be reinforced with an armored cavalry regiment from the Foreign Legion and/or a tank company. The brigade is equipped with 60 VAB (wheeled, armored personnel carrier) and 24 AMX 10RCs (armored car with 105-mm gun.) Weaponry includes 120-mm mortars, 155-mm howitzers and 30-mm AA guns.

The three units, therefore, provide Jeep-type vehicles, armored reconnaissance vehicles, light, armored tracked vehicles, amphibious armored tracked vehicles, amphibious armored cars, antitank guided missiles and conventional artillery, all of which are in keeping with the rapid deployment capabilities so vital for their operations.

The French overseas forces are sited (map 1) so as to not only provide viable military forces at strategic locations, but also to place them within quick-response range to real or anticipated trouble spots. With the exception of the AMX 30 vehicles, their equipment is wheeled.

Several reasons dictate the use of wheeled rather than tracked vehicles for these units. In the first place, wheeled vehicles are lighter than tracked vehicles. Secondly, terrain, vegetation and soil types may dictate raids and deep, swift, penetrations rather than extended actions, all of which implies the use of lighter wheeled vehicles. Thirdly, wheeled vehicles are more easily supported and maintained in outlying areas than are tracked vehicles. This is especially true with regard to fuel resupply. All of the vehicles that equip these "fire brigade" units have similar characteristics; i.e., air transportability, amphibious capability, mechanical reliability, operational simplicity, and logistic supportability.

Training. These units that may be called upon at a moment's notice to intervene in human, geographic, and climatic conditions that are unknown in France, receive specific training to enable them to rapidly adapt to any or all of the above conditions. Much of their knowledge comes from officers, NCOs, and enlisted men who have been stationed overseas and from units permanently based overseas. Also, organic units are often posted to overseas service for periods up to 6 months as reinforcements to French forces or for training exercises with allied forces. In addition to their extraterritorial mission capabilities, these units are also trained to become a part of France's home forces and to operate in the European theater.

COLONEL ANDRE L. RILHAC was commissioned in Armor from Saint-Cyr, Coetquidan Military Academy, France, in 1953. He has served in Vietnam, Algeria, and Germany, and was commander of the 11th *Chasseurs,* French Tank Regiment, in Berlin.

He taught at the French Staff College prior to his assignment as French Liaison officer to the USAARMC, Fort Knox, KY.

Soviet Advanced Armor Officer Training

by Major William L. Howard and Andrew W. Hull

Both the U.S. and the Soviet Union believe in providing training to career armor officers. The in-school programs of the two nations are similar; but in many respects their programs differ in tone, philosophy, objective, and length.

Advanced training of Soviet armor officers is the responsibility of the Military Academy of the Armored Forces *imeni* (in the name of) *Malinovskiy* in Moscow. This school was founded in 1932 as the Military Academy of Mechanization and Motorization of the Workers' and Peasants' Red Army, but underwent a series of some changes: Military Academy of Armored and Mechanized Forces of the Red Army (1943); Military Academy of Armored Forces (1954) and, finally, the honorific *imeni Malinovskiy* was added in 1967. Even though its name has changed, the school's functions have remained relatively constant.

The Academy was given a number of missions by Stalin, some of which went beyond the mere training of future armor officers. These included:

- Developing armored doctrine and tactics
- Training Soviet officers in principles of armored warfare and acquainting them with modern equipment
- Training specialists for the tank industry who would be familiar with the Soviet Army's needs
- Experimenting, testing, and exploiting new technology which could be utilized in Soviet armored equipment.[1]

The early efforts of the Academy were successful and it boasts many alumni who distinguished themselves as tank commanders in WW II, as well as men who became famous tank designers (e.g., Zh. Ya. Kotin who developed the KV tanks, the Stalin tanks, and the PT-76 tanks).

The Academy has the following primary missions:

- Training officers for command and staff positions
- Developing technical or engineering specialists within the armor officer branch
- Conducting technical and doctrinal R&D.

The first mission is conducted through a 3-year command course and the second mission is carried out in a 4-year engineering curriculum.[2] Engineering course graduates do not become tank designers, but serve as military representatives to tank plants, design bureaus, and research institutes and become responsible for monitoring contracts let by the armor branch.[3] The third faculty and student mission is accomplished by having them conduct research projects into engineering or doctrinal topics that will result in either a published paper, a piece of hardware, or a modification to existing equipment.

The faculty of the Military Academy of the Armored Forces is well educated, experienced, and senior in age and rank. As of 1980, the staff consisted of 30 doctors of science and more than 250 candidates of sciences.[4] The staff has an exceptionally large number of senior officers: a Marshal of the Armored Troops is the head and he is assisted by at least two general-lieutenants of the tank forces, two general-majors of the tank forces, two general-major-engineers, and four full colonels.[5] Over 50 percent of the instructors served in the Great Patriotic War: (WW II).[6]

The student body consists of carefully selected captains and majors who have served as battalion commanders or on regimental staffs.[7] These students have a degree from a higher education institution (usually a military school), 2 years service beyond graduation, are Communist Party members, and must be under 35 years of age for the resident engineering program, or 38 years of age for the resident command program. Students up to 40 years may take the correspondence program.

Admission is based on competitive entrance examinations, but an officer must first submit evidence of his suitability. He sends an application, which has been approved by his chain of command, and it must include a variety of supporting documentation. As an example, an officer must list his published scholarly works, or inventions, and, in the absence of such achievements, he must prepare a special paper within his discipline. He must also present references from his military superiors and from the Communist Party. Additionally, he must send a certified copy of his diploma from a higher education institution, a transcript of courses and grades, results of a medical examination, and a copy of his service record. This material is then evaluated by the Academy, which notifies successful applicants not less than 2 months before the entrance examinations are scheduled.

The highly competitive entrance examinations test the applicant's knowledge of his special discipline, the history of the Communist Party, and his skill in one foreign language, usually English, French, German, Italian or Spanish.[8] These examinations are stiff and students are generally advised to study from 2,000 to 3,000 hours before taking them.[9] The burden of this pre-examination studying is eased by military regulations that permit the applicant a special 30-day leave to prepare for the tests. Also, as a general rule, applicants are permitted three tries at the examinations.[10]

The applications and admission process just described are the standard method of entering the Academy. There are, however, exceptions. Officers who have passed all the examinations for a candidate of science degree in a specialty are exempt from taking the entrance examinations, and are given a preferential right to admission.[11] Others who have passed part of their candidate degree examinations can petition for exemption from the examinations.[12] These decisions are made on a case-by-case basis.

Not all armor officers are permitted to attend the Academy, but those who do are destined for major command or engineering assignments. The career enhancement process begins upon graduation when students are assigned a place on a special list of positions to be filled only by Academy graduates. Generally, such positions are choice assignments offering high visibility, pleasant duty, or greater opportunity for professional and military advancement.

Once in the Academy, the student is exposed to a wide variety of subjects and to a program that strives "to see that the theoretical knowledge acquired is reinforced with practical exercises."[13] The school's faculty particularly seeks to develop "leadership qualities in the students, to develop the ability to train and indoctrinate subordinates."[14] The student officers take courses in military history, operations re-

search, tactics, finance, engineering, political subjects, and physical fitness. As an added feature of Academy life, students are regularly exposed to organized and mandatory cultural activities including visits to museums and art galleries, or visits to concert halls.

The educational program of the Academy is accomplished through a combination of classroom instruction, equipment simulators, electronic tactical simulations, and hands-on experience with actual equipment at training ranges. As expected, much of the instruction takes place as classroom lectures given by experienced officers. For example, an article by Lieutenant Colonel V. Ryabchikov describes a training session in which students take turns directing a battle:

> "Officers in interphone headsets were poring over unfolded maps . . . . Commands and reports poured in. Signal lamps flickered on the control desk. The instructor swithed on an epidiascope (slide/movie projector), and the 'battle' panorama was flashed on a large screen. The audience could see tanks, shell explosions, and feel just as one would at a CP. Officer students took turns at directing the battle."[15]

The Soviets seek further realism by sending students to firing, engineering, and chemical training grounds, and by using tanks and armored vehicles on training ranges. The use of such facilities "provides highly-effective, practical training in tactics, operating vehicles, and firing from tanks, infantry combat vehicles, and armored personnel carriers."[16]

The Military Academy of the Armored Forces *imeni Malinovskiy* is more than just a training facility in Soviet eyes; it is also considered a research center. The Academy's staff and students are responsible for conducting R&D in support of developing the theory of the use of armored units and in perfecting armored equipment. Members of the faculty may also monitor technical developments as learned from foreign journals, and pass on the technical insights gleaned from these sources to Soviet armor forces. Academy staff members also serve as propagandists for the armored troops point of view, particularly in the face of challenges, or "heresies," voiced by other branches concerning the role of armor on future battlefields.

The Soviet and U.S. approaches to career training of armor officers reveal many similarities.

For example, both:

- Believe in the value of career training
- Concentrate resident instruction at one school
- Use classroom lectures, training simulators, and training ranges
- Offer instruction in command and staff functions
- Train foreign officers
- Offer resident and nonresident programs

One of the prime differences between the U.S. and the Soviets concerns the philosophy and intent underlying their career training programs. The Soviet program aims at turning out a relatively small number of very well-educated cadre, whereas the U.S. stresses the advanced training of all career armor officers, even though that training is less detailed. The Soviet approach is good in that some officers are very well prepared but, at the same time, this elitest system leaves many line officers with no advanced instruction. This in turn suggests that uneven quality in the Soviet armor troops could cause problems for the Soviet Army should it ever need to fight along broad fronts.

Other differences in the countries' career training of armor officers include:

- Length of the program
- Requirements for entrance to the schools
- Presence of engineering programs
- Rank and experience of in-coming students
- Emphasis on military history
- Age and educational background of the faculty members
- Degree of involvement of general officers in the training process

The "bottom line" is that both the U.S. and Soviet approaches to advanced training have strengths and weaknesses. Because of the program's dissimilar intentions and, hence, contents, it is impossible to rate either as superior to the other.

LIEUTENANT COLONEL WILLIAM L. HOWARD was graduated from The Citadel in 1964 and commissioned in Ordnance and trained as a tank-automotive maintenance officer. He left the Active Army in 1970 but remained active in the Reserve Component. He has been with the 100th Maneuver Training Command since 1973, and has also served tours as an instructor at Reserve Component Armor Officer Advanced Courses and the Command and General Staff College. He transferred to Armor in 1978.

ANDREW W. HULL received a BA in Political Science from Adrian College and an MA degree in Diplomacy from the William Andrew Patterson School of Diplomacy and International Commerce, University of Kentucky. He has published several articles dealing with the Soviet military, including works on the Soviet ground forces in *Armor, Field Artillery Journal,* and *National Defense.*

Footnotes

[1] John Milsom, *Russian Tanks 1900-1970,* p. 37, Stackpole Books, Harrisburg, 1971.

[2] A. Trofimov, "To Those Who Have Chosen the Path to Science," *Krasnaya Zvezda,* Feb. 8, 1980, p. 4. as translated in "USSR Report: Military Affairs No. 1515," JPRS 75762, May 3, 1980, p. 6.

[3] V. Ryabchikov, "Academy of Armoured Troops," *Soviet* Military Review, p. 14, September, 1975.

[4] O. Losik, "An Annivjsary Salute to Personnel of the Armored Forces Academy," *Krasnaya Zvezda,* October 1, 1980.

[5] *Ibid.,* p. 2.

[6] Richard G. Head, "Russian Military Education," p. 16, *Military Review,* Vol. LIX, No. 2, February 1979.

[7] N. Romanov, "Everything Necessary for Productive Training is Available," p. 63, *Krasnaya Zvezda,* Sept. 2, 1978, p. 2 as translated in "Translations on USSR Military Affairs No. 1401," JPRS 72422, Dec. 13, 1978.

[8] Trofimov, *op, cit.,* p. 7.

[9] Harriet Fast Scott & William F. Scott, *The Armed Forces of the USSR,* p. 351, Westview Press, Boulder, 1979.

[10] Ibid., p. 352.

[11] Trofimov, *op. cit.,* p. 7.

[12] *Ibid.,* p. 8.

[13] Romanov, *op. cit.,* p. 63

[14] *Ibid,* p. 63.

[15] Ryabchikov, *op. cit.,* p. 14.

[16] Romanov, *op. cit.,* p. 63.

The Military

by Captain

The U.S. Army first used motorcycles in combat during WW I. Some 10,000 motorcycles were used almost exclusively for courier (messenger) duties. After the war, the motorcycle saw use as a courier vehicle, a traffic control vehicle, and as a reconnaissance or scout vehicle.

Civilian-type motorcycles were used during WW I and the Army made no attempt to improve the motorcycle's military capabilities during the between-war years. The motorcycles were off-the-shelf models designed to meet commercial demands for good performance at high speeds on good roads, but their military performance was unsatisfactory. Weather and terrain conditions often made high speeds impractical for military operations and extended off-the-road operations under adverse conditions at low vehicle and high engine speeds caused the air-cooled engines to overheat and sieze.

In 1939 the Army decided to phase out the motorcycle because the models available were unreliable and unsuited for off-the-road operations. Even so, about 5,000 motorcycles were used for courier and traffic control missions during WW II. The last motorcycles were disposed of by 1957.

After WW II, the civilian motorcycle industry developed a number of lightweight machines that became popular as cross-country endurance and racing vehicles, and the Army's interest was revived. The Modern Army Selected System Test, Evaluation and Review (MASSTER) began testing the military potential of the motorcycle in Janurary 1972, concentrating on the motorcycle's potential as a scout vehicle.

The Combined Arms Combat Developments Activity (CACDA) coordinated the analysis of the MASSTER test and concluded: "No specific user requirement has been identified and there is insufficient information available to warrant development and fielding (of motorcycles) at this time." Department of the Army concurred with the CACDA position but directed further testing. The 82d and 101st Airborne Divisions were asked to field-test the motorcycle, while all schools were directed to identify their requirements (if any) for the motorcycle.

The field-testing resulted in requests for the motorcycle by both of the airborne divisions. The 82d recommended that

Motorcycle

Robert R. Sigl

the motorcycle "be included in appropriate organizations as a reconnaissance or messenger vehicle." The Commanding General, XVIII Airborne Corps, concurred with this recommendation.

Requirements identified by the appropriate schools follow:

- Messenger or courier
- Reconnaissance of routes and battle positions
- Liaison and leader coordination
- Guide vehicle
- Limited logistical support
- Convoy escort and movement control
- Administrative support
- Scouting
- Physical security control and rear area security
- Contact with adjacent units

In July 1974, a joint working group met at Fort Benning, GA, to consolidate these requirements into one Letter Requirement for the development of a scout motorcycle. The Letter Requirement was developed, but later disapproved.

The proponency for the military motorcycle was changed from the U.S. Army Infantry School (USAIS) to the U.S. Army Armor Center (USAARMC) in April 1977. As result, the test that had been scheduled at Fort Campbell by the USAIS was cancelled and the motorcycles were transferred to the USAARMC.

At the direction of V Corps, the 8th Infantry Division conducted a test of 30 Sachs Hercules 125-cc GS motorcycles during September 1977. One of the primary recommendations of this tactically-oriented test was that "the motorcycle that the Army selects should have a 175-cc engine or larger."

During 1978, 12 motorcycles (eight 2-cycle, and four 4-cycle) were obtained for the purpose of testing a representative range of horsepower-to-weight ratios then available in the commercial market. The results indicated that commercial motorcycles were acceptable substitutes for many of the ¼-ton and other light truck roles in combat, combat support, and combat service support organizations and, in May 1982, the Army approved a requirement document that was funded for the procurement of motorcycles.

Where we are today. The primary need and justification

of the military motorcycle is based on the fact that the Threat has the capability to intercept, interrupt, and limit U.S. electronic communications; thereby disrupting the command, control, and movement of combat, combat support, and combat service support units. In this environment, these units require a vehicle that can be used to deliver messages rapidly, conduct liaison, and accomplish personal command coordination in support of tactical schemes of maneuver. As an adjunct to the communications mission, the motorcycle will provide a means for the rapid laying of tactical wire communications.

Many current motorcycle models, fitted with associated auxiliary equipment, combine speed and cross-country mobility that will accomplish these missions.

In the scout platoons of the mechanized, light, and airmobile infantry, and in the ground reconnaissance elements of air cavalry units, the motorcycle will significantly increase the range over which these units can effectively operate, and the speed with which they can accomplish their mission. The motorcycle will also improve the mobility of the individual scout.

When not supplementing the communications systems in combat and combat support units, the motorcycle can perform special missions, including route and battle position reconnaissance in low-risk areas; movement of small, but critical, logistics items; convoy movement control, limited rear area security, and administrative support, such as mail delivery and distribution of administrative information.

The military motorcycle will provide expanded courier capability to adjutant general and finance units, thus enhancing the personnel, administrative, and financial services provided to supported units.

The missions of military police (MP) units require a high degree of mobility and maneuverability for which the motorcycle is uniquely suited. The motorcycles will provide MP units with the ability to rapidly displace in heavily congested areas. The motorcycle will be used by MPs in route and area reconnaissance, convoy escort, physical security, patrol, and traffic circulation control. The ability to move faster than a supported element is critical for conducting these missions. The motorcycle will provide this mobility.

At the direction of the Tank Automotive Command (TACOM), the Test and Evaluation Command (TECOM) is conducting a Technical Feasibility Test (TFT) from June to August 1982 of approximately 15 vehicles from five manufacturers. This test will provide general information as to whether a commercial off-the-shelf motorcycle can meet the specifications and requirements outlined in the Letter Requirement. A few of the essential characteristics follow:

- It will be chain driven, in 250-cc class, with a manual start (no neutral interlock), and will operate on standard military fuels and lubricants without manual mixing.
- It will be equipped with a tool kit, leak-proof gas cap, speedometer, odometer, and resettable trip odometer. The speedometer will be marked in miles per hour and kilometers per hour, the odometer in kilometers.
- The motorcycle will meet an array of requirements that will insure safe, sustained operation, both on and off-road in peace and in war.

In addition to the basic motorcycle described above, the system will be capable of accepting the following auxiliary equipment:

- *M16* rifle scabbard
- Detachable document carrying case
- A rack capable of carrying an operational *AN/PRC-77* radio and other small items
- Blackout drive light

The only other item included in the program is a military motorcyclist helmet. There is an extensive effort underway to provide the rider with a helmet that:

- Provides ballistic protection
- Meets impact standards prescribed by the Office of the Surgeon General
- Is compatible with current and future protective masks
- Is equipped with a headset and microphone for radio reception and transmission

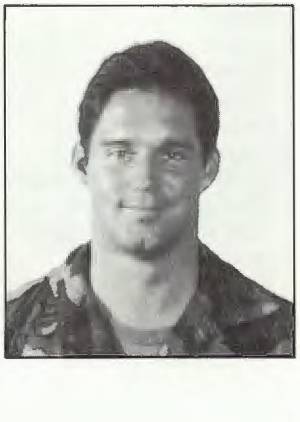
Where we are going. The Motorcycle Program is now *go* with an approved requirement document and is funded for procurement in FY84 and 85. The current schedule and milestones follow:

- 2Q FY83—Type classification, inprocess review
- 3Q FY84—Initial production test.
- 4Q FY84—Conditional release per AR 700-34
- 1Q FY85—Initial operational capability.

Look for your motorcycle on or about 1 October 1984. All motorcycles will come equipped with the auxiliary equipment described and will be completely logistically supportable upon arrival.

The above program does not cover the motorcycles currently in the field. The motorcycles in the field today have been acquired for various missions through a number of methods and are supported through each separate command, have been coordinated and will culminate with a supportable system that will meet all the requirements.

CAPTAIN ROBERT R. SIGL was commissioned in Armor as a Distinguished Military Graduate from the University of Washington in 1974. He attended Airborne Ranger and Armor Officer's Basic Course. He served as a platoon leader, XO, motor officer and troop commander in regimental and divisional cavalry units. He is a graduate of the Air Defense Artillery Advance Course, the Research and Development Management Course, has a master's degree from Boston University and is presently assigned as Project Officer, Ground Cavalry Systems, Directorate of Combat Developments, Fort Knox, KY.



The Alamo Scouts

by Major George R. Shelton

Cavalry scouts (19D) today have a lot in common with the buckskin-clad Indian scouts of Custer's day. They venture into enemy-held territory and ferret out his secrets of supply, transportation, equipment, and headquarters and return to their units with the information needed to defeat the enemy.

In the Pacific during WW II there was a group of scouts whose official name "Alamo Scouts," was reminiscent of the old Indian-fighting days of the army. They regularly penetrated Japanese-held islands, secured vital information, rescued prisoners-of-war, and performed a multitude of covert operations that materially assisted U.S. forces in that theater of operations. The Alamo Scouts were unique teams of highly qualified men trained to a high pitch of efficiency and were entrusted with a variety of vital missions. For instance:

On 22 October 1944, 2 days after the invasion of Leyte, six men grounded a small rubber boat on the beach near the village of Ipal on the northern coast of Mindanao in the Philippines. They were not castaways but were a group of specially trained scouts led by Lieutenant William E. Nellist.[1]

During the next 4 days, Lieutenant Nellist and his men made a thorough study of the beach areas to determine the size and capabilities of enemy forces and the type of enemy installations. They also gathered information pertaining to enemy food and water supplies and located underwater mines. Most important, they prepared detailed maps to pinpoint all intelligence obtained.

After their thorough reconnaissance, the team was evacuated and returned to Sixth Army headquarters.

Lieutenant Nellist and his men were a team of Alamo Scouts, "Alamo" being the code name for the Sixth Army.

The idea of a special reconnaissance unit under an army commander can be attributed to General Kruger, commanding general of the Sixth Army. At that time, December 1943, Sixth Army headquarters was located on Goodenough Island, just north of the eastern tip of New Guinea, and the Alamo Scout Training Center was established on nearby Fergusson Island under the direction of the Sixth Army G2.

The purpose of the Alamo Scout Training Center was to qualify officer and enlisted personnel for the efficient performance of scouting and patrolling duties under all conditions of terrain, weather, and vegetation found in the Southwest Pacific; and to train teams capable of landing near, and reconnoitering areas, of future operations.[2]

The officer concerned with the selection and training of personnel for the Alamo Scouts held the theory that any male in uniform could be trained and designated a scout, but that there would be comparably few who would be capable and dependable in that capacity. Reconnaissance, as it was envisioned for the Alamo Scouts, was a specialized military service requiring a particular temperament and talent. It was believed that men who possessed the necessary qualities were not so rare as to discourage the project. Consequently, a call for volunteers, commissioned and enlisted, was made throughout the Sixth Army.

The first course consisting of 6 officers and 40 enlisted men began on 27 December 1943, at the Alamo Scout Training Center under the direction of Lieutenant Colonel F. W. Bradshaw. The students were divided into teams of one officer and six or seven enlisted men. They remained within these teams throughout the 6 weeks of training.

The 60 hours of training during the first four weeks were spent in physically and mentally preparing the students for the strenuous practical exercises of the final 2 weeks.[4]

The practical exercises of the final 2 weeks put the teams in opposition to each other. Included was the landing of reconnaissance teams on "hostile" shores and the locating and capturing of such teams. Nothing was simulated; but, while live ammunition was carried, it was not used. Four teams of Alamo Scouts were formed from the first class. Special selection processes were needed to make up the Alamo training. Each enlisted man listed three members of his training team (not including officers) he would select to go with him on a four-man patrol in enemy territory. He also had to give the reasons for his selections. Then he had to choose three men from the entire group and give his reasons for his selections.

"The Alamo Scouts landed, armed to the teeth with grenades, Thompson submachine guns, rifles, pistols, carbines and a bazooka."

Officer students named six enlisted students they would most like to have on their teams, and instructors added their comments. From this aggregrate of opinion, the top enlisted men and officers were retained as scouts; the others returned to their units.[5]

On the morning of 28 April 1944, one of the newly formed Alamo Scout teams aboard a landing craft medium (LCM) (flak) of the 2d Engineer Service Batallion's Support Battery was patrolling in Matterer Bay when they were approached by a group of natives in canoes. The LCM commander, who spoke pidgin English and Malay, was told by the natives where the Japanese guns were sited in Demta Bay. Two of the natives were taken aboard and placed in exposed positions to act as a deterrent against treachery, and the LCM set course for Demta Bay. As the craft approached the area indicated by the natives, its 37-mm cannon and .50 caliber machine guns were trained on the shore and when in range, opened fire on a small village. At 1,200 yards the boat fired a salvo of 48 rockets and 30 to 40 Japanese were seen running up a path toward a mountain behind the village. The boat strafed the thatched houses occupied by the Japanese and more troops fled to the hills. The Alamo Scouts landed, armed to the teeth with grenades, Thompson submachine guns, rifles, pistols, carbines, and a bazooka (antitank rocket launcher). Three more Japanese were killed, 6 gun positions were destroyed, and 4 dead Japanese were found in a hut.

A wounded Japanese soldier was captured and, upon questioning, said that 150 artillerymen had been in the village, but that the attack had routed them. One Alamo Scout team and a courageous boat commander had routed 150 Japanese from an artillery position and destroyed their guns.[6]

"He is a "sneeky-peekie" by any standard and his mission is vital . . . the 19D is the "point" man in any military operation."

The daring prisoner-of-war rescue at Cabanatuan in January 1945, was made possible through combat intelligence produced by Alamo Scouts. Although the prison camp was located 25 miles inside enemy lines, guerilla reports indicated that only a small force guarded the camp.

At 0400 hours on 29 January 1945, an Alamo Scout team rendezvoused at Balincarin with Company C and 2d Platoon, Company F, 6th Ranger Infantry Battalion.

The next morning one officer and one enlisted man from the Alamo Scout team, guided by Lieutenant Timbago,[7] a Filipino guerilla, made a final reconnaissance of the stockade area. This reconnaissance revealed that the Japanese garrison of the camp consisted of 73 officers and men. In addition to these there were 150 enemy transient troops who had moved into the stockade to rest for the day. A concentration of approximately 800 Japanese with tanks and trucks were at Cabu, 2 miles to the northeast of the prison camp. The Alamo Scout team returned with complete and detailed information as to the location of the American and Allied prisoners of war within the stockade, the location of all sentry posts, the times of relief of sentries and the location and nature of the enemy defenses.

By 2015 hours, 30 January 1945, the enemy garrison, including the 150 transients, had been annihilated and 512 freed prisoners were moving towards Guimba and friendly lines. The Japanese losses were put at 532 dead, plus twelve tanks destroyed. One Alamo Scout was wounded during the operation while the Rangers lost two killed and one wounded in action.[8]

The 10 Alamo Scout teams produced by eight classes at the Alamo Scout Training Center performed over 60 separate combat operations similar to that of Lieutenent Nellist and his team. They participated in two prisoner-of-war rescue raids and brought in numerous Japanese prisoners for questioning. At the end of WW II, the unit had performed all its missions without a single scout being killed.[9]

A scout is a scout is a scout, whether in buckskins, khaki, or Army green. He is a "sneaky-peekie" by any standard, and his mission is vital. Whether he scouted Indian tribes or Japanese troops, or now trains to seek out Threat forces, the 19D is the "point" man in any military operation. He remains the eyes and ears of the commander; and without his training, skills, daring, and often, pure guts, information vital to the success of an operation would not be available—and a battle (or a war) could be lost.

Footnotes

[1] War Department. Military Intelligence Division. "Alamo Scouts." *Intelligence Bulletin,* June 1945, p. 29.

[2] U.S. Army. Ground Forces. Observer Board. "Report No. 16, on the Alamo Scouts Training Center." Typescript carbon AGF Board, Headquarters, 6th Army, 2 February 1944, p. 1.

[3] Ibid., p 1. and War Department, Op Cit., p. 32. Reports error in figures quoted in that they say 5 officers and 26 men comprised the first class.

[4] Ibid., p 1 and Incl 3-6, and War Department., *Op Cit.,* reports error in stating that the first 3½ weeks were classroom instruction.

[5] Interview with Francis I. Gwaltney, former Alamo Scout, and Ibid., incl. War Department., Op Cit., p. 34. is in error concerning method of team selection.

[6] Headquarters, 2d ESB, *Monthly Historical Report for April 1944.* Lieutenant G. W. Swenson, CE, 28 April 1944, Personal Narrative of Landing at Demta Bay, 28 April 1944.

[7] U.S. Army, Headquarters Sixth Army, *Combat Notes,* Published by ACofS G3, 21 March 1945, p 3. Spelling of Timbago based on interview with Francis I. Gwaltney, former Alamo Scout and friend of Lieutenant Timbago.

[8] Ibid. (for more detailed discussion of the raid).

[9] War Department, Military Intelligence Division. Op Cit., p 36.

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Pershing's Logistical Nightmare

by F. Maitland Cuthbertson

The Pershing Punitive Expedition of 1916 into Mexico was a military failure, but valuable lessons in supply, communications, mobilization, transportation and, not least of all, aviation, were learned and served the U.S. Army well a year later when it went to war with Germany.

When the Expedition rode into the State of Chihuahua, Mexico, its members found themselves in a desert-like area where distances of 25-50 miles between watering places were not uncommon. This arid region extended south into Mexico up to 1,000 miles and was the principal area over which Pershing's troops operated. The Mexican population was concentrated in a few widely-scattered centers along a few railroads, or in the less than 50 percent of the arable land. The lack of any kind of decent road system added to Pershing's supply problems, as well as temperatures that ran from 120-130°F in the day to nighttime lows that would freeze the water in the men's canteens.

Only two railroads served the entire area; the Mexican Northwestern Railroad and the National Railroad of Mexico, both running on north-south axes. The first east-west cross-connection lay some 250-300 miles south of the border and was the Kansas City, Mexico, and Orient Railroad. Pershing's force was thus denied easy access to any mass transportation system—unless they built their own.

The border terrain averaged 3,500 feet in altitude. Further south it reached 6,500 feet. It was into the middle of this devilish area that Pershing's command would ride, march—and fly.

The catalyst that brought the international situation to a head was Pancho Villa's raid into U.S. territory on March 9, 1916. By that time, Villa had become one of the best known and one of the three most powerful political figures in Mexico. But, two German Army intelligence agents were the ultimate instigators of the raid. While Villa's goal was to focus attention on himself and gain support in arms and money, their goal was to start a war between Mexico and the U.S. by preying on Villa's imagined grievances against the U.S.[1] What resulted was not a war, but a punitive expedition that, although it failed to capture the bandit leader, effectively dispersed his group and prevented further raids into the U.S.[2]

Six days after Villa's raid, the U.S. was on the move. Brigadier General John J. ("Black Jack") Pershing was given command of the 5,000-man expedition. He proposed not only to disperse Villa's band, but to capture the man himself.[3]

The expedition soon faced uncomfortable reality as supplies ran short and equipment proved faulty. Many troopers were ordered to leave behind their blankets and ponchos. The men suffered as much as their horses from the burning-hot land over which they marched. Both horses and men suffered from altitude sickness. The generally poor quality of issue clothing and equipment soon became evident. Leggings wore through. Riding breeches gave way at the knees and seat. The resultant exposures not only caused a morale problem, but a physical one as well, as burning sun and freezing nights affected the men.[4] Furthermore, there was the unfortunate tendency of the company and troop aluminum mess gear to melt in the cooking fires.

The issue swords were found to be seriously deficient and the rifles proved awkward to carry and care for because of improper saddle boots. The swords were finally sent back to the U.S.[5] The Army also learned that most of its cavalry gear and other riding equipment was flawed. For example, the 1916 issue bridle allowed horses to drink only with great difficulty and prevented them from grazing. The halters broke at the throat latch and, since they were leather, the horses would chew them for the salt content. This broke the halters and the horses would stray. The army did not issue hobbles, so the men would tether their horses to themselves at night.

The debate over whether the McClellan saddle was superior to the hinged saddle was finally decided in favor of the former. But the McClellan saddle needed modification because it had been designed for the parade ground horse—a fully-fleshed, contented, animal. The stirrups should have been designed with leather toe shield and wider treads and been positioned farther aft for better rider balance. The ill-fitting saddles rubbed the horse's backs raw, which led to bucking and the violent unseating of many a trooper. Also, the McClellan saddle had no provision for carrying rations on extended maneuvers, nor did it have a rifle boot.[6]

In retrospect, such defects in personal equipment and riding gear should not have been unexpected. Endemic to the nature of the military organization, and its quest for parade ground perfection, was the fact that its equipment was not always the best-suited for combat. These problems were often magnified through incompetent management. For example, an acute fodder shortage plagued the 10th Cavalry provisional units throughout the campaign. Yet the military bureaucracy sent no Mexican silver money for local supply purchases until on or about April 11, 1916 when $250,000 arrived in Colonia Dublan, three weeks after Colonel W.C. Brown, 10th Cavalry, left that town on March 19, 1916 with 2 days' rations. He was not resupplied until 32 days later. During this time, he paid over $1,700 out of his own pocket to secure supplies for his command. One wonders about the expedition's fate had not Colonel Brown, and other officers, been blessed with sizable bank accounts.

The next major problem facing the expedition was supply transportation. Despite being given the best care available, larger horses did not have the stamina nor the endurance of smaller, more compactly-built, horses—those between 14-1/2 and 15-1/2 hands high.[7] The machinegun detachment mules were also found to be unfit for extended campaigning. Their average 800-pound weight and 14-hand stature was too small to carry their loads. The ammunition packs weighed 312 pounds and the guns 92 pounds. Under this weight, the average mule collapsed after a few days in the field. Only mules of 15 hands minimum height and 1,000 pounds weight were capable of standing the rigors of the campaigning.[8]

Because of the large number of unsuitable mules and horses, the first week in Mexico saw the expedition suffer a chronic remount and pack-animal shortage. Hastily-sent replacement mules arrived from as far away as Missouri, and wild horses, only half-broken for riding at Ft. Bliss, Texas, were the only remounts available. The large number of unfit animals created a veterinarian shortage. Additional veterinarians had to be rushed in from as far as Brownsville, Texas. Their arrival, and that of replacement animals, revealed a hitherto unsuspected transportation bottleneck; only one railroad on an east-west axis existed on the U.S. side of the border and it was inadequate for resupply.[9]

Despite the deficiencies discussed above, the Pershing Expedition was unique in two respects: it was the first Army expedition to use aircraft and mechanized transportation under combat conditions.

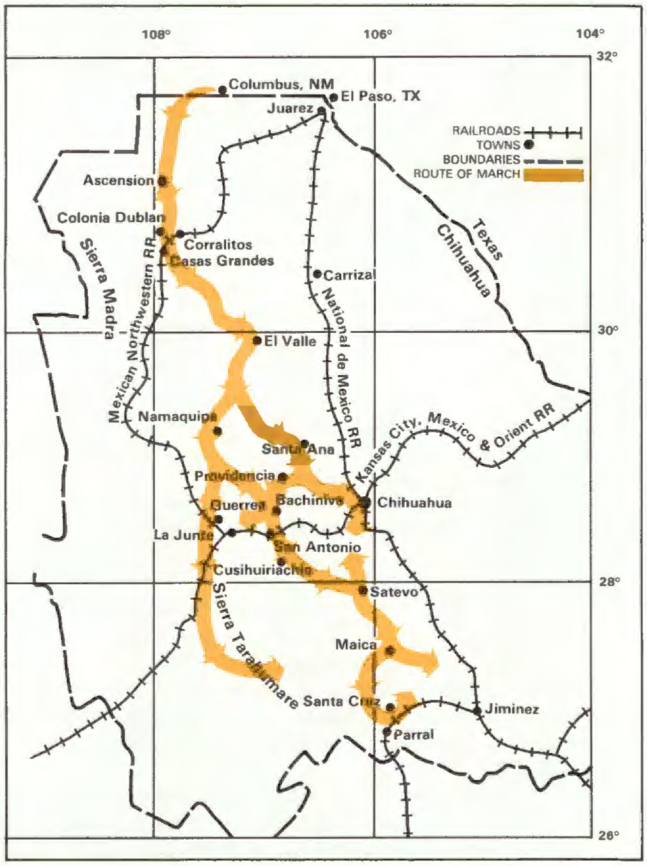
Commanding the first two organized truck companies in the U.S. Army were Captain Francis H. Pope and Captain C.B. Drake. Both arrived in El Paso, Texas, on March 15. Within the hour, two complete transportation companies with all assigned vehicles and their civilian drivers complement arrived. Fifty-four of the trucks were missing bodies. Two operational days were lost searching for a quartermaster wagonwright who could mount horse-drawn wagon bodies on the truck chassis.[10]

However, Captains Pope and Drake used the time well, giving driving tests to the factory-provided drivers. Much to their chagrin, they discovered that many were incompetent.

Shortly thereafter, the rugged field conditions began to take their toll of those civilian drivers who could drive. By April 12, it became obvious that further recruitment of drivers was necessary. In El Paso, not only did civilians volunteer themselves and their vehicles, but even taxi companies provided drivers. The chaos grew so great that El Paso high schools gave students leaves of absence to drive for the Army—a unique driver's education course! By April 14, a total of 400 trucks were making the run of about 200 miles from the border to Colonia Dublan and thence another 200 miles to Satevo (see map).

Two problems hampered the transportation companies: a food and gasoline shortage, and a steadily deteriorating traffic route. The constant truck traffic of this primitive Red Ball Express powdered and rutted the clay into a maze of potholes, ruts, and depressions. Where terrain permitted, drivers widened the convoy route to avoid the mess, leaving patches of ground up to 1/2-mile wide completely pulverized.

When the first rains hit, the route became impassable and traffic came to a stop. Two small mule detachments remained as Pershing's only supply train. Although conditions temporarily improved, unpredictable cloubursts, and their increasing frequency as the rainy season advanced, so worsened traffic conditions that late April saw Pershing's southern base limited to Satevo (see map). Even worse was the fact that supply deficiencies restricted the expedition's movements. After the May rains, both the supply route and the



supply situation became so critical that a first-class military road building project was begun in early June.[11]

The only viable transportation alternative left to Pershing was the Mexican railroad system. Initially, Mexican President Carranza gave Pershing permission to use the railroads, but later denied that he had done so. Therefore, subterfuge was necessary to ship supplies. One shipment on March 29 was officially sent as a result of the supposed agreement. Subsequent shipments were consigned to U.S. citizens unconnected with the U.S. military.[12] These people reshipped Army supplies as ordinary freight, an arrangement valid as far south as Colonia Dublan. If and when the supplies reached Colonia Dublan, the Army purchasing agent would buy the consignment. Since all Mexican railroad priorities and regulations remained in effect, precise prediction of the arrival of any shipment was impossible. For example, when the second shipment of two cars of oats and two cars of mixed goods were sent to Pershing on April 4, the first shipment of supplies had not yet traversed the 120 miles from El Paso to Colonia Dublan. Not until April 12, when the Army shipped 15 cars of hay and 2 cars of oats and rations, did the first shipment of March 29 arrive safely in Colonia Dublan. A 24-hour timetable was worked out for transportation between El Paso and Colonia Dublan on that day.

Pershing's poor communication system also caused major confusion. Initially, the U.S. Army requested civilian telegraphers to augment the shortage of military telegraphers. However, Carrancistas (yet another rebel group seeking control of the Mexican government) controlled the telegraph in Mexico, so U.S. wire communications were neither secure nor assured during the entire expedition. These uncertainties caused cancellation of a plan to use the abandoned Federal Wireless Company's station near Columbus, NM in favor of building a high-powered radio-transmitter overlooking El Paso.

But radio communication, in its infancy in 1916, was severely curtailed by local weather conditions. Communications were, at best, intermittent and unreliable. Moreover, it was alleged that U.S. "ham" radio operators along the border were blocking Army communications and 25 amateur radio stations around San Antonio, Texas, were closed on March 24, despite the absence of any real proof that they were responsible. On the other hand, evidence gathered early in April showed that Mexican operators located in Juarez, Mexico, were deliberately blocking U.S. Army radio traffic.

Only one other form of rapid communication remained to Pershing; the airplane. And, here too, problems arose. Initially, the 1st Aero Squadron, flying JN-4D *(Jennys),* had only 10 of its authorized strength of 20 pilots. The planes, not fully ready for use until March 25, were almost useless to Pershing because of the extremes of altitude and weather conditions. The high elevation reduced the engine's 90 brake horsepower (bph) to 78 bhp. The thin air density caused the engines to run hot and be almost impossible to start in the near or below freezing mornings. They were started by hand-cranking the propellors. Two to 4 hours of cranking were often required. Furthermore, the high altitude made the plane's landing characteristics very unstable; the smallest gust of wind was capable of causing a crash.[13] The reduced engine power made takeoffs perilous and, when the planes did fly, it was only a few hundred feet above ground level. This, plus slow speed, made them easy rifle targets for the Mexican guerrillas.

The low-powered aircraft could not gain enough altitude to negotiate the mountain passes that the ground troops were using in their pursuit of Villa. The *Jennys* were susceptible to intense convection air currents that were capable of tossing them up or down 1,000 feet or more. By March 28, less than a week after initiation of flying, only 2 of the original 8 planes were serviceable. By April 4, Pershing ordered the planes to be used as little as possible because of the hazardous flying conditions.[14]

On March 29, the Army sent Captain V. Clark, an aeronautical engineer, and Lieutenant Thomas DeWitt Milling, a flight instructor, to various aircraft manufacturers to test and procure new planes. They agreed a JN-4D, with a 100 hp motor, might be sufficiently safe, but that a 160 hp motor, which the JN-4D fuselage could not hold would be even better. Therefore on March 31, Secretary of War, Newton D. Baker, ordered 8 Curtiss and 8 Sturvidant biplanes at $5,000 each to replace the *Jennys*.

By April 26, the first 4 Curtiss N-8 biplanes arrived. Their wings were larger than those of the *Jenny's, but they had the same unsatisfactory engines as the Jenny's OX-5, 90 hp.* The manufacturer, in reply to a War Department query, replied that those engines had been on hand and installed because the expedition needed the planes! With these engines, the planes were more dangerous to fly than the *Jennys*. Fortunately, later models arrived with the engines that were ordered.

Another problem with the early airplanes was their wooden propellors. The laminated blades quickly warped and came apart in the intensely hot climate. Steel propellors were mounted, but they, too proved to be faulty. The airframes were not designed to endure such intense dry heat and they quickly warped and buckled. At this point, all aircraft were grounded, ending any possibility that air messenger service could solve the expedition's communication problems.

It is obvious that the Pershing Expedition achieved its penetration despite a military bureaucracy unused to dealing with technological innovation or new mechanical systems. The expedition showed the necessity for improved radio equipment and signal security, as well as the importance of letting research contracts well in advance of an estimated need for new equipment—including aircraft.

More importantly, the supply and equipment problems that plagued Pershing paved the way for necessary, and long overdue, reforms in procurement, supply, and command relationships. The establishment of the "U.S. Army Aircraft Experimental Testing Ground" in September 1916, was directly attributable to the aircraft problems encountered by the expedition. Working along with the Testing Center, the "Army Aviation Board" regularized the management of U.S. Army aircraft procurement and prevented the purchasing fiascos that occurred during the expedition.

When the Army considered the personal equipment failures, harness problems, and vehicular failures along with the communication and aircraft disasters, it became obviously necessary to establish a quality control agency to supervise all equipment purchases. Therefore, the "Army Procurement Agency" was established on September 3, 1926 (8 years after the fact). This agency initiated the competitive bidding system under which the military established its requirements and then let contracts to the civilian firms which filled those requirements least expensively; the genesis of today's military purchasing system.

The Army Quartermaster Service was the last major military department to undergo reorganization because of the defects so glaringly displayed by its poor support of Pershing. At that time, the Quartermaster Service ran a system best suited for maintaining small bodies of troops in the field for extended periods (such as it had done during the Indian campaigns). Pershing's expedition showed that not only was the supply system inadequate, but also the Army's mobilization capability was not adequate to meet the requirements of what was then deemed modern warfare.

The Pershing Expedition, then, was unique in several respects: It was the largest "training" exercise the U.S. Army had ever held in conjunction with another nation—willing or otherwise. It provided incentive for the U.S. Army to review its international organization, a necessary prologue for the Army's coming battles in France. From the supply and equipment viewpoint, the miracle was that the expedition was as successful as it was.

Historically, the Pershing Expedition may have been the point at which the 20th century mechanized and technologically-oriented Army was separated from its predecessor.

Unfortunately, Pershing never did catch Villa.

Footnotes

[1] The German Army had two intelligence agents at Villa's headquarters. Their plan was to cause war between the U.S. and Mexico, thus dimming the chance of U.S. involvement in WWI in Europe. Katz, Friedrich, *Deutschland, Diaz, und die mexikanische revolution: Die deutsche Politik in Mexiko 1870-1920*. Berlin, 1964. Sandos, James A., "German Involvement in Northern Mexico in 1915-16: A New Look at the Columbus Raid," in *Hispanic American Historical Review*, Vol. 50, February 1970, pp. 70-88.

[2] The pursuit was entirely legal. The Mexican government never abrogated the agreement of July 29, 1882 which permitted "hot" pursuit by U.S. or Mexican forces into each other's territory when in pursuit of bandits or Indians. The only restriction placed on U.S. pursuing forces was prior notice to the Mexican District Military Chief of U.S. troop presence. *New York Times*, March 20-21, 1916; Toulmin, H.A., *With Pershing in Mexico*, Chapters 1-2. Military Service Publishing Co., Harrisburg, PA, 1935.

[3] This was one-third of all U.S. Army regular troops stationed within CONUS, and the only troops available for Mexican duty. *New York Times*, March 14, 1916.

[4] By April 13, 1916, most troops in Mexico were in this condition; no clothing issues were able to reach them until April 25, when issues finally arrived in Colonia Dublan. *New York Times*, April 25, 1916.

[5] The swords were trucked back early in April. Tompkins, Col. Frank, *Chasing Villa*, Military Service Publishing Co., Harrisburg, PA, 1934.

[6] Tompkins, *op. cit.*, p. 235.

[7] A "hand" is 4 inches.

[8] As a result of the expedition, a machinegun unit's TO&E was changed so that by the 1930's it had horses that carried lighter ammunition packs and a lighter, redesigned, machinegun.

[9] It ran between Yuma, AZ, and Myrena, TX.

[10] The truck battalion initially had a TO&E of 2 companies. Each company had 54 trucks, 15 motorcycles and 2 wreckers. Twenty-seven trucks were ordered from the White Motor Company of Cleveland, Ohio, and 27 more from the T.B. Jeffreys Company of Kenosha, WI. The first shipment of Jeffrey's vehicles were far superior to later shipments from the same factory, as well as all other vehicles of any make ordered. The White Motor Company provided 2,600-gallon water carriers in May 1916. Tompkins, *op. cit.*, transportation index.

[11] Major William White obtained one million board feet of lumber, 75 pumps, 3 bulldozers, scrapers, and other road-building machinery. In the 250-mile stretch between Columbus, NM, and Namiquipa, Mexico, the U.S. Army had a 500-man Mexican road gang working a 7-day week. *New York Times*, March 29, 1916; April 7, 1916.

[12] President Venustiano Carranza initially gave permission for U.S. usage on March 29, 1916. On April 7, 1916, he denied he had ever given his permission on March 29. *New York Times*, March 29, 1916; April 7, 1916.

[13] The pilots had no parachutes. When a crash occurred, as happened to Lieutenant Thomas E. Bowen on March 25, 1916, it could be fatal.

[14] The JN-4D specifications were: Upper wing span—43', 7 3/8''; Lower wing span—33' 11-1/4''; Length—27' 4''; Height—9' 10-5/8''; Empty weight—1,580 lbs.; Gross weight—2,130 lbs.; Maximum speed—75 mph; Rate of climb—300 feet per minute; Power—OX5 90-hp engine rated at 1,400 rpm; Fuel—21 gallons; Fuel consumption—9 gallons per hour; Ceiling—varied with model, early models had 3,500 to 5,000 foot ceilings, depending upon weather, climate and power. *The 1949 Aircraft Yearbook*. Lincoln Press, Washington, D.C.

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Armor Technology — Part II

by Joseph E. Backofen

This is the ninth in a series of articles on tanks and the technologies of armor penetration, armor, and survivability.

Quite some time ago, J. K. Christmas noted that "since the crew and weapons weigh but a small percent of the whole tank, the real pay load becomes the armor, for . . . the armor is the tank's principal assets, its *raison d'etre*."[1] He further noted that "no startling improvements in the protective value of armor plate reasonably may be expected." Similar comments have been tossed back and forth during the existence of the tank, with the most recent claims being that Chobham and special armors provide all the needed protection and that there can be scarcely better armor.[2-5] Still, it has been recently revealed that these armors can be pierced by modern kinetic energy penetrators.[2, 5, 6] One might even quickly point out that none of this is new and that it is the responsibility of weapons designers to provide weapons that will perforate any armor array and destroy the contents that it protects.[7, 8] Thus, it becomes important to understand how materials and their properties can be used to provide armor protection.

Armor has historically been attacked by two types of threats: those that batter it in an attempt to break it up, and those that perforate it in order to get at the protected personnel and materiel.[8, 9] The former class of threats includes high-explosive point detonating (HEPD), high-explosive squash head (HESH), and high-explosive plastic (HEP) projectiles.[4, 8-11] These generally cause two major effects: one on the armor plate itself, and another on the vehicle structure, or armor array.

When a high-explosive charge is detonated in direct contact with a slab of material such as armor plate, the rapid change from a solid to a gas (explosive) releases great quantities of energy so quickly that a high pressure pushes against the material.[12-25] This high pressure moves through the material rapidly in the form of a shock wave that can cause the material to deform or break if the pressures and reflections from other surfaces are great enough.[12-25] This can lead to fracture of welds, breaking of bolts, and other structural failures. When the shock wave reflection from the free surface on the other (in)side of an armor plate also causes a layer of material to break off and fly away from the plate, this action is called *spallation*. The tendency of a material to spall under intense shock loading has been found to be a function of its hardness and ductility (which is a measure of how much it can be deformed before it breaks). Thus there are two ways to defeat this type of threat to an armor:

- Spaced armor is used so that the first plate absorbs the energy of the explosion and spreads it out over a larger area on the next armor plate.[10, 23, 24] This lowers the intensity of the shock loading on the side of the armor near to the protected personnel and materiel (inside the vehicle).
- Material properties of the armor are varied such that the inner surface toward the protected items has higher ductility. This is generally accomplished by either alloying the plate, heat treatments, or lamination of various materials so as to form a composite sandwich.[14, 20]

Even if the pressure exerted by an explosive charge is not severe enough nor so concentrated as to cause *spallation* of the armor, the blast impulse is still transmitted to the armor and the vehicle structure. This can cause the various pieces of armor and other structures and materials to be grossly deformed into twisted and dished shapes.[12, 23-25] The effects are similar to the destruction of a house by an airblast, namely a crushing, twisting, and pulling apart of the walls, roof, and other parts of the house. Unfortunately, armor arrays and armored vehicles are always subjected to this type of destructive action and can only be toughened through the use of good materials and structural design. Still, it is easy to realize that a 120-mm HEP shell can cause total disruption of a lightly constructed armored vehicle and could possibly remove a turret from a main battle tank with a proper hit.[4, 7]

Armor, armor arrays, and vehicle structures and equipment can be subjected to impulse effects not only from the in-contact detonation of high-explosive shells such as HEP and shaped-charge warheads or projectiles, but also from the impact of kinetic energy penetrators and shaped-charge jets. These latter comprise the classes of threats that attempt to pierce the armor in order to attack and destroy the protected personnel and materiel. Even though their primary intent is to get beyond the armor, they still exert a tremendous pressure over a smaller region of the armor while they are penetrating.[25-31] This then can lead to both shock wave effects and gross deformations similar to high-explosive loading; but they are generally more localized on a smaller scale.

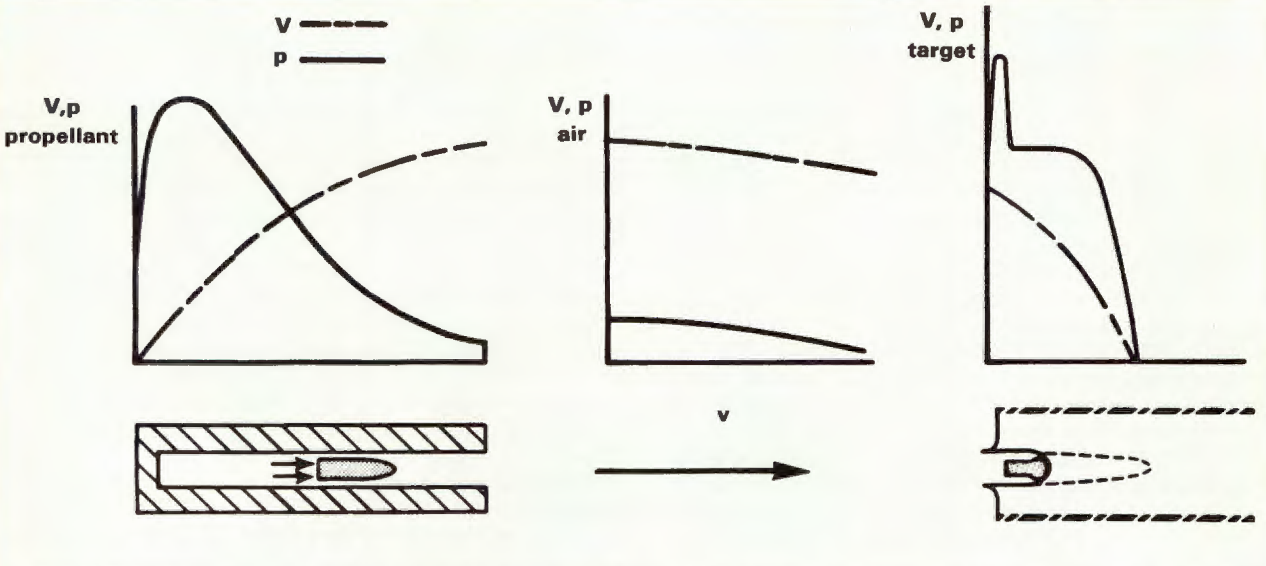
Previous *ARMOR* magazine articles have examined the technologies and trends of both kinetic energy penetrators and shaped charges.[7, 32-34] Similar articles have also recently appeared in other publications.[35, 36] Thus, this article only needs to examine how armor materials and arrays respond to those piercing threats. Since these threats are significantly different from each other (although the long-rod penetrator and the mass-focus projectile formed from some forms of shaped charges appear to be merging toward one another in both shape and velocity), it is not surprising that the development of penetration theories and armor materials for resisting them have proceeded along different paths.

It has long been recognized that the two best ways for armor or armor-arrays to defeat a kinetic energy penetrator are to:[8, 25-31]

- Breakup and/or deflect the penetrator at the first surface impacted.
- Absorb the kinetic energy of the penetrator through deformation of the armor material/array.

Breaking up a projectile when it struck the front surface of an armor was originally associated with the hardness of the surface of the armor plate.[8, 29, 31] However, hard materials (whether they are steels or ceramics) are generally brittle, thus leading to cracking and breakup of the armor.[8, 29, 37-39] The solution to this problem has historically been to use laminates whereby a high hardness outer armor is bonded to a more ductile inner armor which serves to provide ballistic and structural integrity.

Generally, the British firms of Charles Cammell & Co. and Sir John Brown & Co., both of Sheffield, have been credited with inventing compound armor (circa 1877)[8] which had a high hardness steel front plate bonded to an iron backplate. However, it should be noted that laminated metal armor of this type was known and used as long ago as 1390 to 1600.[40] During an investigation into the fabrication of early body armor plate, Dr. W. Campell of Columbia University determined that ". . . in a number of cases, the ancient armor was made in the fashion of the best Damascus blades (for swords); the plate was forged out of a bloom, folded in two, reheated to a welding point, and hammered out again. By this procedure it came about that the plate of armor was built up of thin layers of harder and softer metal interwoven. This indicated, of course, that a highly resistant material was secured which at the same time did not shatter when struck. The metallurgical explanation of the well-known virtues of the armor of Milan of the 15th century was also this, that the plate of metal was highly carburized at the surface, while its back remained relatively soft; the metal then could resist the entrance of a projectile but it would not shatter."[40]



"The shell acquires speed up to 1000 m/sec in the gun barrel. When it hits ship or tank armor, the shell is embedded into it and moves with negative acceleration until it stops. Virtually all of its kinetic energy is transformed into the plastic flow of the armor. The ratio of the paths of the shell in the armor and in the barrel is determined by that of the pressure in the barrel and the resistance of the armor metal."

Figure 1. Conversion of chemical energy into target deformation

Footnotes

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[33] J. E. Backofen, "Shaped Charges Versus Armor-Part II," *ARMOR,* Vol. LXXIX, No. 5, September-October 1980, pp 16-21.

It has also been noted that instead of body armor becoming obsolete with the development of firearms, the better body armor has been noticed to bear proofmarks of the impacts of the projectiles from which it would provide protection.[29, 40] This also proved its capability to stand up to multiple impacts.

The modern U. S. equivalent to the turn-of-the century naval compound armor is dual hardness steel armor which was first produced in 1964 for the protection of critical aircraft components.[29] It was also used for modular armor appliques during the Vietnam Conflict to protect trucks and jeeps from .30-caliber ball projectiles encountered during ambushes.

Ceramic-faced laminate armor research was initially begun during World War II, but was also further developed during the time of the Vietnam Conflict for the protection of aircraft components and aircrew.[29, 37-41] The resulting importance of this form of armor is apparent in its wide acceptance in personnel body armors. However, it is unfortunate that ceramic materials are quite brittle and have the same problem of breaking up into small pieces after impact that was associated with naval compound armor at the turn of the century.[8] The researchers who are deeply involved in the development of the lightweight ceramic armors noted the brittleness and cost of the materials and recommended strengthening them for tensile loads by using metal fillers.[42, 43] Although these ceramic-metal composites (cermets) might be considered to be new armors, the face-hardened steels, such as Class A armor plate, Krupp cemented armor and Wotan armor, consisted of carbides (ceramics) dispersed in an essentially pure iron matrix.[44-49] In brief, they were cermets. The significance of this was apparently "lost" for a number of reasons. First, there were a number of generations between the periods of armor research during which there was little interest in armor research. (The disastrous effects of a similar, but smaller, lapse in what can be termed "scientific-corporate-memory" in the field of tank armor research in Germany between 1945 and 1957 has previously been similarly noted along with the initial difficulties of transferring the armor technologies of the naval engineers over to the army engineers between WW I and II.[50] Second, rolled or cast homogeneous tank armors were selected for use by the U.S. for WW II and afterwards, even though their armor performance was lower than face-hardened naval armors, because they were more readily machined and fabricated by welding.[45, 51] It should be noted, however, that the German vehicles in WW II used face-hardened armor and that the Soviet vehicles used higher homogeneous hardnesses than was practiced in other countries.[51, 52] So, while the U.S. selected its tank armor on the basis of manufacturing capability for quantity production during WW II, it became interested in the quality of performance for specific weight during the Vietnam Conflict and thereafter.

The absorption of the kinetic energy of a penetrator after it has pierced the surface of the armor material or array is determined by the properties of the penetrator and armor materials as well as the cross-sectional area of the nose of the penetrator.[28-31] In a sense, the armor or array is like the inverse of a gun as noted by the famous Russian ballistician, A. F. Ioffe.[53] Figure 1 illustrates the basic concept behind his theory that just as propellant chemical energy is transformed into projectile kinetic energy in a gun by means of a pressure acting over an area through the stroke within the barrel, the kinetic energy is transformed into target deformation (elastic and plastic) as a pressure of resistance is applied over the penetrator's nose until the limit depth of penetration is reached.[53]

(to be continued)

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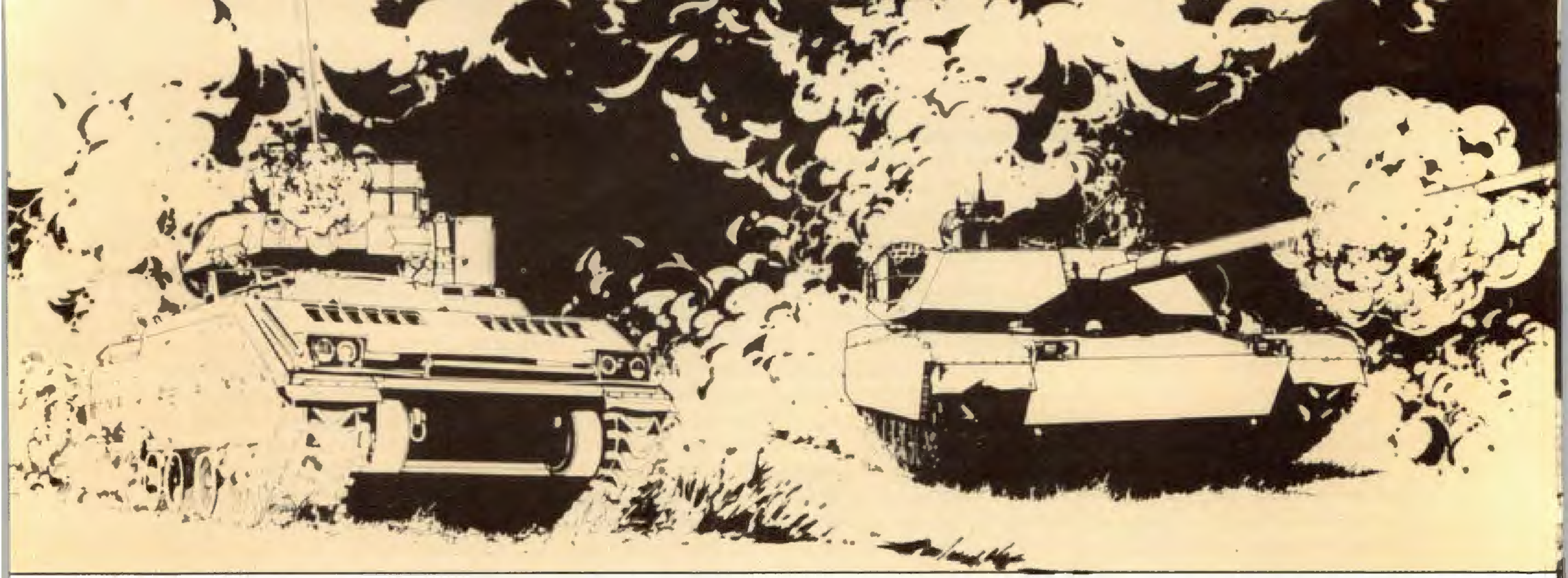


The Deep Raid

AirLand Battle's Power Punch

by Captain Marc C. Baur

Current writing on the AirLand Battle focuses on the use of artillery and airpower to interdict follow-on echelons of attack Threat armies. The scenarios are oriented on a sophisticated European battlefield against an enemy using Soviet tactics. However, the lessons are applicable to other battlefields against other tactics, since all armies practice some form of echelonment, which is subject to exploitation by daring, vigorous, attack action.

The extended battlefield requires commanders to attack the enemy in depth, even though this reduces the friendly combat power immediately available on the frontline. This is substantially different from the classic attrition-delay defense that accepts as inevitable the arrival of enemy reinforcements on the frontline.

Why not attrition and delay? The attrition-based defense suffers from two major flaws. First, it takes longer to maneuver forces to block the main attack than it takes the enemy to reinforce his success. Maneuvering to attack the enemy's mass and strength is a losing proposition. More importantly, though, the attrition-based defense yields the initiative to the enemy, leaving him free to exploit his success by freely maneuvering his follow-on forces.

Why deep attack? The deep attack is not a luxury. It is a prerequisite for success on today's sophisticated battlefield. The deep attack extends the battlefield so that enemy forces are engaged well before they can bring their firepower to bear on the frontline. The aim of the deep attack is fourfold:

- Disrupt the forces the enemy planned on using in his exploitation.
- Reduce the number of enemy troops that will appear on the frontline.
- Impair the enemy's ability to influence the action.
- Weaken his initiative.

Once we can seize the initiative, regardless of the position of forces on the ground, we will be able to dictate the terms of battle.

What are the targets of the deep attack? It is not hard for American commanders to imagine the havoc that unchecked enemy actions could wreak in their rear area. The infrastructure for waging war includes a multiplicity of choice targets, ranging from supply depots and command posts to combat formations massing for battle. What is true for us is true for the Soviets: they are also vulnerable to rear area attacks.

In order to sustain the advances of 30-50 kilometers per day that Soviet doctrine calls for, the Soviets must push forward as much combat power and materiel as possible. This is intended to maintain a high tempo of combat operations. It also presents lucrative targets for planners who must extend the battlefield to include not only the troops actually fighting on the frontline, but also those in follow-on echelons, and the combat service support elements. In fact, the rear area of the lead Soviet divisions includes not only the second echelon regiments that are massed prior to being committed, and the divisional combat service support elements, but also the combat service support of the follow-on division; as well as some elements of the Combined Arms Army. All of these appear very close to the frontlines, within 30 to 100 kilometers, and sometimes closer. Since the width of a division sector is only 20-30 kilometers, the enemy concentration of follow-on units will be dense.

It is important to understand that the Soviets do not intend to distribute their forces throughout the sector they have cleared during their advance. Instead, because they are vulnerable to detection and interdiction of the sort envisioned in the AirLand Battle, follow-on echelons move forward by bounds: moving by night and hiding by day. On the other hand, since their combat vehicles lack effective night sights, their frontline advances will be attempted by day, even though they may attempt to continue to apply pressure with night attacks. What results is an accordion effect, with a sizeable gap between the lead echelon and the follow-on echelons. *This gap, from 25 to 100 kilometers deep depending on the time of day and the frontline situation, is a weak point in the Soviet advance;* a weak point that an astute commander can exploit to delay, demoralize, and eventually defeat the enemy. Thus, despite the focus on artillery and aviation to interdict the follow-on echelons, ground forces may very well prove to be effective in the interdiction role.

An armored unit operating against the second echelon is superior to enemy artillery and aviation on the following counts:

Shock. The appearance of an armored unit in a rear echelon zone will confound commanders and demoralize the soldiers. Support troops will have to be diverted from their primary duties to perform rear-area security, and combat units will have to be diverted from their progress toward the front.

Firepower. By avoiding engagements against deployed combat formations, an armored unit let loose in the enemy rear area is capable of knocking out 30 to 40 vehicles per tank. If machinegun fire is used against unarmored vehicles, the number of personnel kills will be higher. By contrast, a fully-armed *TOW-Cobra* carries only eight missiles, and may carry fewer in order to fly deeper.

Staying power. The presence of an armored unit in his rear creates constant, almost demoralizing, pressure on the enemy commander. He has an unknown type of unit that must be dealt with *now*. Unlike artillery, which is an irritant, and aircraft, which come and go and are subject to air defense fire, the ambush unit is a danger of the most awful kind.

Assured destruction. The very nature of rear-echelon columns—a mixture of soft, hard, and semihard skinned vehicles—is a tanker's paradise. Not only is he—as the ambusher—presented with a lucrative target array, he is guaranteed a number of targets wholly vulnerable to his main gun and many that will be vulnerable to his secondary armament. In addition, it can be expected that enemy units will shoot each other in the confusion.

Target identification. The deep interdiction part of the AirLand Battle is dependent on reliable, accurate target identification prior to engagement. Monitoring enemy activity by electronic sensors on airborne platforms, remote ground sensors, and electronic intelligence is subject to error and false indications. Such monitoring is subject also to delays for processing. On-the-ground observers are able to verify unit type and size, and in some cases may be able to identify the unit itself, without the time delays inherent in stand-off methods.

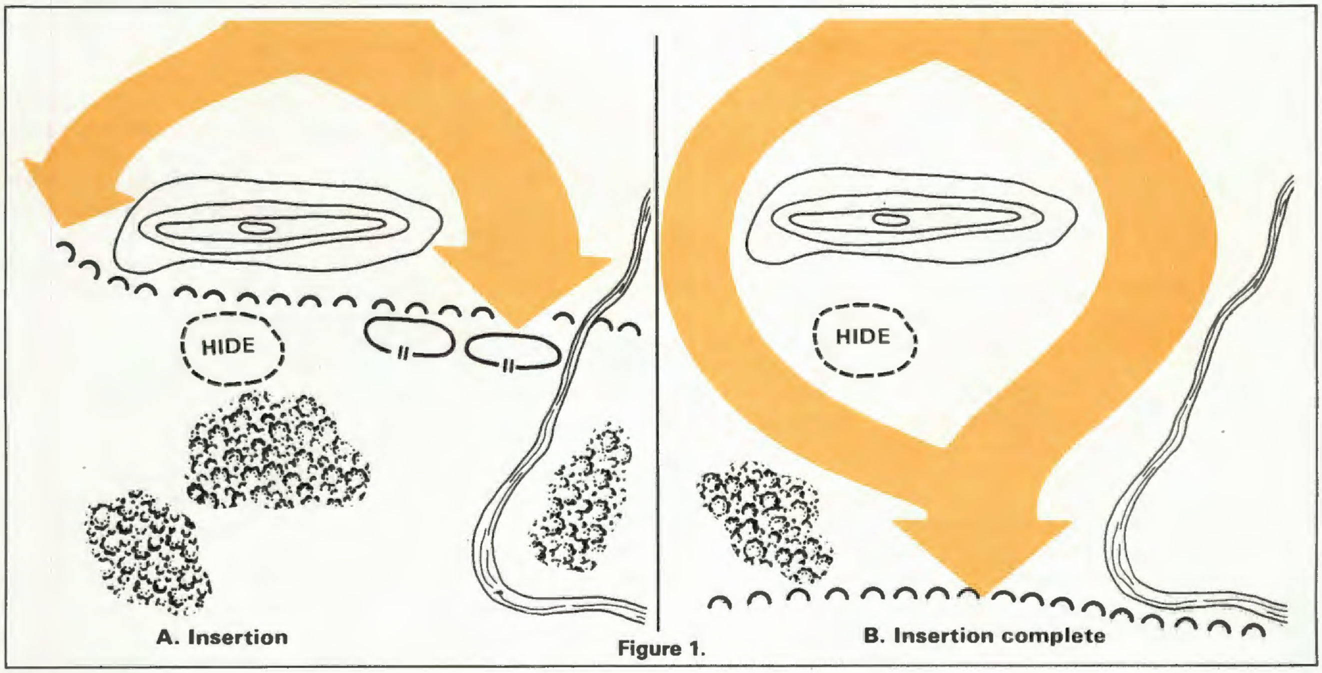
Interdiction of follow-on echelons by the Ground Interdiction Task Force (GRIT) consists of five phases: insertion, movement, attack, hide, and return to friendly lines.

Insertion. Although the GRIT can forcibly thrust through enemy lines, this robs the task force of stealth, which is its best protection; and surprise, which is its greatest advantage. The enemy's knowledge of its size, composition, and location, combined with its proximity to deployed combat formations, make it easy prey for enemy counterattack. A better method is to establish the task force in a hide position, and deliberately allowing the enemy to bypass (figure 1); thereby avoiding combat with leading enemy echelons.

Movement. The GRIT moves from its hide position, attacks, and then moves to another hide position. Because it is operating in unfriendly territory, the task force cannot afford to use the same hide position more than once. This means that all combat support and combat service support elements must accompany the task force. The formation used is similar to that used during break-out operations (figure 2).

Attack. The GRIT may attack logistical units, C^3 units, and even combat units. Care must be taken when attacking combat units, since the situation does not permit the task force to sustain substantial casualties or damage. Surprise must be total, the execution violent, the initial fires lethal, the get-away clean. The preferred time for attack is under the cover of darkness (or reduced visibility) for several reasons:

- The GRIT moves by night and hides by day for the same reason the Soviets do: to reduce vulnerability to air and artillery attack.
- Enemy units move by night. They are more vulnerable to ground attack when moving by night than during the day when they can establish hasty defensive positions around their laagers.
- Our weapons systems are decisively superior to the enemy's during darkness or periods of reduced visibility. For our gunners, there is no difference between night and day, while the Threat gunner's effectiveness is limited during darkness.
- Night attacks cause more confusion and disruption than day attacks, and the attacks take one of two forms. The GRIT may elect to establish ambushes or to attack combat support (CS) or combat service support (CSS) installations. A deliberate ambush is called for when the enemy is moving and detailed information of the enemy target is available: size, nature, organization, armament, equipment, route of movement, and times the enemy will reach or pass certain points on his route. If this detailed information is not available, and if the commander can be reasonably sure that no significant combat forces can influence his action, he may elect to establish hasty ambushes against targets of opportunity. In either case, the task force must have already worked out standing operating procedures for establishing security forces to the flanks and rear of the ambush, and for the deployment of the at-



A. Insertion

B. Insertion complete

Figure 1.

tack force that destroys the enemy in the kill zone.

The GRIT acquires CS or CSS targets either by contacting the intelligence section of its higher headquarters; or by chance. Once the GRIT commander decides to eliminate the target, security forces seal off the area while the assault force sweeps through. Tank main gun fire may be used against the most threatening targets, but the primary suppression weapon should be machineguns. Demolitions experts dismount to emplace explosives in ammunition dumps, fuel facilities, and other targets that cannot be readily destroyed by main gun or machinegun fire. Infantry carriers and tanks should overwatch the demolitions emplacement. The GRIT withdraws when destruction is complete, or to avoid engagement with combat elements.

Hide. The ability to avoid detection and unwanted engagements is the most delicate part of operations behind the enemy lines. Once located, the task force, since it is wholly unsupported, can be quickly isolated and destroyed. However, the gap between the echelons provides a place where the GRIT may well conceal itself. This gap is relatively clear of enemy forces, and by getting as close as possible to the forward echelon, the GRIT improves its protection against enemy nuclear and chemical attack. *Effective camouflage is essential.* The use of air- or artillery-delivered remoted transmitters to simulate the existence of GRITs at other places may be part of electronic warfare deception complementing the overall hide plan.

Returning to friendly lines. The process of returning to friendly lines is no different for the GRIT than it is for any other force involved in a break-out and link-up, and is covered in existing doctrine.

Because of the foreboding, inhospitable nature of existence behind enemy lines, the main requirement of the GRIT is survivability. This consideration dictates the place where the force will be employed, since only the interdivisional gap behind the enemy lines allows sufficient maneuver space without getting trapped. It can be assumed that the GRIT will be wholly on its own and only able to call for help when returning, and then only when near the front. It also dictates the size of the force—again because of the maneuver space available and the size of the targets that are expected to be encountered. A battalion- or brigade-sized unit is ideally suited for the mission. Much smaller units run the risk of being too weak to break contact in the event of an encounter with superior combat forces, and larger units can become unmanageable. *(See "Patton and the Hammelburg Mission," ARMOR, July – August, 1976. Ed.)*

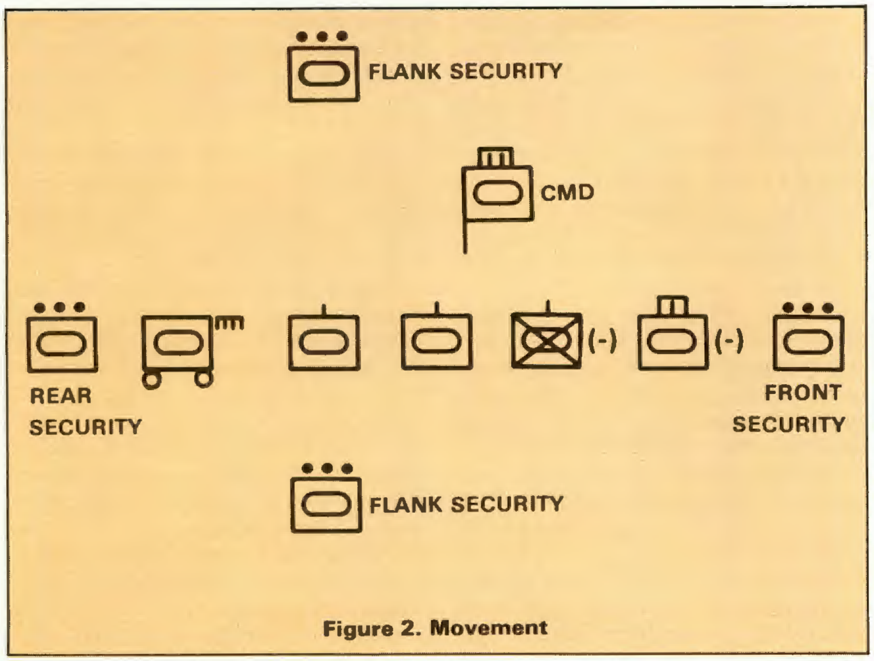


Figure 2. Movement

The Ground Interdiction Task Force is envisioned as being built around the *M1 Abrams* tank and the *M2 Bradley* IFV. Although the tactics proposed could be employed by *M60A3/M113* units, the probability of success is materially enhanced by the use of the newer, more sophisticated, and more powerful systems. This is true not only because increased firepower is available on each vehicle (the fire control and stabilization systems on the *M1* are substantially better than those on the *M60A3*, and the *M2's Bushmaster* turret is significantly better than the .50 caliber-equipped *M113*), but especially because these vehicles have enhanced survivability.

Agility—avoiding hits. The combination of powerful engines, sturdy transmissions, and improved suspensions has produced vehicles that can weave, dodge, and cut while being engaged by the enemy—and while engaging the enemy—which substantially reduces the probability of GRIT vehicles being hit.

Superior armor protection—if hit, defeating penetration. The amount of protection provided by the special armor used on the *M1* and the *M2* is classified, however, it is safe to say that it is superior to the homogeneous steel and aluminum armor used on previous vehicles.

Mobility: Figure 3 shows the relative mobility and trafficability of the envisaged systems. In the most probable combat environment, engagements and getaways in cross-country and secondary road modes, the radius of action of the *M1/M2* team is more than half again as much as for that of the *M60A3/M113* team. This translates into a zone of action more than twice as big for the *M1/M2* team. The disparity is even greater when the probability of the highest Threat engagement is considered: a head-on engagement of the GRIT and an enemy counterattack force. Since the GRIT force cannot accept decisive engagement, it must attempt to break contact when faced with a superior force. The mobility of the *M1/M2* team in rough cross-country terrain is greater than that of the *M60A3/M113* team on secondary roads. We can confidently expect that an *M1/M2* GRIT will be able to outrun any enemy combat vehicles which may attempt to pursue.

Although the emphasis is on the ground elements of the task force, other members of the combined arms team perform vital functions:

Aviation. Air cavalry units assist in locating targets for ground force interdiction. Attack helicopter units prevent the enemy from massing when he is a threat to the task force. Attack helicopters and antitank fixed-wing aircraft deny the enemy the ability to move freely by day, forcing him to move and fight at night when our superior night-fighting equipment gives us a marked advantage. Conversely, there is a synergistic effect because the GRIT forces the enemy to mass for counterattack, thereby establishing targets for air interdiction.

Resupply. Fixed-wing aircraft, or utility or cargo helicopters may be used for emergency resupply.

Artillery. Although the GRIT will

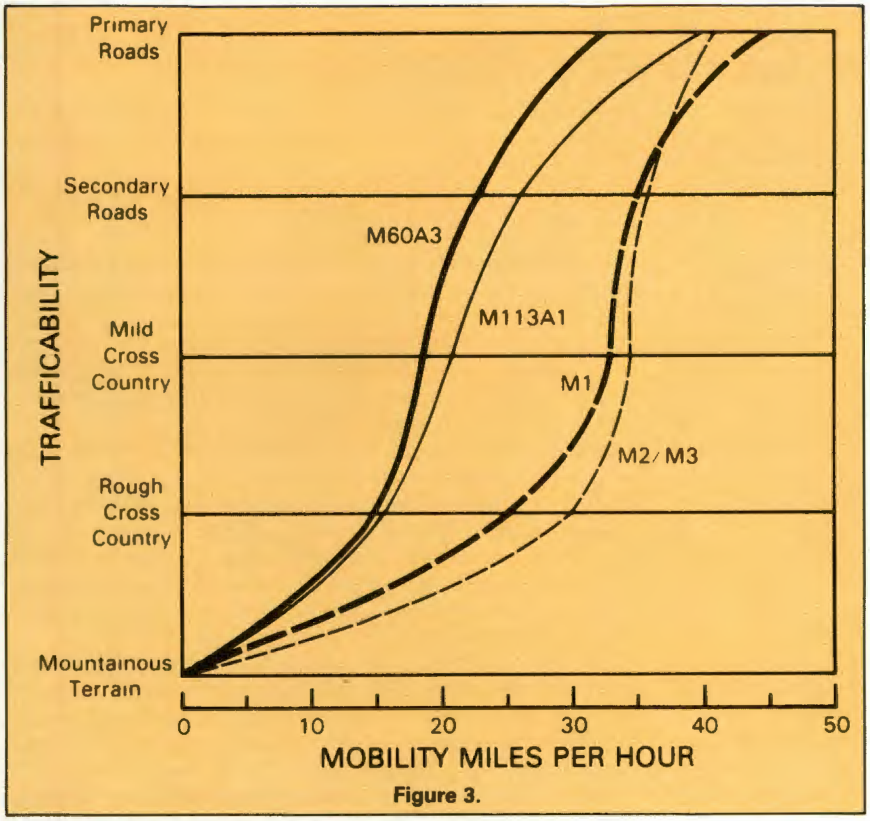


Figure 3.

frequently find itself out of range of supporting artillery, its firepower may be supplemented on special occasions by air assault artillery raids, across the forward edge of the battle area. When the GRIT is within 20 to 30 kilometers of the frontlines, support with systems such as *Copperhead* for hard targets, or multiple rocket launchers for area fire, is extremely effective. Additionally, artillery-delivered minefields could protect the GRIT from counterattack.

Air Defense. The GRIT force is particularly susceptible to acquisition and attack by enemy air assets. Air defense weapons must be mounted in carriers that can keep up with the task force, but since air defense artillery (ADA) provides area protection, the requirements for cross-country mobility are not as strict as they are for the maneuver units of the GRIT. Manportable systems like *Stinger* may be used when other ADA weapons platforms are inadequate. Friendly air power must be able to maintain local air superiority for limited periods.

Engineers. The primary mission of the Engineers in the GRIT force is the destruction of CS and CSS installations. This function can be served by cross-training GRIT infantrymen, or by replacing GRIT *M2* infantrymen with engineers.

Intelligence. Elements of the combat electronic warfare and intelligence (CEWI) battalion assist the GRIT by providing information on likely targets as well as known dangerous enemy troop concentrations. In addition to information available through national and Air Force systems, the CEWI battalion uses organic systems (remote sensors and radio intercepts) to develop a battlefield picture. Jamming and imitative deception of enemy radio stations add to the enemy's difficulty in locating and attacking the GRIT.

Service and support. Because the GRIT force operates in enemy territory, there will be no land lines of communication or supply. Logistics is a critical component of the GRIT. The distance the GRIT can be expected to cover in the course of the destruction of second echelon elements and associated support is no more than 300 kilometers. Conservation of fuel and ammunition should enable the GRIT to complete its mission without resupply. However, longer missions, or other factors, may require the GRIT force to replenish its fuel and ammunition. Resupply is accomplished by aerial delivery, prepositioning, or plunder. Because of the vulnerability of aircraft to enemy air defense, aerial resupply should be limited to emergencies. Numerous terrain studies will have identified the most likely enemy avenues of approach, and in so doing, have identified the most likely GRIT hunting grounds. Prepositioning fuel and ammunition in trailers enables the task force to move its stocks to safer locations if resupply cannot be accomplished on the spot. The task force may elect to carry equipment which allows it to refuel from captured enemy fuel stocks. Ammunition will still have to be carried or prepositioned but should be much less of a logistical burden.

If none of these methods is acceptable, the GRIT may modify existing vehicles for the supply role. For example, a fuel bladder, or ammunition pack may be secured in an *M113,* and fuel drums may be lashed to vehicle decks.

Maintenance. The requirement to keep moving to avoid detection, and the absence of a ground line of supply, means the GRIT is extremely limited in its ability to perform major maintenance. Vehicles that cannot be quickly repaired and that reduce the mobility of the task force are hidden or destroyed.

The power of armor maneuver has already been historically established. On a larger scale, the 1940 German assault into France showed the importance of maneuver over numbers and armament, as the Germans' 2,800 tanks won out over 4,000 Allied tanks, most of which were better armed than the Germans.

The Israelis demonstrated the power of armor against an enemy weak point when, in the September 1969 War of Attrition, they mounted a 10-hour raid involving a crossing of the Red Sea: an attack along a 50-mile route south; the destruction of military installations, trucks, tanks, and troops; and a withdrawal back across the Red Sea. Theirs was the embryonic GRIT. We must be able to confront the Soviets with a full-grown true GRIT.

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Armor Gunnery Ranges

by Major Donald B. Skipper

The methodology for range design and construction has not changed in the past 30 years and the responsibilities for range design and construction are so diffused throughout the army that there is no one source of knowledgeable guidance or direction to turn to for assistance in range development. The confusing funding restrictions that limit one construction project while permitting full construction on others, the impact of new weapons systems, and the fact that range design and construction funds must compete with other military construction funds all exacerbate an already depressing situation.

At first glance, it would appear to be rather easy to identify the need for and request construction of a new range facility to support training requirements. However, if the system is so simple, why don't we have an ideal armor range system throughout the Continental United States (CONUS); a system that satisfies all users' needs? The answer is not simple, in fact, there appears to be a multitude of reasons.

First, tank range construction requests enjoy no higher priority for submission of consideration than any other type of construction. It must compete with such categories as dining facilities, libraries, child care centers, etc. The installation commander reviews the range and training area needs of the post tenant units, and those Reserve Component (RC) units he supports in an attempt to determine range construction needs. These needs are then combined with all other construction needs in preparing the budget request that is sent through channels to Department of the Army (DA). At the major command (MACOM) level, and again at DA, all installation and unit requests are consolidated into a prioritized list and allocated against available funds. Eventually, a training facility is constructed. The Military Construction-Army (MCA) programming cycle takes about 5 years.

Training facility development always lags behind the development and fielding of new weapons systems because the lengthy weapons systems development cycles result in a definition of training system support requirements so late in the cycle that the range development process cannot possibly respond in time. For example, existing tank ranges were developed based upon the capabilities of the *M48* and *M60* tanks. Weapons systems now being fielded with laser rangefinders, improved suspension systems, and stabilized gunnery systems make these ranges inadequate. Sure, we can use an *M60A3* on existing tank ranges, but often we must limit the operation of the weapons system to remain within range safety limits or, in the case of stabilized gunnery, just to stay on the range. With the shoot-on-the-move capability of the *M60A3* and *M1* tanks, there are no tank ranges in CONUS or U.S. Army, Europe (USAREUR) upon which these weapons systems can train and shoot realistically. This is especially true of the *M1* since it can overrun many of the targets on existing ranges before being able to engage them.

The infantry/cavalry fighting vehicles (IFV/CFV) present a different kind of problem for the range planner. These vehicles mount a crew-served weapon and crews will have to qualify with gunnery tables similar to tank gunnery tables. On the surface, there appear to be no problems. We can fire these systems on existing tank ranges. The only problem with this approach is that, with the IFV being issued to infantry platoons that, heretofore, have never required the use of tank gunnery ranges, it's going to get very crowded on the range. There are a lot of infantry and cavalry units that will suddenly have sustainment and qualification gunnery requirements to accomplish, and scheduling already scarce tank ranges will become more difficult.

Many of our present range problems are the result of the bad habit we have developed over the years of "making do." We have adapted old ranges for new uses and, in many cases, we have reached the limits of adaptability. Weapons systems soon to be fielded represent significant advances in technology, and our existing ranges will not be able to support them. Changing doctrine and training requirements also lead to range obsolescence.

Finally, the lack of an army-wide, coordinated effort to optimize development and improvement of training facilities has been a major hinderance to solving the planning and construction of new armor gunnery ranges. Because of the very nature of the Army force structure in CONUS, the responsibilities for range planning, development, and funding have been spread among Forces Command (FORSCOM), Training and Doctrine Command (TRADOC), National Guard Bureau (NGB), Office of the Chief, Army Reserve (OCAR), and various other agencies. DA has not yet filled this void with consolidated Army-wide policy, guidance, or standards for the development of ranges. Worldwide priorities for range construction, based on force modernization considerations, force structure, or weapons systems densities, have never been established. Consequently, the Army is probably not getting the best dollar results from the very limited funds for range development.

If the RC armor force is considered in this analysis, the situation becomes even more complicated because of the geographic dispersion of these units, recently increased weapons systems qualification standards, and the variety of different locations at which these armor units habitually train. One other, often misunderstood, complication in determining the training facilities for RC armor/cavalry units is that a unit's mobilization station may not be the same place that the unit trains during the annual training (AT) period. This duality of training sites can result in the requirement for tank ranges in support of one unit to be available in two different locations. If an RC armor unit mobilized at Fort Hood, Texas, there is no problem since Fort Hood is blessed with an extensive tank range complex. If existing mobilization plans require a similar unit to mobilize at Camp Roberts, CA, or Fort Benning, GA, however, it will not be able to accomplish post-mobilization gunnery training since there are no main gun Table IX firing ranges at either installation. The requirement might exist; but, due to austere funding or higher priorities, the ranges have never been built.

Ideally, range planning, development, and funding should be accomplished in such a manner that force modernization, mobilization, and peacetime requirements are all considered simultaneously. Real-world constraints on land use, noise pollution, and extremely high land acquisition costs will forever prevent us from reaching an optimum solution. The magnitude of this problem, when other type ranges (artillery, air defense, aerial gunnery) are also considered in any attempt at reaching an Army-wide solution, is just now being realized.

Several government agencies are showing an increased interest in the manner in which ranges "happen." The General Accounting Office (GAO) recently completed an investigation into the way Army National Guard and Army Reserve range needs are identified and funded. A DA Inspector General (IG) study has attempted to define this problem for all Army forces worldwide. The IG study team visited MACOMs, installations, and units around the world in an effort to ascertain the status of range planning, development and funding. Several DA-sponsored *ad hoc* training committees have identified the lack of uniform policy and guidelines for range development as a major problem in training the force. DA is now in the embryonic stages of developing a program to improve this area of training management and is designing an Army Master Range Plan to provide the consolidated Army-wide policy, guidance, and standards for development of ranges.

The situation is not uniformly bleak. Some installations in CONUS have developed detailed range development programs that have considered the myriad of subjects described above and are actively pursuing approval and funding for construction. TRADOC has published TC 25-2, *Training Ranges,* which provides guidance for the actual design and construction of ranges to support both present and developing weapons systems. This training circular can be very helpful to developing a long-range training facility development plan.

However, in light of real-world constraints on the construction of new ranges, it would be prudent to examine a few other approaches to a long-term solution for the range problem.

One approach would be for DA to continue the present system, with MACOMs developing 5-year range plans and then competing for funding at every decision level. If this method is perpetuated, it will be necessary for a DA-level review committee to thoroughly validate and prioritize the MACOM budget requests based on peacetime and wartime needs. Even with a careful analysis of requests, with the large number of new weapons systems driving the need for range upgrade and new construction, it will be difficult for DA to determine the optimum combination of "when what should be built where."

A second approach would be for the TRADOC proponent schools, in their role as doctrinal centers, to review the condition of existing ranges and training facilities that support their particular combat arm. Once the conditions of existing facilities are adequately defined, it would be a relatively simple matter, based on known force modernization factors, to forecast what must be updated, or built, to support the weapons systems requirements of that particular combat arm. For example, the Armor School could make use of data on tank and aerial gunnery ranges that is regularly obtained during Office of Armor Force Management and Standardization (OAFMS) field visits and develop a priority list of armor range needs through the year 2000. Similar lists from all the schools could then be consolidated at TRADOC, reviewed by the other MACOMs and forwarded to DA for funding consideration. This approach has the advantage of providing a clear definition of range needs based on all known factors and would be easily understood by any budgetary committee.

A third approach is more controversial. It involves the establishment of a regional range concept. It has the advantage of simplifying all of the considerations discussed above and might, in the long run, result in a substantial cost savings. Historically, the Army has developed range facilities based on the needs of a unit at a particular location at the time the budget request for the facility is formulated. The major disadvantage in this is that the force structure is a dynamic, constantly evolving system. Based on force structure and stationing policies, units are activated, moved, and/or deactivated all the time. The force planners attempt to station units where adequate ranges and facilities already exist; but, for a variety of reasons, this is not always possible. By using a regional range concept, DA would establish several comprehensive range facility complexes throughout CONUS. These would be similar in nature to the Grafenwöhr major training area in USAREUR, and would support the annual training and weapons qualification needs of all Army forces within the region. Because they would not be subject to the whims of the force planners, these regional training complexes could be fully developed with the knowledge that, regardless of unit activations or deactivations, the need for these facilities would always exist in that region. To some degree, a regional range complex would simplify the complicated range scheduling problems that we now have in both the active and reserve components and, in the long term, would probably reduce the overall cost of such facilities for the entire force. Real estate acquisition costs, environmental problems, and the quality and standardization of training facilities would all benefit from the adoption of this approach. Location, design, operational control, and funding would all have to be explored in detail before any decision of this concept could be made.

These three approaches are all long-term solutions. In the short term, what can the user of a training facility do to improve the present system? In order to improve the quality of a range, or upgrade a training facility, the user must thoroughly articulate needs. We can no longer afford to "make do" with existing inadequate facilities. If you are required to fire a tank Table IX, why don't you have one available? If there is supposed to be two moving targets on a range to support simultaneous engagements, why is there only one? Has anyone documented the need for a range upgrade and insured that this need received the proper attention? Does the installation Director for Reserve Components become involved in developing the needs of RC armor units for inclusion in installation or MCA budget submissions? Is the unit next door scheduled to receive IFVs or CFVs in 1984? And, if so, where do you think they are going to fire and, even more important, what impact will their IFV/CFV gunnery training program have on your unit's ability to schedule ranges and conduct gunnery training? If an installation facilities review board or council has considered all of these questions, you are in good shape. Chances are they haven't—because you haven't asked.

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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 49)


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PROFESSIONAL THOUGHTS

The Real Spirit Of Victory

Recently the Army has been stressing "The Spirit of Victory" as its theme.

Certainly, that is an appropriate theme in the field of war, where the moral is to the materiel as three to one (Napoleon), and the starting point for the study of all relevant things is the human heart (de Saxe).

We should be grateful for this acknowledgement that war is above all a psychological transaction, where people's opinions and emotions—and, yes, their spirit—are more decisive than physical factors.

Nevertheless, in selecting the Yorktown Campaign as the symbol of the Spirit of Victory, the Army was, in my opinion, mistaken. Understandable though that symbolism was in the Yorktown Bicentennial Year, Yorktown is not a very useful symbol for an Army facing the specific Threat that our Army faces today.

However magnificent the Yorktown operation was, it is doubtful that a campaign displaying such advantages for our side offers a useful psychological model for the Central Battle in Europe—a conflict in which almost all the advantages of numbers, logistics, initiative, etc., would lie with the enemy.

American history does, however, offer an example of just the kind of spirit U.S. forces will need to defend Western Europe against a Warsaw Pact attack. It is an example from U.S. naval history—yet is so apt, and its lessons so sound for combat in any medium, that it is worth reviewing.

It was the battle between John Paul Jones' *Bonhomme Richard* and the British man-of-war *Serapis*—well known by name and legend ("I have not yet begun to fight"), yet little is known as regards the details that made Jones' famous remark both necessary and significant.

What is not generally understood is that Jones was, by every objective standard, defeated. He was outgunned, outmaneuvered and outshot. For most of the battle, he was able to use only two, later three, small 9-pounder guns, and only a small force of musketeers in the tops continued the fight along with the 9-pounder crews.

Bonhomme Richard was shot to pieces, and filling with water. Though *Serapis'* upper decks were cleared, her lower-deck guns continued to smash into *Richard* at pointblank range.

One of Jones' officers, convinced the ship was lost, called for quarter without authorization. It was that action that compelled Jones to issue his famous retort.

Jones also had difficulties with other American ships at the scene. Far from aiding him, they avoided the fight with one exception. The *Alliance* suddenly began to fire broadsides into the *Bonhomme Richard*. The situation became desperate and Jones' officers urged that he surrender.

"I would not, however, give up the point," Jones explained in his after-action report to Congress. The British fire slackened and then they surrendered. Within hours, *Bonhomme Richard* sank.

Jones had fought against superior forces and won. He did not win because of better equipment or coordination or maneuver or unit cohesiveness. He won purely and simply because he was too bloody stubborn to admit defeat.

Jones' example is not one to be lightheartedly followed in all circumstances. The military's all-too-common "positive attitude syndrome" can be destructive. It is usually foolish to insist on a positive attitude in a negative situation—because it may blind you to the possibility of changing the situation for the better.

Even in war, the stakes are usually less than millenial. Most wars are fought for national interests that fall short of life-and-death vitalness. That's why nations so rarely fight to the death, and most wars end before either side runs out of combat power completely.

However, one can reasonably argue that protecting NATO against Soviet attack is a life-and-death vital interest to the U.S. In that case, facing the prospect of a bonafide Armageddon, it is important to defend Western Europe with unprecedented determination, no matter how grim the situation may become.

(That does not mean we should *plan* the defense of NATO with a blindly positive attitude.) Planners should unhesitatingly trumpet all of our shortfalls and deficiencies, taking as realistically negative a tone as necessary to awaken our allies and our fellow Americans to the need for better preparedness. Once battle is joined, however, it will be too late for that and we will have to do the best we can with whatever we have.

From general to private, we must inculcate in our troops a clear understanding that this battle may truly decide for all time whether their families continue to live in the kind of society we now enjoy or in a society of poverty, fear and oppression.

As soldiers, we must all grasp that if ever a struggle justified the subordination of self to a larger cause, this would be that struggle. We must determine that, like Jones, we simply "will not give up the point." For, as Jones recognized, battle is a psychological contest more than a physical one. There is a point where the psychological pressure will tell and a commander, or his troops will snap, without much regard for the physical progress of the battle.

Warsaw Pact forces should be quite vulnerable to such psychological crisis, especially if we conduct our political, combat, and psychological warfare strategy so as to intelligently exploit their vulnerability.

It is doubtful that they would attack the free nations (which many of them secretly admire and envy) with anything like the enthusiasm they would understandably show in a direct defense of their homelands. The national hatreds that tear the Soviet Union's innards would not cease, and might even grow, in the stress of battle.

However, creating such a breakdown will take time, plenty of battle stress, and a realization that no quick-and-easy Warsaw Pact victory will be permitted. And that means our side has to put up one hell of a fight—a better fight than might be anticipated from the current businesslike approach to NATO defense.

The businesslike approach must be foresaken, at least until NATO nations field sufficiently strong forces or develop a sufficiently imaginative indirect offensive strategy to win a business-as-usual war.

Given the current balance of forces and the NATO posture, only unprecedented ferocity will buy the time we need. Only an honest conviction in the soldier that he has the moral fiber to fight to the bitter end, a determination that "the other guy will break first because I'm *not* going to break, *ever*", will produce the requisite ferocity.

Such is the Spirit of Victory our Army needs in the 1980s.

It is a most untraditional requirement, for an Army accustomed to approaching war as an engineering project, to be solved cold-bloodedly, with superior resources, ingenuity, and soldiers who are everyday folks temporarily clad in Army green.

Somehow we must find a way, within our democratic context, to resurrect the dedication, self-sacrifice, and fury of John Paul Jones.

If this seems to be asking U.S. soldiers to become suicide fighters, that is a mistaken interpretation. For, as Sun Tzu repeatedly remarks, it is the soldiers who reconcile themselves to self-sacrifice who are most likely to survive in war. Those most anxious to preserve their lives, ironically enough, are the very ones most likely to panic, become disorderly and die needlessly, Sun Tzu argues.

Even if Sun Tzu is right, priming American soldiers for such fierceness is not a pleasant prospect. But neither is losing World War III.

HARRY F. NOYES, III
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The Motor Sergeant

The motor sergeant's job is not an easy job even under the best of circumstances. However, when it is just a title, bestowed without regard to qualifications, it becomes an impossible series of daily tasks.

After analyzing a series of reports it is apparent to me that a trend is developing. The average unit motor sergeant's rank is lower than authorized—sometimes as much as three grades. Also, he or she generally lacks the necessary training and experience to be fully qualified for, and capable of, filling that position.

This is not to infer that those filling the slot lack potential, initiative, or drive. Most give it all they've got—and more. The problem is systemic and certainly not the fault of excellent soldiers doing their very best. There is an apparent shortage of experienced maintenance NCOs (available to units) who are capable of immediately taking charge of a motor pool. Far too many of our young motor sergeants are in an on-the-job training (OJT) status, doing the job as *they perceive that it should be done.* They have not been prepared, however, for the responsibility of managing a motor pool. Such a situation is demoralizing and creates frustration.

The motor sergeant is a vital middle manager in the maintenance system. Filling existing motor sergeant vacancies is usually considered a simple process. (Perhaps simplistic is a better word.) The company commander needs one; personnel cannot help him—the installation has all the maintenance personnel it is authorized. So, the CO goes down to the motor pool, taps the most experienced mechanic on the shoulder and tells him he is now the motor sergeant.

Good solution? Yes, if the pick is a good one. Most often it is the beginning of mayhem in the motor pool because it takes management training to become a motor sergeant. Motor sergeants should be made through training, not by an oral order from the CO.

Consider some of the functions the position demands:

Shop layout. Anyone experienced in vehicle maintenance can take one look at a motor pool and pretty well tell its operational qualities. Work must flow in the shop just as efficiently as it does in any other facility.

Work scheduling. Mechanics are mostly part-time workers these days. A 50-percent wrench-turning availability has become the norm. Experienced management can take up some of this slack. Lack of such training aggravates the situation.

Motor stables. This is the time set aside for the chain of command to supervise sections, squads, platoons, and headquarters staff elements that are performing preventive maintenance. Unfortunately, if anyone shows up at the motor pool, the one expected to supervise is the motor sergeant. And, when the unit fails an equipment maintenance inspection, the motor sergeant is usually blamed. During motor stables, the motor sergeant is an *advisor*. He is an invaluable part of the period, but not all of it.

Repair parts ordering and stockage. To effectively supervise a motor pool, an NCO must be able to reference technical publications, correctly identify needed parts, know how and when to order them, and be thoroughly familiar with prescribed load list (PLL) procedures. This takes training, which is eventually returned to the unit—with dividends.

There's an old saying that familiarity breeds contempt. It's surprising how many are familiar with the existence of TM 38-750, *The Army Maintenance Management System* (TAMMS), but not with its contents. If a mechanic is expected to come out from under a vehicle and run a motor pool, it would be wise to find out if he or she knows TM 38-750 from cover to cover. This publication is the foundation of a sound vehicle maintenance program.

Teacher. There is no formal instruction in the Army's school system to train motor sergeants and there are very few installations that include this requirement in their logistics training programs. We have survived over the years because motor sergeants have traditionally trained their own replacements. But they did not do so by limiting their efforts to only the mechanical aspects of the job. TAMMS and PLL clerks, as well, were included, as were a number of officers.

But we still need a formal training school for motor sergeants because the more we "make" motor sergeants, the more we "break" the system. We must train motor sergeants to qualify for the job, not merely appoint them—and hope for the best.

The motor sergeant job list above is not all inclusive. You can probably add a few more, but it's easy to lift a pencil and be critical. What we need are solutions; things that can be done to get us away from the crisis, quick-fix, temporary solutions we now have.

Aberdeen is to be commended on initiating the organizational maintenance supervisors' (motor sergeants') course. It fills a very real need in units. As for course content, it should include the following:

- Motor pool management
- Recovery
- Repair parts ordering and stockage
- Use of technical publications
- TAMMS
- Techniques of leadership.

I would offer these considerations for eligibility. Let E4s attend the course as a reenlistment option or place them on TDY while enroute to a new duty station.

If that approach is considered too costly, contract out a training package to the civilian educational institutions that now provide logistics training at installations. Also, there are probably enough trained, retired maintenance personnel around who would jump at the opportunity to impart their hard-won knowledge—knowledge based on experience.

I'll end with a plea. Give some ambitious soldiers a break. Those who are willing to take over a motor pool not only exhibit the initiative needed in maintenance, but are also much needed in the Army.

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A Jump TOC for Command and Control

An armored battalion commander must provide for the control of the battle in spite of the fact that his tactical operations center (TOC) will be expected to move at a moment's notice, if it is to avoid enemy harassing fires and direction finding techniques.

To accomplish this he has two assets when displacing the TOC. They are the Headquarters and Headquarters Company, and Combat Support Company (HHC and CSC) commanders. Once the battalion deploys, the various platoons of the HHC and CSC are either under battalion control or are attached to the line companies.

Traditionally, the armored battalion will use at least one of these two commanders as the officer in charge (OIC) of the TOC, or commandant. This task usually goes to the HHC commander since it is his soldiers that man the TOC and it is his equipment being used. The CSC commander is usually given jobs ranging from combat outpost commander in the area defense, to base of illuminations commander during night operations since the assets for these tasks come from his company. The varied nature of the equipment under the control of the CSC commander makes him a rover, like a roving linebacker in football defense.

There is a system by which the CSC commander can monitor the activity of his sub-elements and provide the battalion command group with valuable assistance in its control of the battle. In the 4-37th Armor, the CSC commander is the controller of the "jump" TOC and a member of the command group for the battalion's field operations. In this role he is responsible for the tactical organization, displacement, and control of the jump TOC.

Jump TOC Concept. In addition to providing an auxiliary command center for the battalion during the displacement of the main TOC, the jump TOC also provides the commander with an outpost through which he can tactically command the unit as far forward as possible.

The jump TOC provides this continuous control by being forward of the main TOC in relation to the battle and by maintaining constant radio contact with the main TOC and the maneuver units. The jump TOC is, in fact, a smaller version of the main TOC and provisions must be made for it to duplicate the efforts of the main TOC if it becomes necessary. The officer in charge must stay abreast of the battle to facilitate an instantaneous handoff of command and control from the main TOC. The main TOC normally displaces at least once or twice during a 24-hour period, so that it is not unusual for the jump TOC to assume net control responsibilities for hours at a time.

The jump TOC is an independent agency that must provide its own security and logistical support, and deploy separately from the main TOC. In this vein, it is better to support the jump TOC through the assets of the CSC, which relieves the HHC from this requirement and permits it to devote its full effort to the responsibility to support the main TOC.

Jump TOC Composition. In the 4-37th Armor the jump TOC is made up of the command tank section, a personnel carrier from the CSC and, when feasible, the jeeps of the battalion commander and the CSC commander. These vehicles are manned by their regular crews, while the CSC normally takes one scout crew in the personnel carrier. This small mobile group comprises the auxiliary center that moves with the commander when he is not with the main TOC. Each vehicle has its specific purpose and the loading plans for these vehicles are based on the mission of mobility and backup control of the battle.

Though the jump TOC is designed to be small and mobile, it must contain some rudimentary items to accomplish its mission. It must have the radio capability to maintain contact on the secure brigade and battalion command nets. The TOC also must have situation maps and other graphics to depict the battle so that the commander has the most up-to-date information available in making tactical decisions from that location.

The tanks of the jump TOC (usually two) come from the HHC command group vehicles. They are manned by the battalion commander and his crews, and an HHC tank crew. The personnel carrier is the CSC commander's tracked vehicle specially modified for the purpose of being the control center of the jump TOC. This *M113A1* is outfitted with a two-net transceiver capability, with one net secured and one auxiliary receiver. The nets monitored on this track are: the brigade command, the battalion command, and either the battalion administrative/logistic net or the firing frequency. The CSC commander normally commands the personnel carrier and is assisted by a sergeant from the scout platoon. The vehicle also carries a large plywood map board with several overlays to be used to depict current battle situations and unit dispositions.

When the jump TOC is not forward of the main TOC, it integrates into the security plan of the main TOC. When it is forward, the vehicle crews provide local security, and the tanks cover likely enemy avenues of approach. The carrier employs a modified *M577* extension to provide a light-secure working area and briefing tent for the commander. In a static situation, the jump TOC can deploy a small general purpose tent for sleeping if it is required to operate at extended periods away from the main TOC.

Jump TOC Operations. The CSC commander is responsible for the movement of the jump TOC and instructions for this movement normally are issued in the initial operations orders while the command group is still situated with the main TOC. Once the order is released, the CSC commander conducts a map reconnaissance and selects likely forward sites for the placement of the jump TOC. The normal considerations are taken into account with emphasis on the radio siting, overhead concealment, and defensibility. If possible, a ground reconnaissance is conducted by the CSC commander or his scout assistant. During this time, the jump TOC OIC is also looking for supplemental sites for the main TOC and advising the main TOC OIC of their location.

Before the order is executed, the jump TOC moves into the site most likely to promote communication between it, the main TOC, and the maneuver units. The new position is reported to the main TOC and the jump TOC begins to monitor the battle.

The CSC commander's job is more than that of a glorified radio operator. He must maintain situation maps, be prepared to assume net control responsibilities, and answer for the commander on both the battalion and brigade command nets since the commander can only transmit and receive on one net at a time if he is in his tank. Having a scout crew on the personnel carrier gives the jump TOC OIC a scout NCO, who is familiar with operations, and who can act as an assistant.

As the battle progresses, it may be necessary for the commander to go forward and personally assess the situation. This is when the mobility of the jump TOC becomes valuable by permitting the commander to move about the battlefield in a combat vehicle and have all the assets immediately available to him for controlling the battle and making decisions based on as much information as possible.

The jump TOC system as practiced by the 4-37th Armor has become a battle drill and has proved its usefulness to the battalion commander. While acting as the jump commander, the CSC commander can monitor the employment of the assets of his own company, advise the battalion commander on their employment, and monitor the execution of their assigned missions. This makes for smart, aggressive, deployment with all commanders deeply involved in the operation. A prime example of the value of this system occurred during a recent battalion Army Training and Evaluation Program exercise. During the attack phase, the commander was travelling ahead of the jump TOC as it was moving with the advancing armored forces. The commander was "killed" by enemy fire. This event normally may not have come to the attention of the main TOC for some while; but it was SOP that if the commander did not answer the net immediately, then the jump TOC personnel took over control of the battle and supplied information to the main TOC. This occurred without delay, with the CSC commander controlling the battle until the S3 and, later, the XO, could come forward from the main TOC and be handed the battle with no disruption of control.

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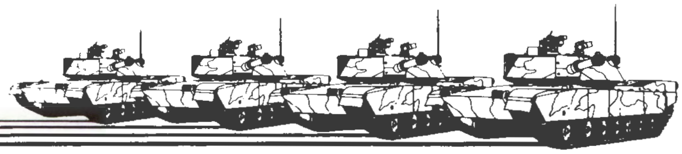

Tank Gunnery and The Training Dilemma

There has been a great deal of discussion lately on the necessity and ability of the Army's Reserve Components to adequately train and meet the requirement to "flesh out" the force. In Armor, we are faced with the challenge of insuring that Reserve Component (RC) units of Armor are trained to meet the standards set for well-trained Armor crewmen and leaders who are tactically and technically proficient. It is with that requirement that a training dilemma emerges.

The guide for RC training is Forces Command (FORSCOM) Regulation 350-2. As currently written, Appendix B, "Reserve Component Weapons Qualification and Familiarization," states, "The armor unit gunnery program is the first priority training requirement for armor and armored cavalry units" . . . and most armor leaders would agree that tank gunnery is the single most important contribution a tank crew can make to the battle. However, the statement continues by noting, "Gunnery must be integrated with Soldier's Manual (SM) and Army Training and Evaluation Programs (ARTEP) training to provide a rounded program." Now, here's the rub. A well-rounded program oriented to the SM and ARTEP requires a well-trained armor crewman. The SM for 19E skill level 1 or 2 identifies 102 common tasks and 50 duty tasks that an armor crewman should be able to perform to standard, if he is to be basically trained and MOS-qualified. Of the 152 tasks required, 32 are directly related to tank gunnery and are skills that would be required to provide a "qualified" crewman. At skill level 3, some additional gunnery related tasks are required by the tank commander, but these are basically position-specific skills, reflecting the fact that skill levels 1 or 2 contain all that is necessary to shoot the gun effectively. With these points in mind, let's look at the dilemma we face.

As mentioned earlier, the armor unit's tank gunnery program has been identified as the "first priority training requirement." Along with this requirement comes the pressure on unit commanders to provide "qualified" tank crews during inactive duty training (IDT) and annual training (AT) periods. As a result of this pressure, the focus of a majority of training is directed at the tank gunnery program. This, in itself, is not bad until we bump off the total time available to RC units to train in all areas related to tank crew proficiency. Under the current system, each RC unit in addition to its 2-week AT (minimum 88 hours) participates in 48 paid drills during the training year. Each of these unit training assemblies is 4 hours in duration and is combined into a multiple unit training assembly 16 hours in length (MUTA-4). As a minimum, there are 280 hours available to the RC unit throughout the training year and while that number represents the minimum amount of time available, it is a number that closely matches the total actual time available to the unit to train. A problem begins to develop when it is understood that included in the 280 hour figure is the time required for personnel and logistical requirements that must be administered at company level. The amount of time it takes to satisfy such requirements will differ from unit to unit and therefore, it is impossible to determine exactly how much is sacrificed, but any soldier that has ever been assigned to a company understands the importance and necessity of spending this time, especially when the unit members are only available a total of 16 hours a month. So given a well-thought out and flawlessly executed training plan, it is clear that sometimes less than 192 hours is available at home station (less than 88 hours of AT) to cover the 152 SM tasks and insure the ability of the soldier to perform those tasks to standard.

With the number of hours available, and the emphasis placed on tank gunnery, it is clear that any unit attempting to maintain a balanced training program is forced into focusing its attention on gunnery. The results can be anticipated; less than standard performance on a majority of the SM skills required of an armored vehicle crewman. Coupled with this realization is that in addition to generally weak performance in SM tasks not related to gunnery, the gunnery program itself may fall short of the qualifications standards prescribed in FM 17-12. The reader should note that this is not an indictment of the soldier's ability or willingness to train, but rather of the "training philosophy" that drives a program beyond the limits of what can reasonably be accomplished within the time, space, and monetary constraints of reality. Now we have the dilemma; too much time devoted to tank gunnery, not enough time on other training skills.

A proposal for consideration in resolving the dilemma would change the wording and intent of FORSCOM 352-2 by reducing the annual tank gunnery requirement from qualification to what can be best described as integrated tank crew familiarization including a familiarization run on Tables VII A and B. (The term integrated tank crew familiarization is appropriate since mini-tank ranges are stationary and remove the driver from tank gunnery. Furthermore, the subcaliber tables do not make full use of loaders.) Remove the pressure to "qualify" annually and you have removed a significant training burden from the reserve component unit commander. Note that this approach in no way eliminates the requirement to have tank crews shoot both subcaliber and main gun tank tables annually; the approach is designed to bring the gunnery requirement into perspective as a training requirement. With tank crews shooting mini-tank ranges at home station and main gun tank tables during IDT/AT, the commanders could restructure their training into a more rounded program intended to cover all SM requirements.

The most obvious question is, "when do RC tank crews "qualify" to the standards set in FM 17-12?" This requirement could be met during the post-mobilization training period that is utilized to fine tune RC units prior to deployment. If the unit has trained up to standard on 120 of the 152 SM tasks required, and is familiar with the 32 gunnery specific tasks, it should take a minimum amount of time to qualify tank crews to the standards required. It seems logical to concentrate our effort on 21 percent of our training requirement after mobilization, rather than try to qualify a majority of the soldiers on 79 percent of what it takes to survive and accomplish the mission on the battlefield.

Once again, it should be stated that not all observations and recommended solutions apply equally in all cases. There will always be the exceptional unit that can train to standard and produce outstanding armor crewman in the time available, as well as the unit that lacks adequate training time after mobilization to allow modification in training standards, and their needs and requirements must be handled on a case by case basis. Tailoring training to the unit's needs, rather than the blind acceptance of an unachievable training philosophy is what is needed to produce results.

Armor leaders and senior commanders must face the fact that if we are to successfully apply the firepower, mobility, and shock effect of all our armored units, then we must focus our training and attention on those skills so vital to getting to the first battle position successfully. Without those skills, we may well never get any opportunity to fire a shot.

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Recognition Quiz Answers

1. **AMX VC1.** (ICV) Crew: 3 plus 10 infantry; Weight: 15,000 kg (33,075 lbs); Power-to-weight ratio: 16.66 hp/ton; Maximum road speed: 65 km/h; Maximum road range: 350-400 km; Armament: 1 x 20-mm cannon or 1 x 12.7-mm machinegun or 1 x 7.62-mm/7.5-mm machinegun.

2. **AMX-10P** (ICV). Crew: 3 plus 8 infantry; Weight: 14,200 kg (31,311 lbs); Power-to-weight ratio: 19.71 hp/ton; Maximum road speed: 65 km/h; Maximum road range: 600 km; Armament: 1 x 20-mm cannon, 1 x 7.62 machinegun, 2 smoke dischargers.

3. **PANHARD EBR** (heavy armored car). Crew: 4; Configuration: 8 x 8; Weight: 13,500 kg (29,767 lbs); Power-to-weight ratio; 14.81 hp/ton; Maximum road speed: 105 km/h; Maximum road range: 650 km; Armament: 1 x 90-mm gun (FL-11 turret) 1 x 7.5-mm machinegun (coaxial), 1 x 7.5-mm machinegun at each driver's position (2).

4. **AMX-10RC** (recon vehicle). Crew: 4; Weight: 15,800 kg (34,839 lbs); Configuration; 6 x 6; Power-to-weight ratio: 17.72 hp/ton; Maximum road speed: 85 km/h; Maximum water speed 7.2 km/h; Armament: 1 x 105-mm gun, 1 x 7.62-mm machinegun (coaxial).

5. **PANHARD AML** (recon vehicle). Crew: 3; Configuration: 4 x 4; Weight: 5,500 kg (12,127 lbs); Power-to-weight ratio: 16.36 hp/ton; Maximum road speed: 90 km/h; Maximum road range: 600 km; Armament: 1 x 90-mm gun, 1 x 7.62-mm machinegun (coaxial), 2 x 2 smoke dischargers.

6. **AMX-13** (light tank). Crew: 3; Weight: 15,000 kg (33,075 lbs); Power-to-weight ratio: 16.66 hp/ton; Maximum road speed: 60 km/h; Maximum road range: 350-400 km; Armament: 1 x 90-mm gun, 1 x 7.5-mm or 7.62-mm machinegun (coaxial). Optional for AA: 1 x 7.5-mm machinegun.

Submitted by SSG David L. Merryman, Intelligence NCO, DCD (Threat) USAARMC.

OPMS-EPMS

Officer Terms Clarified

The new Defense Officer Personnel Management Act (DOPMA) was signed into law in September 1981 and many terms relating to officer management have been clarified by MILPERCEN. The act will be fully implemented by September 1982. According to MILPERCEN officials, a number of Army Regulations dealing with officer promotions, retirements, accessions and other matters are being revised.

Some of the officer terms involved include:

Officer—a commissioned or warrant officer, unless otherwise specified.

Regular Army (RA)—Those persons whose continuous service on active duty is governed by law. At present there is a limit of 63,000 RA officers in the Army.

U.S. Army Reserve (USAR)—All Reserve Component officers who are not members of the Army National Guard. Some USAR officers may be on active duty, and some of these may be on the active duty list (ADL) (See below.)

Army National Guard of the United States (ARNGUS)—Reserve Component officers who are members of the Army National Guard. Again, some of these may be on active duty, and some may be on the ADL.

Army of the United States Without Component (AUS)—Consists of officers not assigned to a component, such as RA, USAR, or ARNGUS. Before DOPMA, the AUS provided a means for temporary appointment of officers to fill Army grade requirements. With DOPMA, however, commissioned officers will normally not receive AUS appointments.

Temporary Appointment—Appointment or promotion in the AUS. Generally applies to warrant officers only.

Permanent Appointment—With DOPMA, all commissioned officer promotions will be permanent promotions in a component: RA, USAR, or ARNGUS. Also, an officer can be in only one component at a time.

Active Duty List (ADL)—A list of commissioned officers, by seniority, serving on active duty. Some categories of officers are not on the ADL, such as USAR officers on active duty for training.

Promotion Zone—An eligibility category defined by an announced range of dates of rank. It consists of commissioned officers from the ADL, and in the same grade and competitive category.

Date of Rank (DOR)—The date on which an officer was appointed to a particular grade.

Competitive Category—A group of commissioned officers competing for promotion. These categories include Army officers in specialties 00 through 54, and 69 through 97. Also, chaplains, medical, dental, and legal officers are included.

Active Guard/Reserve (AGR)—Applies to USAR and ARNGUS officers on fulltime duty (over 179 days) who provide fulltime support to the Reserve Components. This term replaces "statutory" and "long tour" as they pertained to training and fulltime duty. AGR commissioned officers, it should be noted, are not reflected on the ADL.

Enlisted Preference Statement

AR 614-200 requires that each soldier submit an Enlisted Preference Statement within 30 days of his promotion to staff sergeant.

The following information on the Enlisted Preference Statement is not available anywhere else and is necessary to the assignment process:

- Duty position preference (troops, staff, instructor, ROTC, ARMR, Full Time Manning, 1SG)
- Service schools desired (Drill Sergeant, Recruiter, 1SG Course, etc.)
- Number and ages of dependents
- Unique assignment considerations (joint domicile, sole parent, special dependent care requirements, etc.)
- Typing ability
- Remarks by soldier concerning specific assignments desired and for which he is qualified.

The Enlisted Preference Statements now at the Career Management Individual File (CMIF) for soldiers in grades E6 through E8 range from 1 to 9 years out of date. You can influence the assignment process by *ensuring* that your *current* DA Form 2635 is on file with Branch. You can further assist in your future assignments by ensuring that at least one of your first three choices is to a command with a high-density armor population. This holds true for divisional installations in CONUS, Germany, Korea, Hawaii, and Panama, and Alaska for CONUS tours.

Route your completed—*and signed,* Preference Statement through your PAC and MILPO so that your assignment preference can be recorded on DA Form 2-1 and the Enlisted Master File as well.

Files on soldiers in grades E1 through E5 are not maintained at Branch. If you are within this grade spread, your preferences are available to Branch through the Enlisted Master File which is updated when you screen your DA Form 2-1.

Enlisted Assignments Branch, Infantry/Armor Branch

LTC Richard C. Pahland, Chief, Infantry/Armor Branch

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SFC (P) Robert Way	Professional Development NCO
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2461 Eisenhower Avenue
Alexandria, VA 22331

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Commercial (202) 325-8071/8072/9080/9192

news notes

A new, mast-mounted helicopter TOW sight permits the helicopter to "hide" and fire the TOW missile while remaining under cover. The TOW climbs to the sight's line of vision while the helicopter remains hidden.

Vehicle Fire Extinguishing System

A new vehicle fire-fighting system, using halon gas, is under development at the Yuma Proving Ground, Arizona. It is activated by automatic light-sensitive detectors and is known as an Automatic Fire Suppression System (AFSS). It was developed by the Grumman Aircraft Corporation of Long Island, New York.

The halon system reduces the risk of serious injury to crewmen because of its blanketing effect, which smothers a fire almost before a human could detect the fire.

In tests, fires were detected and suppressed in milli-seconds. A milli-second is one-thousandth of a second.

A similar system has already been installed in the *M1 Abrams* and the *Bradley Fighting Vehicle.* A halon system will be added to the *M60* MBT.

Antiair *Stinger* Tests Prove Successful

The first firing of the new *Stinger* weapon system by U.S. forces on Crete against simulated aircraft targets resulted in 37 successful intercepts out of 40 firings.

The *Stinger,* a shoulder-launched, fire-and-forget weapon, uses heatseeking devices to hit low-flying high-speed jet aircraft and helicopters. It is replacing the *Redeye* missile system.

The Army began supplying *Stinger* weapons to troops in Europe in 1980 and the Marines received the new weapon last year.

Navigation System Is Tested

The Navstar Global Positioning System (GPS), a space-based radio positioning and navigation system that will provide three-dimensional position and speed information to ground troops, armored vehicles, and aircraft, is under development by the GPS Joint Program Office at Los Angeles, California.

When in operation, the GPS will provide position information accurate to fifteen-meter spherical error and speed accurate to within .1 meter-second. Presently, the *M60A3* tank and the *UH-60A* helicopter are being used in the testing phase.

U.S. Horse Cavalry Association Reunion

The U.S. Horse Cavalry Association will hold its annual reunion on October 15, 16, 17 at Fort Riley and Junction City, Kansas. Contact the Association at P.O. Box 6253, Fort Bliss, Texas, 79906.

Combat Vehicle Heading Reference System

A new navigational system for tanks has been developed that will give a heading within 3 degrees and is virtually unaffected by the tank's magnetic influence. The Combat Vehicle Heading Reference System uses a fluxgate compass, long used for aerial navigation. One limitation that occurred during development—having to return the turret to a known position before a compass reading is taken—has been solved by the installation of a directional gyroscope (DG) in the command tank. The DG is not affected by changes in the magnetic field around the tank and with the turret in the known position can "tell" the DG its relationship to north.

Krupp Mak, Blohm & Voss and Euromissile have combined the *Roland* low altitude surface-to-air missile system with the *Leopard 1* chassis and have produced a highly mobile low-level air defense system for the battlefield and for the protection of installations. The hybrid unit weighs in at 37.85 tons and it is also armed with smoke grenade projectors and a machinegun.

2d Lieutenants Robert B. Abrams, right, and Peter R. Mansoor were honored at their West Point graduations with Honor Sabres, given by the U.S. Armor Association and presented by Colonel Jack W. Dice, senior armor officer at the academy. Abrams received his sabre for excellence in military leadership and Mansoor received his sabre for excellence in academics. They were commissioned in Armor.

BOOKS

DEUTSCHES MILITAR ARCHIV, loose leaf, $8 per issue. GE Archiv Verlag, 3300 Braunschweig Kosherstraze 2, Germany.

The high interest, not only in Germany, given to military matters, traditions and history, prompted the publishers to begin a history of the German soldier from an objective and critical point of view. The series is compiled by military historians and the publishers did not restrict them to purely military descriptions, but also looked at contemporary history. This is where the real value of the collection lies.

The collection is subdivided into five parts entitled, *The Military, The Soldier in Service and Society, Weapons, Tactics, Strategies, The Uniform in the Change of Time,* and *Wars, Battles, Encounters.*

Beginning in February 1981, five new collection sheets have been issued each month and a binder is available. This publication will attract military buffs, historians and laymen. Highly recommended.

WOLFGANG GERHARDT
Brigadier General, GS
German Army

THE AMERICAN THREAT: NATIONAL SECURITY & FOREIGN POLICY, by James L. Payne. Lytton Publishing Co., College Station, TX. 1981. 344 pages. $7.95.

Payne labels his book an analysis of international relations and US foreign policy. The central feature of his analysis is relationships "on the basis of threats of war." To support his thesis, he takes us through what he terms appeasement theory; examples of US successes and failures in the application of national threat. What Payne is really serving is deterrance theory under a different name.

On balance, Payne fails to make a convincing argument for his analytical framework. Flaws notwithstanding, those whose interests lie in deterrance and decisionmaking will find this worth their time.

COLONEL WILLIAM M. STOKES, III
Organization of the Joint Chiefs of Staff
Washington, DC

EISENHOWER'S LIEUTENANTS; THE CAMPAIGNS OF FRANCE AND GERMANY, 1944-1945, by Russell F. Weigley. University of Indiana Press, 1981. 800 pages. $22.50.

Eisenhower's Lieutenants, a new study of Allied generalship from Normandy to final victory in Europe, synthesizes much of Weigley's earlier work and combines it with painstaking research to produce what may well emerge as the definitive work on the subject.

Technically a study of Allied generalship, this is actually more a study of Amerian generalship. Allied contributions and generalship are not brushed aside. Montgomery, for example, receives a particularly careful and balanced examination. But, Weigley demonstrates that the final compaigns across France and Germany were mostly American in degree of participation and almost totally American in strategy and operations. His conclusions are provocative. American generalship is rated competent, but overly cautious. Bolder, more audacious, generalship, he argues, might well have shortened the war. More importantly, he suggests that the American way of war was flawed. With combat formations mobile, but lacking in sustained power, Eisenhower's lieutenants pursued a strategy of direct confrontation with the German Army. The result, says Weigley, was that victory reflected more the preponderance of American materiel than the brillance of American generalship.

Readers interested in the tactics of the breakout and pursuit across Europe are provided an engrossing, richly-detailed campaign history. Those interested in a more theoretical analysis of the American way of war will be equally satisfied. Only the very mediocre collection of supporting maps detracts from this volume.

Professionals will find this book particularly important since Weigley's conclusions raise disturbing questions about the inadequacies of American wartime doctrine. On the European battlefields, the preponderance of American materiel offset those doctrinal shortcomings. But no such luxury exists today. This book should be read and studied by every serious military student.

CHARLES F. BROWER
Major, USMA

AMMUNITION (INCLUDING GRENADES AND MINES), Brassey's Battlefield Weapons Systems & Technology, Volume III, by K.J.W. Goad and D.H.J. Halsey, Pergamon Press, Inc., 1982, Elmsford, New York. $17.50

This well written and liberally illustrated volume is a primer on the requirements, methods of operation, design principles and brief history of various kinds of ammunition including kinetic energy, HEAT, and antitank mines. It is for the young army officer and NCO who desires further knowledge in military weapons. The self-test questions following each chapter are an additional value. However, the glossary is more readable to UK readers, but will be useful to US readers.

The technical content is concise but avoids formulas and lengthy tables. It lacks, however, a bibliography. Even so it is highly recommended for all military personnel who desire an overview to ammunition and its effects. However, those who have access to the US Army Research and Development or Materiel Engineering Design Handbooks (AMCP 706-Series), are advised to consult those handbooks for precise detail and useful reference material.

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

THE MILITARY: THEORY OF LAND WARFARE AS BEHAVIORAL SCIENCE by Harry Holbert Turney-High. Christopher Publishing House, West Hanover, Mass. 1981. 320 pages. $12.00 paperback.

This anthropological approach to the study of warfare considers history, psychology political science and economics.

The historical nature of man in conflict is fully explored as one form of human behavior and the reader is compelled to reflect on the motivation of those faced with the uncertain future in battle. The effects of tactical and technical revolution are well addressed as they relate to human behavior. Also, the meaning of professionalism and all it entails is given much attention, and such demands, and how soldiers have reacted to them are demonstrated. The use of mercenaries is presented as well as how they perceive themselves and how they are seen by society in general.

The Military is well documented and provides interesting reading about the most challenging of human endeavors.

SFC ROBERT CORDELL
Teaching Associate
USACGSC, Ft. Leavenworth KS

THE SIXTH PANZER DIVISION by Helmut Ritgen. Osprey Publishing, Ltd., London. 1982. (German)

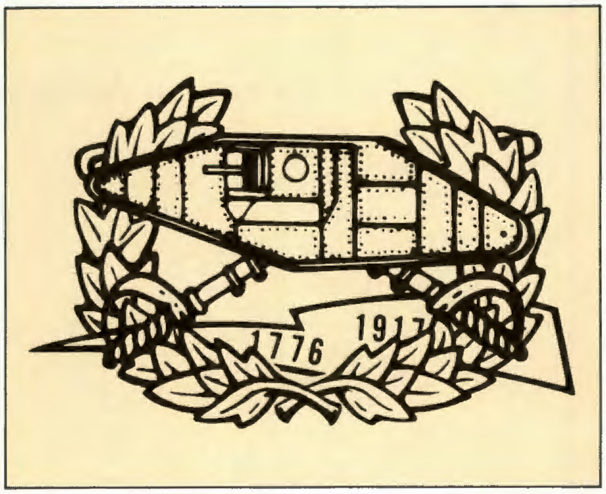
The organization, equipment, battle actions, leaders and units of the 6th Panzer Division are the subject of this superb little book of text and first rate photographs from the author's own files. Colonel Ritgen commanded tank units in Russia and the West from his commissioning in 1938 until his capture in the Ruhr Pocket. He has had an equally distinguished career with the FGR Bundeswehr.

The book is an excellent account of how various changes in armor organizations affected the lower level units of the Wehrmacht. It is highly recommended for armor students.

DONN A. STARRY
General, USCINCRED
McDill AFB, FL

STEEL ON TARGET

The written record of Armor and Cavalry achievements from 1888 to the present is depicted in the pages of the Cavalry Journal and ARMOR. The unbroken chain of bound volumes shelved in our office contains a heritage of which we can all be proud. All the great names, all the great debates, all the battles, and victories and defeats are forever preserved in the pages of our journal.



Some may recall those times past with the nostalgic view that the golden era of cavalry retreated into the past along with the horse, or that the zenith of Armor's achievements occurred during the lightning thrusts from the Channel to the Elbe. Mention the Central Highlands or the Black Horse, and air and armored cavalrymen of modern vintage relive past memories as glorious as those of their forebearers.

But, let there be no yearning for the past. While we may recollect those days with pride and a passion for our grand achievements, and hold them forever in our memory, they are but a legacy upon which to build a more glorious future.

The future is now. Today is an exciting time to be part of our branch. The scope of Armor's involvement in shaping today's–and tomorrow's–Army should be an inspiration to all of us. Each of us must seize the opportunities available in our daily endeavors in order to contribute our small part in the larger undertaking.

The great accomplishments of the past, which we revere in memory, often didn't seem so grandiose to the soldiers and officers who took part in them, because the larger undertaking was possible due to the efforts of ordinary men doing mundane tasks well. Yet, when the sheet was balanced, the sums of their efforts added up to great accomplishments.

All who are a part of the Armor Force, whether troop leader, trainer, crewman, or staff officer, have a small piece of the overall responsibility to see that our Army is fit to fight today, or tomorrow. Our small piece may seem ordinary or mundane today, but someday in the future as we are browsing through the pages of ARMOR as it records the accomplishments of the seventies or eighties, we may well exclaim, "Those were the good old days."

Good Shooting!

7th Cavalry

(Garry Owen)

Lineage and Honors

Constituted 28 July 1866 in the Regular Army as 7th Cavalry. Organized 21 September 1866 at Fort Riley, Kansas. Assigned to 15th Cavalry Division December 1917-May 1918. Assigned 13 September 1921 to 1st Cavalry Division.

Dismounted 28 February 1943 and reorganized 4 December 1943 partly under cavalry and partly under infantry tables of organization and equipment. Reorganized wholly as infantry 20 July 1945 but retained cavalry designations. Reorganized 25 March 1949 with troops redesignated as companies. Relieved 15 October 1957 from assignment to 1st Cavalry Division.

Reorganized 1 November 1957 as a parent regiment under the Combat Arms Regimental System.

Campaign Participation Credit

Indian Wars
- Comanches
- Little Big Horn
- Nez Perces
- Pine Ridge
- Montana 1873
- Dakota 1874

Mexican Expedition
- Mexico 1916-1917

World War II
- New Guinea
- Bismarck Archipelago (with arrowhead)
- Leyte (with arrowhead)
- Luzon

Korean War
- UN defensive
- UN offensive
- CCF intervention
- First UN counteroffensive
- CCF spring offensive
- UN summer-fall offensive
- Second Korean winter
- Third Korean winter

Vietnam
- Defense
- Counteroffensive
- Counteroffensive, Phase II
- Counteroffensive, Phase III
- Tet Counteroffensive

Decorations

Presidential Unit Citation (Army), Streamer embroidered *ANTIPOLO, LUZON* (2d Squadron, reinforced, cited; WD GO 36, 1946)

Presidential Unit Citation (Army), Streamer embroidered *YONCHON, KOREA* (1st Battalion and attached units cited; DA GO 74, 1952)

Presidential Unit Citation (Army), Streamer embroidered *TAEGU, KOREA* (3d Battalion cited; DA GO 33, 1952)

Presidential Unit Citation (Army), Streamer embroidered *PUSAN, KOREA* (3d Battalion and attached units cited; DA GO 35, 1952)

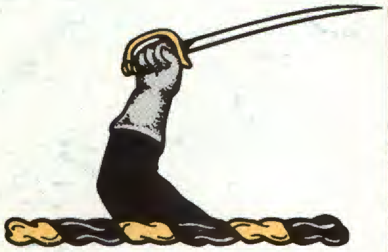
Presidential Unit Citation (Army), Streamer embroidered *PLEIKU PROVINCE* (1st and 2d Battalions cited; DA GO 40, 1967)

Philippine Presidential Unit Citation, Streamer embroidered *17 OCTOBER 1944 TO 4 JULY 1945* (7th Cavalry cited; DA GO 47, 1950)

Republic of Korea Presidential Unit Citation, Streamer embroidered *WAEGWAN-TAEGU* (7th Cavalry cited; DA GO 35, 1951)

Republic of Korea Presidential Unit Citation, Streamer embroidered *KOREA* (7th Cavalry and attached units cited; DA GO 24, 1954)

Chryssoun Aristion Andrias (Bravery Gold Medal of Greece), Streamer embroidered *KOREA* (7th Cavalry cited; DA GO 2, 1956)



Symbolism

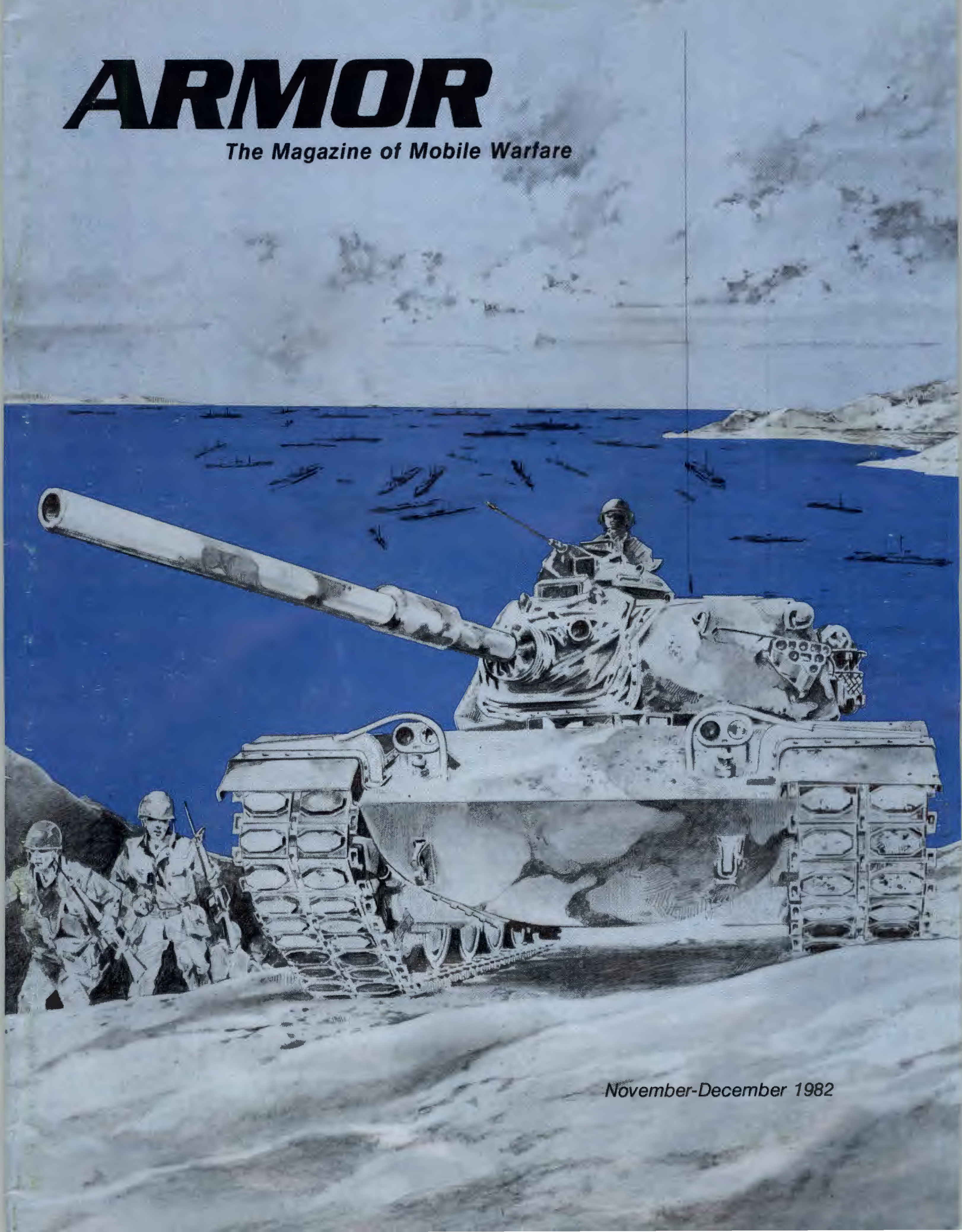
The field is yellow, the cavalry color. The principal charge is a chevron whose origin tradition ascribes to the spur, which was formerly of that shape without rowel. The number of horseshoes corresponds to the numerical designation of the regiment. The phoenix symbolizes the resurrection of the regiment after its virtual extermination in the Battle of Little Big Horn in 1876. The Indian head and yucca commemorate Indian campaigns and the Punitive Expedition of 1916, respectively. The crest shows the position of "Raise Sabre" taken at the commend "Charge" as prescribed in 1873, the arm being habited in the uniform of the period.

Distinctive Insignia

Within a gold horseshoe showing seven nail holes, heels upward and the opening between the heels closed with a blue ribbon bearing the words *Garry Owen* in yellow letters, the crest of the regiment.

ARMOR

The Magazine of Mobile Warfare



November-December 1982

United States Army Armor School

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November-December 1982 Vol XCI, No. 5

FEATURES

DEPARTMENTS

COVER

The U.S. Marine Corps' prepositioned forces include armored units for rapid deployment to trouble spots. Marine Captains Drennan and Schaller describe on page 26 the famous amphibious combat arm's use of armor in its unique role in U.S. defense.

LETTERS

Article 15 Comments

Dear Sir:

The underlying theme of CSM Gillis' column on Article 15s in the July-August issue of *ARMOR* is disturbing. The first implication is that any commander who requires the soldier to use any of the "infamous 72 hours," as CSM Gillis describes it, is not administering "swift justice." As a company commander at Fort Knox, I did not require that a soldier use all 3 working days, but I did insist that he or she consider the decision overnight. The Article 15 proceedings are the first time the soldier has been presented with the specific charges against him or her (assuming proper confidentiality has been exercised in the orderly room), and the moment is often emotional and not conducive to rational decisions. Allowing a soldier to consider all of his options (right to consult with available counsel, opportunity to present a statement and witnesses in his behalf, an open hearing, alternatives to Article 15 proceedings) and make a decision in a few stressful seconds may be swift, but it does not necessarily equate to justice. Article 15 proceedings that are perceived as retributive reflex or mechanistic ritual will discredit the command much more than any rational delay.

A second point that seemed to offend CSM Gillis was suspended punishment. While each case is unique, a suspension is often a powerful rehabilitative tool, since it is conditional upon continued acceptable behavior and can be vacated if necessary. A suspension provides both an incentive for the soldier to improve his behavior and an opportunity for the commander to observe the impact of the punishment. This is particularly important for a first offender or an otherwise well-disciplined soldier who suffers a careless momentary lapse. Commanders who indiscriminately use the "big stick" approach are not taking advantage of tremendous flexibility afforded by the Army's administrative, nonjudicial, and judicial processes.

The final implication that was made in the column was that company commanders recommend Field Grade Article 15s solely to inflict greater punishment on the soldier. This ignores the impartial attitude that should be maintained while administering an Article 15. Granted, the proceedings are not offered unless the evidence against the soldier strongly supports such action. However, since the soldier has not yet been afforded the opportunity to present evidence in defense, or facts in extenuation or mitigation, it is presumptious to assume guilt and suggest a specific level of punishment prior to the proceedings! The level of the proceedings should be determined by the seriousness of the offense, and should provide the appropriate *range* of punishments *available* to the commander offering the Article 15.

An Article 15 should not be viewed as some sort of contest that a commander must "win." I never felt my command authority was threatened when I dismissed charges against a soldier who was able to provide credible witnesses and a convincing defense; neither did I feel that the chain of command had been undercut when a soldier successfully appealed to my superior commander. That is how the system is designed; and if the system is not properly used, it loses all credibility and becomes a facade concealing the underlying injustice.

I do agree with CSM Gillis that the chain of command (loosely used to include noncommander supervisors) should be reinforced—which is why I suggest that a soldier appearing to hear Article 15 charges be accompanied by his or her immediate supervisor. Many (although, realistically, not all) punishable offenses could have been prevented with better leadership. Disciplinary proceedings are not only a time for administering justice, but also provide an opportunity for those exercising authority to soberly evaluate their own leadership performance.

JOHN R. DREBUS
Captain, Armor, USAR
W. Lafayette, IN

Soviet Tank Designations

Dear Sir:

I have been fascinated by the debate in *ARMOR* for the past few months over the *T-72* and its follow-on, most recently the letters of 1LT Warford and Dr. Volz. Perhaps I could add a few words to clarify a few matters.

Dr. Volz has contended that the *T-72* follow-on is unlikely to be designated *T-80*, since the Soviets seldom (or never) repeat a vehicle designation. *T-80* was the designation of a light tank manufactured in 1943 in very small numbers. It may indeed be that the follow-on will not be designated *T-80*. In fact, several Soviet defectors have mentioned the designation *T-74* when referring to an improved *T-72* they observed. However, Dr. Volz's recent contention that there are no cases of the Soviets reusing a designation is not the case. Dr. Volz rightly questions the validity of the alleged *T-34* light tank shown in Milsom's book. This does not show the actual *T-34* light tank. The actual *T-34* light tank (officially designated Small Scout Tank *T-34*) was designed by the N. Kozyriev bureau at Zavod Nr. 37 in Moscow in 1932 as part of their program to develop a new, light tank for the Red Army. The *T-34* was a non-amphibious counterpart to other prototypes of light amphibious scout tanks that eventually resulted in the *T-37* amphibious tank. Only a single *T-34* light tank was built, and in 1940, the designation was resurrected for use on the *T-34* medium tank. Another example of duplication of designation was the *T-29*. The *T-29* designation was originally allotted by the Grotte design team, part of the OKMO design bureau at the Bolshevik Factory in Leningrad, for a heavy tank design also known as the *TG-3*. Since the vehicle never entered production, the same designation was used later in 1934 by the Barykov design team at Zavod Nr. 185 (SM Kirov) in Leningrad (the renamed Bolshevik Factory) for an unrelated design. The second *T-29* was an improved *T-28* with wheeled/tracked Christie suspension.

I cannot agree with 1LT Warford's contention that the *T-64* is the newer of the *T-64/T-72* pair. Earlier, when I wrote my book "Modern Soviet Armor," I had suspected that the *T-64* might be the more advanced of the two due to the greater engine volume and other factors. However, more recent evidence points in the other direction. To begin with, the new book by the Soviet defector Suvorov titled the "Liberators" indicates that the *T-64* entered service use in 1967, much earlier than most Western observers had believed. Furthermore, Suvorov makes it quite clear that the *T-64* suffered from numerous and serious engineering defects including a faulty suspension and engine problems. These allegations have been confirmed by other emigres. What would appear to be the case is that the *T-72* was adopted even though in many respects it was a retrograde step in Soviet tank design. It dropped the sophisticated suspension of the *T-64* for a conventional torsion bar suspension, and dropped the more advanced engine of the *T-64* for a hardy derivative of the old V-2 diesel. 1LT Warford's circumstantial evidence for the *T-64* does not hold water. The Group of Soviet Forces, Germany (GSFG) does not necessarily get the most advanced Soviet hardware since it is more accessible to Western intelligence than other areas. Traditionally, the most modern equipment goes to the frontier districts, i.e. the Soviet units in Belorussia and the Ukraine bordering the Warsaw Pact satellites since they are more secure from Western intrusion, and are in ethnically secure areas. The *T-64* has not been sold abroad for the simple reason that from all accounts it suffered so many problems in service that the Soviets would have been foolish to offer it for sale.

As a minor note, Robert Arnoldt's Kursk article contained a few errors. The Soviets did not deploy any *T-34/85* or *SU85* at Kursk since neither type was in production yet. Indeed, the development of the *T-34/85* was prompted by the experiences at Kursk. It is one of the ironies of history that Kursk, where Soviet armor won such a great victory, was one of the few great battles on the Eastern Front where Soviet armor was at a clear qualitative disadvantage. Also, Arnoldt errs in the German losses of *Elephant SP* guns available. About 39 were lost during the fighting, not 90 as he claims.

STEVEN ZALOGA
Greenwich, CT

Support Platoon Training

Dear Sir:

Captain Safiers' article regarding the training of the support platoon (July-August 1982 *ARMOR*) is right on target.

Being a support platoon leader within the 11th Armored Cavalry Regiment, I can fully identify with many of the problems of training and maintaining the support platoon. However, no matter how good you are, many of the problems will not go away unless you have a battalion commander who cares—and shows it. Many times it takes the firepower of a lieutenant colonel to tell the staff and line commanders to make better plans for those support assets available or to do without (i.e., no 24-hour notice for fuel in garrison, no fuel will be given). Routine checks by line commanders and executive officers 5 days before field exercises to eliminate the "Friday Fuel Rush" (especially before a major field exercise when everybody and his brother suddenly needs fuel, but did not seem to need it the day before.)

Through our squadron commander, we have established a major truck overhaul program and given it a tremendous amount of support (not just lukewarm either). The squadron has set Wednesdays aside for support platoon training and nothing else (even truck drivers need training for all of you who seem to feel that support platoons have nothing better to do but wait hand and foot on line units).

Finally, I bring you these words that my squadron commander told my men and myself...."I have lots of platoons, and I can probably survive losing 2 or 3 of them; however, I have only one support platoon. How can I survive without you guys?" Without support for support platoons, just how far can a battalion go?

JOHN MENTER
First Lieutenant, Armor
Support Platoon Leader
3/11th ACR

Infantry-Tank Signals

Dear Sir:

I have read "Armor Operations In Built-Up Areas," by LTC Esposito in the July-August issue of *ARMOR* with considerable interest because, as an infantryman, I am sure that armor and infantry teams are going to play a big part in future urban combat situations. As the colonel said, "tanks cannot survive in the urban combat area without infantry support..." and the same holds true for the infantry who will need the tank's main gun support in clearing out well-protected pockets of resistance. And in these combined arms (or "buddy teams") operations, tank-infantry communications are going to be *vital*.

The colonel points out that lack of telephone communication with the *M1* tank can be a hinderance to tank-infantry communication and notes that not even FM radios will provide an infallible link between the tanker and infantryman. He says that "hand and arm signals will be the infantryman's primary means of communication with the tank..."

Taking into consideration the fact that the infantryman will very rarely, if ever, be able to stand upright in combat when signalling to the tanker, I have evolved a few simple hand, arm, and weapon movements by which the infantryman can pass on vital information to the tanker. They are:

For *enemy in sight* he points his rifle at the *M1* to mean *tank* and points to himself to mean *infantry*. For an *antitank weapon*, he points his rifle at the *M1* and *fires a round*! (nobody is going to get hurt!)

If enemy *personnel carriers* are the principal enemy force, he points to himself and rotates his finger to simulate wheels. For a *street-level target* he extends his arm horizontally and for an *overhead (second-story) target* he signals *thumbs up*. For a *cellar target* he would signal *thumbs down*. To indicate *mines* he cups his hands and thrusts them up and out to simulate an explosion, and to show an *antitank obstacle* he crosses his arms over his chest.

Communications between tanker and infantryman in urban fighting is a two-way street (no pun intended). The foot soldier has to know if the tanker has understood his sign language and the best way for the tanker to tell him is with his main gun. Up and down for *yes*, sideways for *no* and in a circle for *repeat*.

I hope that these rudimentary signals will be useful.

JACK GARNER
First Lieutenant, Infantry
USAREUR

Let's Have Just One Boss

Dear Sir:

Let's hear it for Major Boyd! Making the Executive Officer (XO) the headquarters and headquarters company (HHC) commander or even making the HHC commander a member of the staff makes good sense. It is extremely difficult to serve two masters, and this is the position in which the staff NCO is placed. Captain Brasier points out the problem. We must serve the company by carrying out the troop assignments from the "first shirt," but we also have to please the staff officer by completing the overall-mission assignments. Often this is complicated by the jealousy and friction that exists between a commander, who feels he owns the NCO, and the staff officer, who feels he has first call on his services. It would be great if both officers understood each others responsibilities, and could reach an accommodation; but most often this isn't the case, so the NCO gets confusing directives, mission assignments that interfere with troop assignments, and *vice versa*. It all leads to a very confusing, frustrating position for the staff NCO, and often leads to reduced efficiency. Another solution would be to take the battalion headquarters platoon out of HHC entirely and make it a separate entity. It would still be serviced by HHC for administration and supply, but would be responsible to only one director, the battalion commander. This would certainly make the "two bosses" problem simpler and would improve communications between the NCO and his officer. At the very least, he would readily know who his leader is.

ROGER T. R. WHEELER
Sergeant First Class
HHC, 1-210th Armor, NYARNG

Sergeant Wheeler's letter refers to a professional thought, "The Executive Officer as a Commander," by Major David G. Boyd that appeared in the January-February issue of ARMOR and a letter to the editor by Captain Stephen A. Brasier that appeared in the July-August issue of ARMOR.

M1 Resupply Problems

Dear Sir:

In your May-June 1982 issue of *ARMOR*, you published a well-written, as well as interesting, article by Captain Drebus on the *M1* tank resupply problems. In the interest of equity to the *M1* tank and the Army, I would like to address his concerns.

First, it should be said that in the development of the *M1*, mobility, firepower, and crew survivability were the most important concerns. As to the reduced number of rounds stowed in the *M1* over the *M60* series, this was one of the logistical prices to be paid for crew survivability. As to the future and the larger 120-mm gun, this, again, is the price to be paid in order to have a round that will defeat the anticipated Threat.

To resolve the increased ammunition replenishment requirements, the Army has taken some definite steps. First, is the armored, forward-area, rearm vehicle (AFARV) for which the concept evaluation program test was completed in April 1981. The AFARV concept calls for the vehicle to pick up ammunition in the battalion trains area and deliver it to vehicles in the forward area, thus eliminating the need for combat vehicles to withdraw from battle positions to rearm.

For the near term, the Army will receive its first deliveries of the heavy, expandable-mobility, tactical truck (HEMTT) in FY 83. This will be a 10-ton ammunition/fuel-dedicated resupply vehicle that will replace the current 5-ton cargo truck in ammunition units.

As for refueling problems in the *M1*, the project manager for the *M1* has indicated that a "fast refuel" modification will be made in August 1986 as part of block II improvements. The fast-fuel modification will allow fuel to be pumped at 200 gallons per minute instead of 50 gallons per minute at each of two ports (front and rear). To prevent foaming, displaced air will be vented at a location other than the inlet ports.

While these solutions are not immediate, they are real ones. Admittedly, as logisticians, we too would like greater significance placed on the application of integrated logistics support in the development of our new weapons systems. However, while logistics concerns are, indeed, important, they cannot take precedence over life-preserving, mobility and firepower features that our combat systems must have.

L.J. TURNER
Major, USA
DA-ODCSLOG

Kursk Reviewed

Dear Sir:

For many years the war between Russia and Germany has been of great interest to me. The Eastern Front was the decisive one for setting the stage for the postwar world. If the Russians had gone under, no combination of Anglo-American power could have destroyed Nazi Germany, not even the atomic bomb.

It was on the Eastern Front that the decisive war was fought; the Battle of Kursk that was the decisive battle of that war; and it was at Prokorovka that the decisive engagement of that battle was fought.

On the morning of July 12, 1943, Germany still had a chance for at least a draw; by sundown, Germany was doomed.

Mr. Arnoldt has written an interesting article on the Battle of Kursk if for no other reason than there are so few on the subject. My major disagreement with Mr. Arnoldt is his assumption that the Battle of Kursk was lost for the Germans before it started.

In the north, the battle was at best a stalemate, with the Russians having numerous forces for continual counterattacks. In the south, the situation was far different. By July 11, all the main lines of Russian resistance had been broken. All Russian armies, but one, had been mangled. On July 12, the *Panzer* divisions under Hoth were taken by surprise by units of the 5th Guards Tank Army. The Russians used the only tactics that gave them any chance of winning. They took the Germans by surprise by rushing in hundreds of *T-34s* among the German tanks, thereby nullifying the German advantages of superior armor, guns, and tactics. The Russians brought their *T-34s* into pointblank range, where their 76.2-mm guns were just as deadly as the German's 88's and long 75's. With the Russians using the element of surprise, the steam was knocked out of the German drive. The Germans lost.

Many times before, Russian tank armies of *T-34s* and *KVs* had been destroyed by the Germans with relatively little cost to themselves. At Prokorovka, the Germans could have done it one more time. If they had, Hoth could have taken the Russian forces opposing Model from behind and collapsed the Kursk salient. After that, the Germans would have had 1 year to do as much damage to the Russians as possible and then been able to meet the landing at Normandy with a more favorable ratio of force. The story of D-Day might have been far different.

D.A. NEWSOM
Lubbock, TX

Personal Stories Wanted

Dear Sir:

A lot of the finest WWII stories are disappearing into the cemeteries. Veterans are passing on without passing on their experiences, which is a shame.

I would like to hear from ex-servicemen who have stories to tell, both horror and humorous. They deserve to be recorded for posterity.

Please write to: Robert Lally, Box 2721, Olds, Ontario, Canada, TOM 1PO.

Kursk Defenses

Dear Sir:

It is always a pleasure to read a historical account where the major principles of war are practiced. "The Battle of Kursk" by Robert T. Arnoldt (July-August, 1982 issue of *ARMOR*) is an outstanding vignette of such an account.

Mr. Arnoldt refers to the "...millions of antitank and antipersonnel mines...sown through the defenses." This reference to mine warfare understates the engineer contribution in this famous battle. The Soviets at Kursk prepared one of the most elaborate defensive systems ever constructed. The density of mines, 3,500 per kilometer of frontage, has not since been matched in scope. The construction began 12 April 1943, following written instructions of the Soviet Army Chief of Engineers issued the preceding month. Almost half a million civilians, infantry, and engineers (about one company per kilometer of front) were employed daily. In the southern section of the bulge (zone of Mr. Arnoldt's article) these obstacles and positions were emplaced:

89,888 antitank mines
63,843 antipersonnel mines
500+ kilometers of trenches
140 kilometers of antitank ditches
110+ kilometers of wire entanglements
1,100 command and observations posts
Almost 4,000 shelters and dugouts
900 dirt and timber pillboxes

The Soviets are concerned that the significance of this battle will be misplaced by Western historians. Because of this concern, in 1974 their Progress Publishers, (Moscow) printed *The Battle of Kursk* directly in English which was edited by Major-General Ivan Parotkin. In this book, Colonel-General Alexander Tsirlin (Engineer Commander, Steppe Front, Battle of Kursk) relates the engineer contribution to the "Pakfront." Each "Pakfront" was assigned a platoon of engineers to lay mines during the course of the battle. On 5 July 1943, such a platoon laid 1,000 mines that accounted for 42 percent of the German tank casualties in its "Pakfront" sector that day. Colonel-General Tsirlin says "...Minefields became the basic type of obstacle, and their organization the main mission of the engineer troops in defense."

These defenses and tactics stopped the 48th *Panzer* Corps short of the Soviet third zone of defenses near Kruglik and Novaselovka (Nowosselowka). The actual German advance during 4-11 July 1943, averaged less than 3 kilometers a day, well below their 20-25 daily goal. The Battle of Kursk is a classic example of the Economy of Force principle attained with enormous engineer support. The time saved during the 8 days allowed the Soviets to mass its reserves and launch its major counterattack of 12 July 1943. The rest is history and aptly summarized by Mr. Arnoldt.

Sincerely,

DOUGLAS K. LEHMANN
Engineer Studies Center
Fort Belvoir, Virginia 22060

Antisniper Tank Machinegun

Dear Sir:

The September 22, 1982 issue of *U.S. News & World Report* shows two Israeli tanks in Beirut on page 22 that excited my curiosity.

As an armor officer I was interested enough to examine the picture in some detail and saw some very innovative uses of existing systems for mobile operations in urban terrain (MOUT) and other armor operations.

Specifically, the use of Nomex tank crew uniforms and personal body armor. Also noted were the two smoke grenade launchers, each with a 10-round capacity, as well as the stand-off armor bolted to the turret. But the real eye-opener was the mounting of M-2/M-85 caliber .50 machineguns in a *Telfare* or *Telfare*-like device. Since the tank already had two .30 caliber machineguns (it apparently was an *M60* series tank) for the tank commander and loader, this system at first seemed a clumsy way to augment the tank's small arms firepower. Second thoughts provided another answer; namely antipersonnel precision gunnery. Imagine a condition in a MOUT encounter where sniper fire is sufficient to suppress accompanying infantry fire. Without resorting to the main gun to fire on a single position, how could a buttoned-up crew get the sniper? The solution is self-evident. The gunner uses the main gun fire control system to provide a safe, efficient antisniper capacity with the .50 caliber machinegun.

I would like to hear from someone in the armor community who has seen this configuration employed as I see it, or who can offer an alternative reason for this configuration.

WILLIAM A. HIPSLEY
First Lieutenant, Armor
Hemet, CA

See *Defence Attache*, No. 4/1982, article "Puzzle of the Add-on Armour" for more on add-on armor and the .50-caliber machinegun mounted coaxially with the main gun. Ed.

COMMANDER'S HATCH

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

Institution and Unit–Partners in Training

The primary goal of Army training is to develop and sustain individual and unit proficiency. The Army training system—consisting of the initial training base, training in units, and training support products—supports training and maintains combat readiness in the Army. The degree of success the Army attains in training its soldiers depends upon the understanding each of us has of the interrelationship of all elements of the Army training system and the significant roles training in units and training support plays in achieving individual and unit proficiency.

As was pointed out in the July-August *ARMOR* synopsis of the Armor Conference 1982, the Armor Center trains the Career Management Field (CMF) 19 soldier on only the selected, essential tasks necessary to perform as a crew member in combat and not necessarily to all Soldier's Manual standards. I would like to focus on this and the importance of that training in units which will result in the ultimate goal: an armor crewman or cavalry scout who knows his job and can accomplish his mission. The fact that the Armor Center is not training the CMF 19 soldier to job proficiency in all tasks does not mean the Army's job is done when we turn that soldier over to the unit. Far from it. The all-important task of training this new accession to become an effective armor crewman or cavalry scout has just begun.

The training of the new soldier, who possesses designated skills, now shifts from Fort Knox to the gaining unit. Training in units involves learning and sustaining proficiency in the individual and collective skills that units need to accomplish their missions. The commander is responsible for developing and implementing the best mix of individual and collective training that will help soldiers learn and sustain proficiency in needed skills.

When one considers initial and unit training requirements, most individual training for the CMF 19 soldier is conducted by leaders in the unit. The Trainer's Guide lists the tasks and level of proficiency to which tasks are taught at the Armor Center and the tasks that are to be trained by the unit. The Soldier's Manual lists the individual tasks, the conditions under which they are to be performed, and the standards of proficiency to be achieved. The unit chain of command should utilize the Trainer's Guide to determine which tasks need to be taught to the new soldiers and combine this with the Soldier's Manual to ensure the tasks are properly and completely trained.

Other support materials developed to facilitate training in units include Training Extension Courses (TEC), Graphic Training Aids, and the Army Correspondence Course Program (ACCP). Extension Training Materials (ETM) catalogs in the DA Pam 350-series list the ETM that support training in units and are referenced by the Table of Organization and Equipment units that use the same Army Training and Evaluation Program (ARTEP). DA Pam 350-100 provides a complete, consolidated listing of all ETM that support individual training. Additional information on how to use TEC can be found in TC 21-5-3. DA Pam 351-20 series, the ACCP Catalog, lists correspondence courses and subcourses, explains enrollment procedures, and describes ACCP policy. It should be noted that ACCP has been designed to support individual and group study as well as supervised on-the-job training.

Building upon individual proficiency, the successful unit training program melds individual and collective skills at crew, squad, section, platoon, and company levels. Collective training develops the critical teamwork needed by crews and units by efficiently allowing soldiers to practice individual skills while developing their collective skills. The Armor Center is currently developing crew drills, with evaluation guides, which will be incorporated into the FM 17-13 series, tank/track commander's guides, to be fielded in FY 83-84; and separate tank platoon battle drills in FY 83.

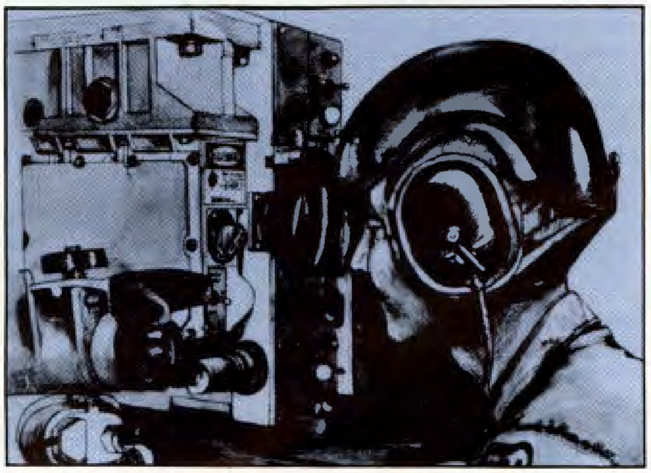
To assist the trainer in establishing a unit training program and in determining his unit strengths and weaknesses, Armor and Cavalry ARTEPs are provided. These are provided as tools to the trainer to assign training objectives, program resources, and assess unit proficiency. The drills and the ARTEPs contain a cross reference to individual tasks to facilitate reinforcement training as training weaknesses are identified.

The aim of the Armor Center is to provide units with motivated, confident soldiers who are trained to the limits the Army can afford; and then, to support training in units to produce proficient soldiers in combat-ready armor and cavalry units.

Through our combined efforts we can reach this goal.

MASTER GUNNER'S CORNER

SFC Chris M. Pruitt
Senior Instructor
Master Gunner Branch, USAARMS



Know the System, Use It, Get Hits

GUNNER—SABOT—TANK—(UP—IDENTIFIED)—FIRE!! But did you hit? If not, why not?

Through the years, tankers have thought of gunnery as more art than science, and the "top gun" of any battalion was looked upon as some sort of magician, able to bring together all the mysteries of ballistics, mechanics, and rangemanship to acquire his top gun status.

In recent years, with improved fire control systems, especially in the *M60A3* and the *M1*, more analysis has gone into the thinking about tank gunnery, and the *science* of gunnery is beginning to supplant the *art* of gunnery in our teaching at the Armor Center, and this is now showing in our emerging tank gunnery doctrine and training programs. The gist of this change is that tank gunnery can be improved; that a body of knowledge exists which, if understood and applied, results in more effective shooting; and that tankers, especially tank commanders, must thoroughly understand tank gunnery.

The first step in smart tank gunnery is to make sure the gun delivers the round to the point the gunner desires—the aimpoint he sees through his sights. Making sure that the gun can do this has, for many years, been done by *zeroing*. A new procedure, called *system calibration,* has recently been introduced to the Army through TT 17-12-1, *105-mm Tank Gun Fire Control System Calibration*. This is *must* reading for every TC. The calibration policy was described in the last issue of ARMOR magazine, so it will not be described here.

The U.S. Army has been zeroing tank guns as a means to improve hit performance for many years, so the question naturally arises, "Why change?" The reasons for changing the calibration policy have to do with the nature of zeroing itself.

Crew-Induced Errors in Zeroing. In performing the zeroing process, crews often induce errors which reduce, rather than improve, the ability of their tanks to shoot accurately. Tests have shown that the problems associated with sensing the rounds on the target, calculating group center of impact, and correctly referring all sights result in crew-induced errors that often degrade firing accuracy.

Zero Instability. The zeroing process compensates for a variety of error sources that affect accuracy. Some of these errors are constant, such as parallax and drift, but most are errors which continuously change, such as environmental conditions (temperature, wind, etc.), gun tube wear, and the condition of the fire control system. When a tank is properly zeroed, the zeroing process locks in corrections for the errors that exist at the time of zeroing. This gives the tank its best probability of hitting targets as long as those same conditions exist. However, as conditions change, those locked-in corrections are no longer effective and can result in a decrease in accuracy. This loss of effective zero is called zero instability, and testing has proven that it will occur regardless of the time elapsed, the distance traveled, or the number of rounds fired since the zero was recorded.

Some reasons for changing the calibration policy relate to the characteristics of our ammunition.

Environmental Sensitivity to Armor Defeating Ammunition. Some of our kinetic energy combat ammunition is composed of metal alloys that are environmentally sensitive and cannot be fired in peacetime. As a result, crews will never zero their tanks with the primary armor defeating rounds prior to combat. Chemical energy rounds have always been a problem due to their obviously destructive effects.

The M48A5 and M60A1 Lack Discrete Zero Capability. On the *M48A5* and *M60A1*, the crew cannot zero for each type of

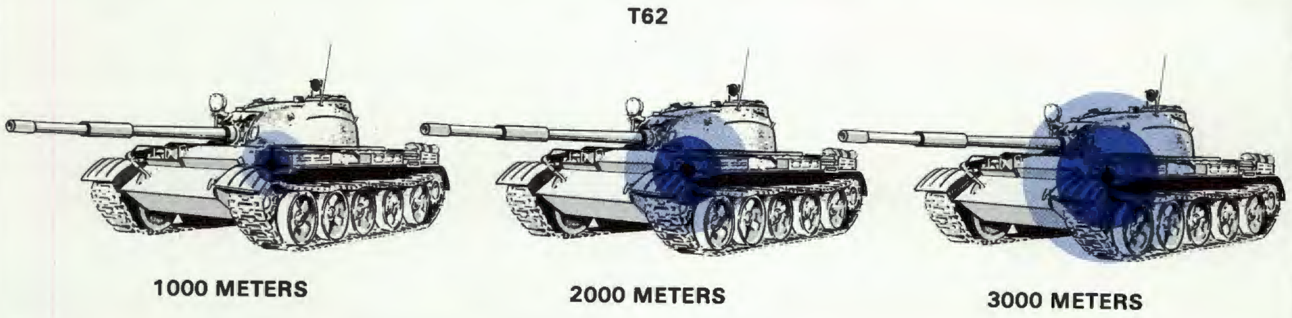


Figure 1

ammunition, as can be done on the *M60A3* and *M1*. If an *M48A5* or *M60A1* is zeroed with one type of ammunition (for example, APDS), that zero will not apply to any other type of ammunition (HEAT, HEP, or APFSDS). The zeroing process for one type of ammunition will degrade the ability of the tank to accurately deliver all other types of ammunition.

Zeroing with Training Ammunition. At present, zeroing is generally limited to training ammunition. Due to the ballistic differences between training rounds and the service rounds they represent, the zero achieved with a training round will rarely (if ever) be accurate for service ammunition. Borrowing the TPDS zero, for example, and using it as a substitute for zeroing APFSDS provides no real accuracy improvement over firing from boresight.

Lot-to-Lot Ammunition Differences. Accuracy testing has shown that differences between lots of ammunition of the same type may be sufficient to make a zero achieved with one lot of ammunition ineffective or degrading for a different lot of ammunition.

The points mentioned above are very significant. They simply explain that if you zero with training ammunition you will undoubtedly hit panels on a range, but that training round zeros do not enhance the capability to hit combat targets with service ammunition, no matter how refined your training ammunition zero is. Even if you could zero with service ammunition, the simple act of changing to a different lot of ammunition might not only make the initial zero ineffective, but may reduce your real probability of hit (PH) capability. The conclusion is obvious. There is no need to zero. In fact, our modern fire control systems, properly maintained and properly boresighted, and verified through the Accuracy Screening Test, are capable of shooting very accurately.

How accurately? I'm sure some of you would say you can shoot Ivan's eye out at 2,000 meters. Before you place your bets, look at some of the factors that will cause a well-trained crew with a well-maintained and calibrated tank to miss.

Random Errors. Random error sources are those that vary for each round fired. They cannot be predicted from one round to the next, nor can the crew compensate for them. The TC and gunner must be aware of random errors and not be unduly influenced by them when they occur.

Round-to-round dispersion. With a perfect gun and ammunition and firing under ideal conditions, all rounds would hit the same spot. In reality there is a spread of shots around a central point. The area into which these shots fall is called the *dispersion zone.*

There is no way the crew can compensate for dispersion, but they should be aware of its effects. As range to the target increases, so does the dispersion zone. If the round misses by only a slight amount, a re-lay/reengage technique may achieve a target hit (figure 1).

This illustration shows a close approximation of the round-to-round dispersion of kinetic energy rounds. The outer circle shows APDS, the inner circle, APFSDS. Knock his eye out? Maybe not. Put *steel on target* in combat? You bet! The circles show where 90 percent of the rounds of each type, fired from a calibrated tank, aimed at the center of mass, and properly ranged, will hit. We obviously achieve an excellent PH out to 3,000 meters.

Now, we know what our gun will do with our modern ammunition. How do we engage those enemy tanks?

Modern tanks have increased vehicle and crew survivability. The slope of the upper glacis has been increased, the composition of armor has been improved, and, in some instances, special types of armor have been applied. These targets will pose a dangerous threat on the next battlefield. Even so, our present and future ammunition will defeat all tanks—but possibly not at all ranges and from all angles.

Therefore the smart tank commander or his gunner will engage the enemy from the flanks or rear where the armor is thinner and less sloped. Hits in these areas will probably result in a sure kill. If a tank must be attacked head-on, shots from above as it moves down a slope or at its bottom as it crests a hill should be sought. Study the terrain and wait for that good shot that offers the best chance for penetration and a kill. These same shots are available when a tank noses into a ditch or climbs out, so look for them. Search for every tactical advantage, and when it comes, use it.

Understand your strengths. Make sure your tank is properly calibrated and that the fire control system works. Know the capabilities of our service ammunition and the vulnerabilities of the enemy's armor. Get smart — shoot smart.

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 48)


①


②


③


④


⑤


⑥

The Tactical Use of Frozen Waterways

By Major B. B. Bell

Historically, frozen lakes and waterways have been used advantageously in combat operations, and can continue to be used in areas where ice forms naturally.

Perhaps the two best known examples of the use of iceways in combat are the destruction of the Russian 44th Motorized Infantry Division by Finland in 1940, and the Russian defense of Leningrad in the winter of 1941-42.

During the winter of 1939-40, the Finns halted the advance of the 44th on the Raate road with roadblocks. The Finns then built several ice roads across frozen lakes to the south and parallel to the Russian column. These ice roads were used for rapid troop movement and resupply, and culminated in attacks on the Russian flanks as deep as 20 miles to the rear of the roadblock.

The use of ice in defensive operations is epitomized in the Russian defense of Lenigrad when the German Army had surrounded that city except on the east, which was protected by Lake Ladoga. The defenders were being starved to death when the first relief party crossed the ice on 17 November 1941. By 22 November, the first motor vehicle convoy crossed the lake and the supply line was in full operation. By January, 400 3-ton trucks were crossing the ice each night.

What then should we know about ice? There are two basic categories of ice, sea water and fresh water. Sea water freezes at about 28.75°F and is always somewhat weaker than fresh water ice due to voids created by brine pockets in the ice.

> *"There is absolutely no room for guesswork when crossing ice as breakages are almost always swift and catastrophic." (See photo on page 11.)*

Fresh water ice is generally sub-divided into four categories:

- *Normal or Clear ice.* Clear ice is simply ice that freezes at 32°F and is the ice by which strength characteristics are measured.
- *Snow ice.* In most northern areas, lake or river ice will become snow-covered during the winter. If water tables change and the ice fractures, water will pour up through the ice, saturate the snow, then freeze. Snow ice is generally white in nature as compared to clear ice. Snow ice is always less dense than clear ice and consequently weaker. If snow ice is encountered, thickness tables for clear ice must be doubled when determining load carrying capacity.
- *Frazil ice.* Frazil ice is formed in fast-flowing streams and is the result of ice discs forming in the fast-moving, super-cooled water. Once the surface of a flowing stream freezes, these ice discs tend to rise and attach themselves to the underside of the surface clear ice. They then become mixed with the continued formation of clear ice and will cause the overall ice strength to decrease somewhat. When frazil ice is encountered in an ice cover, tables for clear ice should be increased by 25 percent.[1]
- *Shell ice:* An early fall freeze in the north may cause a layer of ice to form when water levels are still high in streams. When this water level falls to its winter level, the top surface will again freeze so that there are two layers of ice with a large air pocket between them. Shell ice should be avoided as it is usually weak and under great internal stress.[2]

FM 31-71, *Northern Operations,* contains an excellent table for use in determining minimum clear ice thickness for various loads. Some of the more critical strength requirements are shown in Table 1.

Table 1.

Load	Inches of Ice Temp 0° to 10°F		Min. Meters Between Units
	Risk	Normal	
Single soldier on skis	1½	2	5
File of soldiers 2-meter interval	3	4	—
¼-ton truck	5	8	15
2½-ton truck	13	15½	25
UH-1 helicopter—landing or parked	8	10	20
M109 howitzer	17½	20	40
M60 tank	26½	31½	70

Risk ice measurements can be used with safety for individual crossings. The normal ice measurements are for repeated loadings.[3] Another useful ice table is contained on page 66 of the March-April 1975 issue of *The Military Engineer*. This table deals with graduated weights and not specific vehicles and may be useful when load tonnages are easily determined.[4] Before attempting to cross ice with any load, ice thickness must be physically checked by advance parties, pathfinders, or scouts. If the ice is too thick to cut through by hand, explosives, such as shaped charges, should be used. There is absolutely no room for guesswork when crossing ice, as breakages are almost always swift and catastrophic.

Ice bridges. As the freezing process takes place and snowfall accumulates, the natural insulating properties of the ice and snow tend to significantly slow down the freezing process. When time is critical, an ice bridge can be constructed by adding water to the top of the ice. This process is an engineer function, but in northern climates one should not count on scarce engineer support. If there is a snow cover, the snow should be removed and used as berms along the edge of the proposed bridge. The wider the bridge the better. The natural ice thickness should exceed 4 inches to ensure troop safety during the construction process. Maximum bridge strength is obtained when the width of the bridge is between 150 and 200 feet. Logs or brush can also be used for berms, or if nothing is available simply let the added water find its own course along the bridge route. (Table 2.)

> *"We can be sure that in northern climates frozen lakes and rivers will only enhance the Threat's ability to maneuver against us."*

Water should be added to the ice surface in 2-inch increments per day as this amount will freeze solidly in 24 hours. If the temperature is below −20°F, 3½ inches may be added per day. The best way to obtain water is with 3-inch engineer pumps. Another technique is to drill holes in the ice with hand or power augers along the centerline of the proposed bridge. Normally, the underlying water is under great pressure and will bubble up and flood the proposed roadbed. Also, the use of tank and pump units on fuel trucks should be considered.

As water is added to ice bridges, many experts advocate adding logs, brush, or grasses. These materials do not strengthen the ice itself but tend to prevent catastrophic failure if the ice is overloaded.

Table 2. Typical Ice-Bridge Construction Data

Type of bridge	Length feet	Width and thickness	Men required	Constr time hours
Straight bridge	330	150 feet wide	32	4
Skew bridge	330	Minimum ice thickness, 16 inches	32	1½
Skew bridge	600	Minimum ice thickness, 16 inches	32	4

The last consideration in building a bridge is the addition to the final surface of 3 to 4 inches of snow, if available. This cover provides a wearing surface and prevents the thawing effects of solar penetration.[5] (Table 3.)

Ice bridges have been constructed over the years to effectively speed up the natural freezing process. They have recently demonstrated their worth in support of the construction of the Alyeska Oil Pipeline across Alaska where loads up to 100 tons were routinely supported on them. The military planner would be wise to become familiar with the capabilities and construction techniques of ice bridges.

Tactical considerations. Tactical plans should not be based solely on the use of frozen waterways, because weather changes could doom an entire operation. As time permits, permanent "floating" or girder bridges should be placed over the ice for it is unwise to continue to depend on the stability of the ice.

Frozen lakes, rivers, or streams often provide excellent routes for foot and vehicular movement in offensive operations. They should be used whenever possible because they offer freedom of movement. However, caution is indicated due to the loss of concealment and possible exposure to enemy fire while on the ice. This shortcoming can be minimized by moving very close to the shoreline or actually on it when possible. Frozen lakes and rivers provide excellent landing zones for airmobile operations, and U.S. doctrine advocates their use.[6] In these instances, pathfinders must be used prior to landing to confirm ice thickness.

Frozen lakes and rivers can cause numerous problems for the defender. Lakes and streams that anchor a defender's flank in warm weather may provide high-speed avenues of approach into his flank in winter. As such, ice areas will lengthen the frontline of a given sector and cause the defender to deploy more troops and weapons along them. It is therefore critical that these natural routes be denied the enemy as much as possible.

> ***"Lakes and streams that anchor a defender's flank in warm weather may provide high-speed avenues of approach into his flank in winter."***

Employing engineers to the maximum extent possible, minefields should be placed at choke points along the rivers or near natural egress points on lakes. The most effective minefield consists of using 10-pound shaped charges every 3 meters along the ice. Several rows of these charges may be required in building an effective minefield. The charges must be placed in or under the ice and should be command detonated. The 10-pound charge will blow ice up to 4-feet thick. For each additional foot of ice, 2-1/2 pounds of a plastic or other waterproof explosive should be added. When such a minefield is detonated, it will deny the area to the enemy for up to 24 hours at temperatures around −25°F, for even when the area is solidly refrozen, large, jagged ice chunks will restrict movement of personnel and equipment across the area.

The most favorable time to command detonate an ice minefield is after leading formations of a dismounted enemy have passed over it. This technique will ensure the leading troops are cut off from reinforcements, allowing them to be rapidly destroyed by friendly troops. If tanks or other tracked vehicles are crossing the ice, it is best to blow the minefield when the leading vehicles are on it. Once blown, the weight of the vehicles will magnify catastrophic ice failure.[7]

Threat doctrine emphasizes the use of ice in offensive operations. Such doctrine details exactly how they will conduct assault river crossing over frozen rivers, and how they intend to use tanks during the crossing. Where they find the ice too thin to carry tanks, they have developed ingenious methods to assemble pontoon bridges on top of the ice to support their attack.[8] We can be sure that in northern climates frozen lakes and rivers will only enhance the Threat's ability to maneuver against us.

Table 3. Reinforcement of Ice

Material	Thickness of reinforcing layer	Requirement for 13-foot track	Increase in bearing cap. assuming 6-inch ice thickness
			Percent
Ice and snow, 3 layers	Pack layer 1½ inches		20
Straw	2 to 4 inches	6 pounds per foot run	20
Straw, 3 layers	Each layer 2 to 4 inches	20 pounds	25
Brush	2 to 4 inches	2 cubic feet per foot run	25
Ice block	Dependent on size of blocks		
Planks, 2 inch		2 runways 3 feet wide	50

Today, the Army has large forces deployed in cold regions. Korea, Alaska, and Germany all provide terrain that is radically changed with the onset of winter when the formation of lake, river, and stream ice adds a dimension to the battlefield that has often proven decisive in past wars. A thorough understanding of the problems and opportunities offered by this phenomenon will help ensure that we maximize this combat multiplier while denying its use to the enemy.

Footnotes

[1] "Ice Bridges For Heavy Haul," Stephen L. Den Hartog, *The Military Engineer*, March-April 1975, p. 65.

[2] FM 31-70, *Basic Cold Weather Manual*, Department of the Army, April, 1968, p. 107.

[3] FM 31-71, *Northern Operations*, Department of the Army, 21 June 1971, pp. 3-20.

[4] "Ice Bridges for Heavy Haul," Stephen L. Den Hartog, *The Military Engineer*, March-April 1975, p. 66.

[5] Ibid., pp. 64-66.

[6] FM 31-71, *Northern Operations*, Department of the Army, 21 June 1971, pp. 2-12.

[7] FM 31-70, *Basic Cold Weather Manual*, Department of the Army, April 1968, p 143.

[8] *Soviet Doctrine and Capabilities for Winter Operations*, Major John W. Knox, U.S. Army Institute for Advanced Russian and East European Studies, APO New York 09053, 1978, p. 23.

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Engines For Combat Vehicles

by Colonel Samuel Myers

The phrase, "People talk horsepower and buy torque," is normally applied to the new car buyer who is very concerned about a car engine's horsepower, but who is really seeking that surging acceleration that snaps his head back as he leaves a stoplight. It applies equally well, however, to the military man who is always asking for the "horsepower-to-weight ratio" of a vehicle when what he really wants to know is the vehicle's *agility*. Horsepower and torque are very definitely related, and those overly concerned with horsepower should have had their eyes opened when the Army changed from the *M48A2* to the *M48A3* tank. The *M48A2* had a fuel-injected 850-hp gasoline engine that was replaced in the *A3* model by a diesel engine of similar displacement that developed only 750 hp. Did the *A3's* agility suffer? Certainly not. In fact, the *A3* not only has better fuel economy, the main reason for the change, but it also had better acceleration and a similar top speed.

"So why," you ask, "should I be so concerned about the difference between torque and horsepower? I'm not out to be an automotive engineer!" Well said, but an appreciation for the difference between the two should take off the mental blinders many people have about horsepower.

If a comparison is made between the characteristics of various engines and vehicle requirements, a better understanding can be obtained as to what type of engine is best suited for each type of vehicle. In making such comparisons, an understanding of the following terms will be helpful.

Torque is a force acting about a lever arm, as in turning a crank handle. It represents *force*. A *force* acting through some distance is called *work*, and work done per unit of time is called *power*. Torque supplied to a driving wheel, divided by the radius of the wheel, equals the force the wheel applies to the ground to make the vehicle move. The *time rate* of applying this force is called *horsepower*. Torque is what *gets you going;* horsepower is what *keeps you going*. How much of each you need can be easily calculated. For example: a 3,200-pound vehicle acted upon by a force (torque) of 3,000 pounds will accelerate at 30 feet-per-second or about .9 "g," which will "spin" the tires. Since an average-size passenger car has a wheel radius of slightly over 1 foot, and low gear and rear-end gear ratios that multiply engine torque by nearly 10 to 1, the engine would have to be generating somewhat over 300 pound-feet of torque to spin the wheels. This torque value is about average for large U.S. V-8 gasoline engines in passenger cars. The engine that produces 300 pound-feet of torque will probably produce about 230 hp.

Horsepower needs are related to speed. It is the *time rate* at which you must supply torque to the rear wheels to overcome *rolling resistance* and *air resistance*. Rolling resistance is a fixed value, depending mainly on car weight. Air resistance depends on frontal area and streamlining and is a function of *speed squared*. For example, the 3,200-pound passenger car requires about 30 hp at the wheels to go 55 mph. Considering power train inefficiencies and accessory losses, the engine would have to be developing about 40 hp to achieve this speed. You may ask, then, "Why does one need a 230-hp engine if one is only going to use 40 hp to go 55 mph?" The answer is, one doesn't. Small foreign cars with 90-cubic inch, 60-hp engines can easily go 55 mph, but they take a lot longer to get there. Large-volume, spark-ignition, reciprocating engines (conventional, passenger-car, gasoline engines) produce large amounts of torque and horsepower. The average values are about .75 hp per cubic-inch of displacement and about 1 pound-foot of torque per cubic inch. But such figures are not typical for other types of engines.

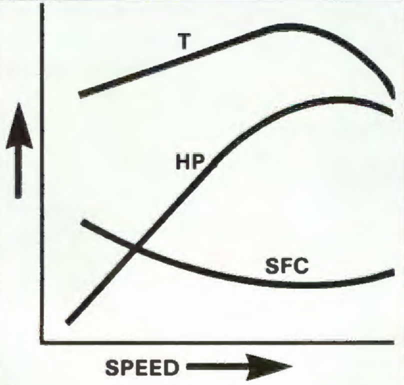

Figure 1.

Torque and horsepower are measures of *gross output*. For comparison we need parameters that relate output to size, or *specific output*. The values quoted above are examples of specific horsepower and torque. *Specific fuel consumption* (SFC) is the number of pounds of fuel required to produce 1 horsepower for 1 hour. It is inversely related to the more commonly used term "fuel economy" (or miles per gallon) in that the lower the SFC, the better the economy of the engine. Another useful term is the *specific weight*, which relates an engine's weight to its output power. Besides these measures of output, it is useful to examine the performance curves of an engine. These curves for a conventional gasoline engine appear in figure 1.

The value of such curves is in comparing their shape when comparing engines. In the gasoline engine, torque rises with speed and then falls off rapidly; horsepower increases rapidly, peaks, and then falls off; SFC is best at mid to high speeds (at the speed where best torque and horsepower occur).

Since combat vehicles are quite heavy, they require very high torque at the driving sprockets or wheels to set them in motion and to climb hills. On the other hand, heavy vehicles are not usually designed for high speeds (over 50 mph), thus horsepower requirements are not as proportionately high as those of a passenger car (figure 2).

The power train, which is the means of adapting engine output to vehicle requirements, is made up of a transmission and final drives that multiply torque and reduce speed to match the engine's output to the vehicle's requirements. Therefore, the more nearly the engine's output curves match the vehicle's requirements, the simpler the power train can be.

Gasoline or Spark Ignition Engines. Most such engines are the reciprocating (piston) type found in modern passenger-cars. They may be water- or air-cooled, but all have an electrical system for firing the spark plugs. An innovation is the rotary, or Wankel engine. It operates on the same thermodynamic cycle as a conventional engine, but has an eccentric rotor which accomplishes the equivalent actions of intake, compression, power, and exhaust stroke of a piston engine. Figures 3 and 4 show the generalized curves for these engines.

Spark-ignition engines are relatively lightweight for their output, run at high speeds (up to 6,000 rpm), produce high specific torque and horsepower, and have low SFC (good economy) at high power; but have poor economy at low-power levels, such as idling or low-speed operation. They are complex mechanically but, because of extensive development, have a high reliability and low cost. They have the disadvantage of using an expensive, highly-flammable fuel, require relatively frequent maintenance of the electrical system, and have a shorter life span than other types of engines.

Diesel or Compression Ignition Engines. In the spark-ignition engine, a compressed fuel-air mixture is ignited by a spark. In the diesel engine, fuel is sprayed into a highly compressed (very hot) charge of air that then burns the fuel, producing power. Diesel engines are heavier than spark-ignition engines and run slower, but these qualities give them a considerably longer service life in commercial use of 200,000-300,000 miles before overhaul. Though the injection system is intricate, it is much more durable than the electrical system of a gasoline engine, so the diesel engine is generally more trouble-free. Diesel engine performance curves are shown in figure 5.

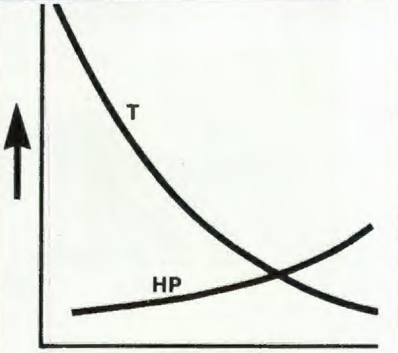

Figure 2.

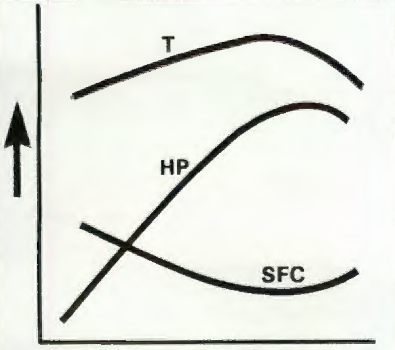

Figure 3.

The diesel engine has a lower operating-speed range (about 500 to 2,500 rpm) than does the gasoline engine, a relatively flat torque curve, a lower peak horsepower, and low SFC. In current commercial use, diesel engines are the most efficient means of deriving motive power from petroleum fuels. They have excellent economy at idle or low-power output, and they have low-specific horsepower but high-specific torque. Some recent innovations in compression ignition technology, such as the variable compression ratio pistons, have dramatically raised these values to the point that they can greatly exceed those of a spark-ignition engine; however, reliability has yet to be proven equal to conventional engines. Diesel fuel is cheap, dense (more fuel per gallon), and relatively safe; but the engines are more expensive, larger, and noiser than gasoline engines. They are almost universally used in heavy, commercial vehicles and are presently predominant as the powerplant for tanks and other combat vehicles.

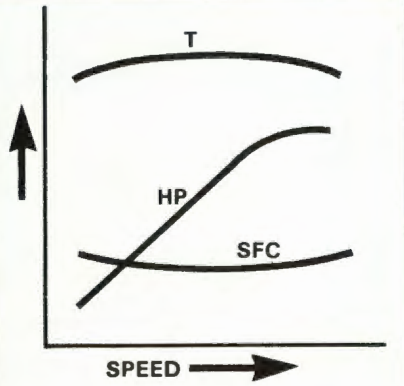

Figure 4.

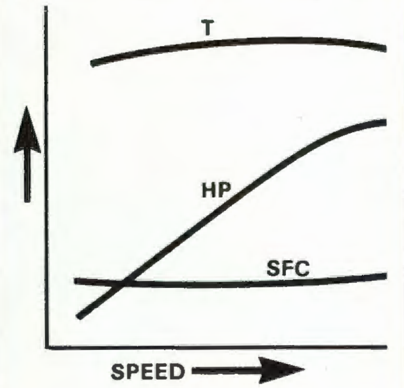

Figure 5.

Turbine Engines. Gas turbine or "jet" engines have become predominant in aircraft propulsion. Recently, considerable emphasis has been placed on developing turbines to power ground vehicles by producing shaft power as opposed to reaction or "jet" power. Gas turbines have some markedly different characteristics from reciprocating engines (figure 6). Gas turbines could almost be called "constant horsepower" engines. Their torque is at a maximum at stall and decreases with speed. For this reason, except for speed-reduction gears (turbines turn at up to 50,000 rpm) a transmission is almost unnecessary. The attractive torque characteristics have led to a high interest in gas turbines as power plants for heavy vehicles. Turbines are lightweight, small, simple (few moving parts), reliable, easy to start, and can burn a variety of fuels (JP4, diesel, gasoline). They suffer, however, from two main problems: First, fuel economy is very poor at idle or part load and second, they require very high air intake rates for their size. The first problem is slowly being solved through advances in technology and the use of recuperators. The second is mainly a problem in combat vehicles only since gas turbines require large air duct areas and air cleaners which are difficult to provide on armored vehicles. Properly silenced, they are quiet and nearly vibration-free.

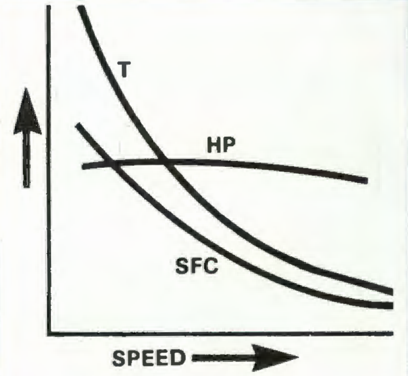

Figure 6.

External Combustion Engines. The three engines just discussed are called *internal* combustion because the heating of the fuel-air mixture takes place in the same place where the work is done. In an *external* combustion engine, a working medium (steam is the most common example), is heated in one location and sent to another (a cylinder or turbine) to produce power. Before the turn of the century, most of the power produced in this country was by steam, and even now, a large percentage of electric power is produced by steam turbines. Though several different types of external combustion engines exist, the steam engine bears a hard "second look" as a vehicle powerplant, particularly in the light of automotive emission problems.

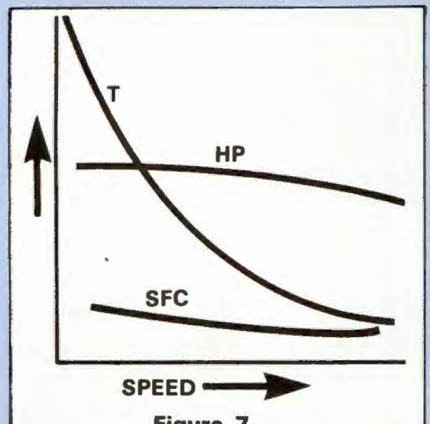

Figure 7.

A steam engine's torque and horsepower curves are similar to those of the gas turbine, but the fuel consumption is uniformly low (figure 7). This is because only enough steam needed to meet the power demands is produced. There is no compressor to run constantly, as in the gas turbine; and, at idle, the steam piston does not even turn over, thus only enough fuel to maintain the boiler pressure need be burned. A steam-piston engine produces maximum torque at zero speed so it needs neither transmission nor speed reducing gears. External combustion engines can be designed to operate on any fuel—coal, petroleum fuels, natural gas, or nuclear reactors. They are simple, rugged, reliable, and, in production, could be cheaper than diesel engines. They, like gas turbines, have two major drawbacks: First, they are heavy, and second, their working medium creates problems. The first problem is under attack and some promising developments are being made to reduce the size and weight to at least the same realm as spark-ignition engines. The second problem, mainly that water (the usual working fluid) freezes at 32° F, may be solved by using other fluids. Freon is one alternative, though it tends to break down at high temperatures. All steam engines are "closed-cycle," i.e., the vapor is condensed and reheated so there is little, if any, water loss.

Electric Power. Many early model autos use electric power. Electric motors are quiet, efficient, emission-free, and have torque and horsepower curves that relate exactly to vehicle requirements, hence no transmission is needed (figure 8). Moreover, since driving motors on each axle, or sprocket, can be individually controlled, no steering transmission is needed.

No fuel consumption curve is shown for an electric-powered vehicle. Therein lies one of the problems with electric power: the storage battery. Dramatic advances are being made in reducing battery size and weight, but the number required to power a heavy combat vehicle for extended periods of time is currently unacceptable. One alternative is fuel cells, which produce power directly from fuels (without combustion in an engine), but though development is progressing, fuel cells are bulky, complex, and low in efficiency. Another system involves using an engine, running at relatively constant speed, to turn a generator that provides current to the axle-mounted traction motors. An example is the diesel-electric locomotive that pulls most of the trains in this country. This compound engine-generator-motor approach involves some power inefficiencies but has one big advantage, if the vehicle's operational requirements are carefully considered. Most combat vehicles rarely operate at high speeds; their engines are more often at idle or are moving at low speeds, and road marches are often made at relatively constant engine speed.

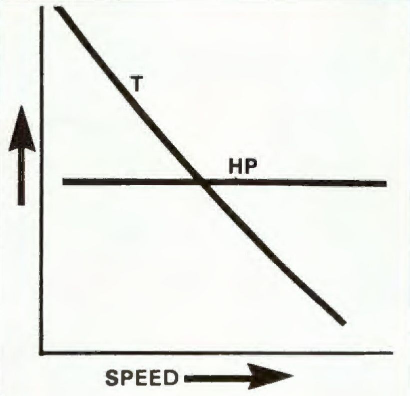

Figure 8.

From a detailed analysis of a specific vehicle's operational profile, it is possible to calculate the *average* horsepower requirement and the *maximum* torque and horsepower requirement. The vehicle can then be built with electric motors to provide the *maximum* requirements, a small constant-power, fuel engine and generator to provide the *average* power requirements, and a relatively small bank of batteries to act as a reservoir. The battery reservoir serves a dual purpose. It absorbs excess power when the vehicle idles or moves slowly, and provides a surge of extra power for rapid acceleration and high-speed operation demands. Such a configuration could achieve excellent fuel economy because the engine could be designed to operate at conditions of best SFC. Additionally, constant-speed operation has many advantages in terms of durability and reliability. In particular, this scheme is very conducive to using a gas turbine since the turbine is small, light, and achieves best economy at maximum power.

One interesting application of the technique of compound propulsion is found in the Swedish "S" tank. It has two engines feeding a common transmission: a diesel is used for low-speed operation and road marches and a small, powerful, gas turbine is brought into operation to provide extra torque for cross-country operation and extra power for high-speed operation. The easily-started gas turbine can be used to preheat the diesel and its fuel, warm the batteries, and crank the heavy diesel, which are major advantages in cold weather.

Summary. There are, of course, many more types of propulsion systems than have been discussed here and many other characteristics of engines that must be considered in selecting the correct combat vehicle engine-system. In addition, the requirements of combat vehicles vary, as between a main battle tank and a light combat vehicle. The reader is invited to make his own comparisons and draw his own conclusions as to what he believes to be the best engine-vehicle combination.

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Tactical Control of a Passage of Lines

by Lieutenant Colonel Edwin P. Smith

Passage of lines is high on the list of critical tasks to be accomplished during the Airland battle, and there is little dispute about the difficulties associated with its execution. However, there is considerable debate as to *how* a passage of lines should be conducted.

Generally, the purpose of any passage of lines is to relieve one unit with another so that a higher-level of operation can continue. The relief, as well as the passage to effect it, may be rearward, forward, or lateral. The passage itself becomes a problem in traffic and tactical control, requiring effective battle-transfer techniques and efficient movement-control measures. Solving these problems requires some agreement concerning both handoff techniques and control measures.

Battle transfer. Any passage is simply a means to an end—the effective handoff of battle control. Against that backdrop, the transfer of responsibility for command, control, and communications (C^3), must be discussed.

First, exactly *where* is the battle to be handed off? This transfer usually occurs at a phase line, which has been commonly defined by the passed and the passing unit, or by the higher command common to both units. In a rearward passage, for example, the German Army uses a "covering-fire line," where the battle is handed off from the withdrawing-force commander to the overwatching-force commander. In a forward passage, this line is most often the forward edge of the battle area (FEBA) or the forward line of troops. In either case, stationary forces overwatch moving forces out to the range of their supporting direct-fire systems and coordinate the use of their combined indirect-fire systems.

In a rearward or lateral passage, the passing forces are relatively free from maneuver constraints until they pass the handoff line, beyond which they must comply with control measures, e.g., passage points and lanes that have been established by the stationary-force commander to keep from interfering with the scheme of maneuver and fire support plan. Similarly, during a forward passage, advancing units are constrained in movement until reaching the FEBA, after which it is the main battle area (MBA) overwatching forces that are restricted, in deference of the attacking unit's scheme of maneuver.

The decision as to *where* and *how* to handoff the battle is based upon several factors. Mission, enemy, terrain, troops and time available (METT) head the list. The missions of both passing and passed units are closely related and one can easily impact—favorably or unfavorably—upon the other. For example, a passing tank-heavy task force—which has completed its covering-force mission and is enroute to a battle position or assembly area where it is to refit, rearm, and refuel in preparation for counterattack contingency—may easily impede MBA brigade units that have deployed for a deliberate defense, unless coordination between all units is complete. For the passage and handoff to be successful, both unit commanders must understand the mission and the related scheme of maneuver or movement plan of the other. Because the handoff involves the transfer of responsibility for the further attrition, denial, and defeat of the enemy, the current enemy situation and capabilities are critical items of information that must be commonly understood and exchanged by passing and passed unit commanders at all levels. Furthermore, the composition and disposition of friendly units, and the terrain over which the passage is to be conducted, are of obvious importance in facilitating the handoff. For an overall plot and check of the planned "flow," such information is best exchanged by passing company or team executive officers (XO) and passed-unit company commanders and by passing-battalion liaison officers and stationary-battalion S3s. Those chosen to complete this essential task must be knowledgeable and dependable command representatives and yet, particularly with regard to the passing unit, they must not be the key leaders who will be concentrating on defending or moving to attack the enemy.

"Friendly casualties could result if just one task force fire support officer's restrictive fire line is one terrain feature off . . ."

The handoff decision process requires a consensus on control measures. This consensus begins by deciding which control measures are necessary and then determining how they are to be developed. However selected, the necessary control measures should be simple and precise to prevent confusion, rather than control, from ensuing. Imagine—or recall—one battalion exploiting through another, or attempting to do so, where passage points or lanes (per overlays) don't match, guides don't know the recognition signals, or recovery assets aren't prepositioned at "choke points" to keep the flow smooth.

Boundaries, phase lines, restrictive fire lines, contact and passage points, routes, and recognition signals are normally used to execute passages. Boundary shifts necessary to conduct the passage have to be considered. Those boundaries existing before a passage of lines should be measured by whether or not they help or hinder the passage, handoff, and any subsequent changes to the task organizations of the forces involved. If, for example, the covering force's unit boundaries are coincident with those of MBA forces, control of the passage of lines is made easier; in other cases, such boundary alignments may not be feasible because enemy avenues of approach or friendly axes of advance may dictate otherwise, and existing boundaries may require some shifting for the passage.

Phase lines, by definition, influence the timing of the passage and handoff. They regulate the time of attachments or detachments; the phasing of the operation forward or rearward; the shift of fire control, direct and indirect; and, most importantly, the transfer of battle control. As such, these control measures must be easily recognizable on the ground and must be commonly understood by all users. Friendly casualties could result if just one task force fire support officer's restrictive fire line is one terrain feature off, and therefore possibly in the midst of friendly unit's battle positions. As a minimum, one phase line must dictate where the control of the battle and related support arrangements are shifted from one set of units to another. Once that line is drawn, other phase lines are mutually selected as needed Sometimes phase lines serve dual purposes to insure that converging friendly forces don't take one another under fire—as in the case of restrictive fire lines.

Within these control lines, the points of contact between friendly forces must be carefully selected. Contact points must be easily recognized, but not so easily that they are open to enemy detection. In any event, make certain that contact points are the same on *all* players' maps, and that *all passage participants have them.*

These points are not quite as critical for forward passages as they are for rearward passages. For example, consider the passage of covering-force units through MBA defenses. Contact points will often serve as initial coordination locations between unit liaison representatives A checklist for the liaison representatives follows:

- Missions of units and tentative battle plans
- Disposition of the stationary force, including obstacles
- Contact points/coordination points/passage points/release points
- Passage lanes
- Attack positions (forward passage)
- Enemy disposition and situation
- Time of transfer of responsibility (if specified)
- Order of march of passing units
- Communications (codewards, frequencies, call signs—exchange of communication and electronic operating instructions (CEOIs))
- Recognition signals (per CEOI)
- Supporting fires (direct and indirect fires available from the stationary unit)
- Location of combat support and combat service support elements
- Combat service support assistance available (e.g., medical support and vehicle recovery)
- Assembly areas

"Passing units under enemy pursuit–and possibly disoriented–will have all they can do to find the contact points."

In a rearward passage, contact points are generally just to the rear of the area where returning units first attempt to disengage from the enemy. Passing units under enemy pursuit—and possibly disoriented—will have all they can do to find the contact points. These points must not only be recognizable, but must also be selected with the mission of MBA overwatching forces in mind. Additionally, rearward passage contact points should:

- Allow for the reporting of advancing-enemy sitings
- Be beyond the range of FEBA direct-fire systems, but within the overwatch range of forward security elements
- Provide for a quick exchange of recognition signals and enemy information.

The initial contact between friendly units must ensure a "quick release" from the enemy, yet not interfere with the deliberate defense planned by units along the FEBA.

Movement from the contact point, where units are first picked up by guides, to the passage point at the entrance to the passage lane should be along a short, concealed route. The entire passage, from contact points to passage points, should be planned to help ensure a simple but flexible passage of one unit through another. How many lanes and

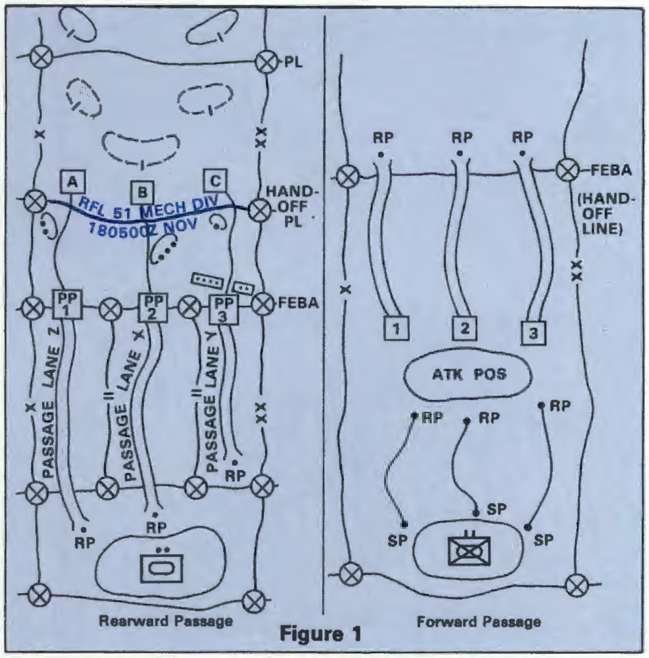

Figure 1

routes are needed depends on the number of units passing, the terrain, the stationary unit's overwatch capabilities and barrier system, and defensive plans (figure 1).

Movement and Control. The traffic control plan for maneuver and combat support units is another factor that must be addressed during the planning and execution of a passage of lines. Again, a few clearly understood control measures—known beforehand to all participants—will help ensure success. The passing unit must recognize and honor the passed unit's control measures as traffic laws not to be broken.

At battalion and brigade level, consideration must be given as to which assets—military police, scout squads, or cavalry platoons—are to be used for traffic control to assist the passage. Problems can be avoided if priorities of the passing unit's movements are clearly established to regulate the flow. Otherwise, where phasing is not completely forecast, columns of tracks and tanks can stretch for miles, as happened during a recent REFORGER forward passage of lines.

Generally, a unit being passed will assist the passing unit with guides and limited combat service support (CSS) (e.g., maintenance, vehicle recovery, medevac, and refueling). Once through the passed unit, the passing unit is on its own and must plan ahead and coordinate its CSS accordingly.

Just as mutual understanding of control measures through close coordination is a must to passage control, so are recognition signals between moving and stationary units. CEOIs provide these and they should be used rather than *ad hoc* arrangements that might not get "the word" down to the troops. This presumes, however, that CEOIs are complete and available and that there is some standardization among allies (e.g., gun tubes on returning vehicles always positioned toward the enemy). If used properly, ground surveillance radar and other early-warning assets also can signal the beginning of a passage.

At best, it is difficult to conceal a passage, thus movement control measures and common-sense operational security (OPSEC) procedures are the key. Sometimes, the worst weather, or darkness, or a city where a unit would not be expected to traverse, are the risks that are the most operationally secure. At the very least, OPSEC risks must be considered ahead of time.

Liaison between units involved in a passage must be continuous in order for the necessary coordination to be accomplished effectively. Some suggest collocating tactical operations centers or command posts to expedite coordination and later control. However, thorough liaison efforts should suffice and avoid magnifying C^3 signatures. XOs are the key players in these liaison efforts. In fact, consideration should be given to making the XO (at each level) the passage commander, freeing the commander and the operations officer to concentrate on the activities preceding or following the passage.

Liaison concerning combat support (CS) and CSS arrangements is important and time-sensitive. Artillery and engineer support should be continuous, with indirect fire assets and combat engineers employed in time-phased echelonment forward or rearward. Engineer work lines and priorities should complement the planned battle management, and electronic warfare support should confuse the enemy, but not hamper friendly C^3. Main supply route use, trains locations and supply availability, population-control measures, and collection and evacuation (maintenance, medical, and POW) procedures must be previously mapped out. Tactical air and attack helicopter support must be thoroughly planned and employed efficiently. Should mission, support relationships, or location changes occur that affect CSS arrangements, the information must be passed between supported and supporting units.

Air defense artillery units, whether under operational control or attached, must be included in the plan and employed as they are for river crossings, where maneuver units are temporarily massed at certain vulnerable points. Control of air defense assets must be understood at least at battalion and brigade staff level, and S4s must be prepared for the unique support required by *Vulcan/Chapparal* air defense systems. Battalion and brigade TOCs probably best serve as the sites for such coordination, with the XOs acting as coordinators.

A passage of lines is an exercise in time and space management. Therefore, the use of terrain and roads must be closely controlled, and communication systems must be adequate for resolving movement problems quickly when they are reported by traffic regulators. Task force and brigade commanders and their staffs must anticipate problems, develop solutions, and be prepared to apply those solutions when required. All participants must know the present and proposed locations involved in the operation, as well as the priorities for CS and CSS. To avoid confusion, rehearsals are always a good idea if the tactical situation and time permit. In any case, coordination of a minimum number of control measures can be used as a simple, flexible plan to ensure the relief of one unit by another, with little or no change in efficient battle management.

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Armored Combat Vehicle Technology

by Newell R. Murphy, Jr.

Although the new combat vehicles that are being fielded have capabilities that far surpass their predecessors, consideration must be given to even better performances in the future. This is particularly true in the area of mobility and agility, where answers must be found to such questions as, "Is mobility/agility synonymous with increased survivability—at the loss of lethality? How will tactical doctrine be affected? What is the impact on logistical support"?

Answers to these, as well as other questions, and solutions to problems involving the technology for designing and building armored vehicles in the late 1980s were the objective of a 4-year Armored Combat Vehicle Technology (ACVT) program conducted jointly by the U.S. Army and the Marine Corps. The program examined potentials for improving weapon systems, armor, and mobility/agility performance with particular regard as to how advances in these areas could be combined to produce combat vehicles of greater battlefield lethality and survivability. This article is concerned only with the mobility and agility part of the program, which consisted of the following closely related activities, which were the long-range part of the program.

- Careful testing of two special-test chassis, plus the General Motors *M1* automotive test rig (ATR), the *M113A1* armored personnel carrier, and the *M60A1* main battle tank, to develop data relating various measures of performance to a wide range of vehicle design parameters, terrain conditions, and driver behavior.
- Development or refinement of analytical models for predicting vehicle performance, and validation of these models using the data base derived from the above.
- Use of the validated analytical models to conduct broad parametric studies, to support war games that integrated mobility/agility, weapon systems, and armor considerations; and to evaluate concept designs for lightweight combat vehicles based on present and near-future component technology.

The principal special-test chassis was the high-mobility/agility (HIMAG) vehicle (figure 1), on which the gross weight, center of gravity, suspension spring and damping rates, and wheel travel could be widely varied. The HIMAG was used with various drivers for ride and shock tests, dash tests, and traverse tests. The second special-test chassis was the twin-engine *M113* developed for research purposes by the U.S. Army Engineer Waterways Experiment Station (WES) and referred to as the *M113 Hotrod* (figure 2). The *M113 Hotrod* (86 gross horsepower-per-ton (hp/ton) and the *M1* ATR (36 gross hp/ton) were used in special tests to examine the effects of high speeds on the motion resistance offered by different types of soils.

The immediate objectives were to address the following issues:

- What are the effects of various vehicle chassis-design parameters upon the attainment of high mobility/agility?
- Are there any risk areas associated with high-speed travel in the area of vehicle-soil physics?
- What is the fraction of available mobility used by a crew?
- What is the *M1* level of mobility?
- What is the mobility/agility performance of the HIMAG test bed versus that of conventional armored vehicles, the *M1,* and lightweight concept vehicles?
- Can lightweight combat vehicles be designed with mobility/agility equal to or greater than that of the *M1?*
- Does the attainment of high mobility/agility provide a payoff in survivability?

Mobility Agility Tests. The test work was designed to develop quantitative data relating specific measures of vehicle performance to the engineering characteristics of a vehicle configuration and of the terrain, and to driver behavior. Emphasis was placed upon obtaining a wide range of variations in vehicle and terrain so that trends could be clearly seen and analytical models could be widely tested.

More than 1,900 mobility/agility

tests were conducted with 21 high-performance and two contemporary vehicles. Eighteen distinct configurations of the HIMAG variable test bed were tested to explore mass and suspension effects on performance. Tests were also conducted with the ATR (with and without the 13.5-ton turret), the *M113 Hotrod* and two contemporary vehicles, the *M60A1* and the *M113A1*. The test vehicles provided a range in gross vehicle weight from 9 to 52 tons, in gross horsepower-per-ton ratio from a low of 14 for the *M60A1* to a high of 86 for the *M113 Hotrod,* and in sprocket hp/ton ratios from a low of 8.4 for the *M60A1* to 40.0 for the *M113 Hotrod*. The vehicles were instrumented to measure and record the data of interest in each test.

Seven types of tests were conducted in quantitatively defined test areas to produce the desired data base and vehicle-terrain-driver relations.[1] Five principal types of engineering tests were run—acceleration-deceleration (dash), ride dynamics, obstacle-impact response (shock), turning, and controlled-slalom (maneuver). Two types of tests were conducted to test tactical performance—a 20-km traverse test through many quantitatively defined terrain types for vehicle speed and driver response evaluation, and hit-avoidance tests to determine the survivability attributed to vehicle mobility/agility. The majority of tests were conducted at Fort Knox, KY, but some special soft-soil tests were conducted in a floodplain near Vicksburg, MS. In the latter tests, trafficability, mobility, and agility data were obtained from cross-country and soft-soil tests at speeds more than twice those ever before achieved.

Mobility/Agility Models and Simulation. Concurrent with the field tests, turning, maneuver, and traverse models were developed to describe the mobility/agility performance along any specified path, through any terrain.[2] Field test results validated these new models[3] and revalidated the basic Army Mobility Model (AMM)[4] and its dynamics model VEHDYN[5] as well. The several validated models provided the analytical tools needed to predict mobility/agility performance and to conduct meaningful parametric studies.


Figure 1.


Figure 2.

These models were used to compare the performance of more than 30 concept combat vehicles in quantitatively defined German and Middle East terrains. These models were designed by the engineers at the U.S. Army Tank-Automotive Command to meet specific Army and Marine Corps requirements, plus the *M1,* the *M3* Cavalry Fighting Vehicle, the *M60A1*, and the *M113A1*.

Mobility/agility performance depends on design balance, terrain, weather, and a specified mission profile. It cannot be assessed on the basis of a single vehicle parameter.

Results of HIMAG Chassis Tests. Figure 3 illustrates the principal factors that affect mobility/agility performance. The results of the ride and shock tests showed that the effects of suspension jounce travel (i.e., the vertical travel of a roadwheel from its static equilibrium position to the bump stop) depended on the degree of suspension damping, suspension spring rate, vehicle weight, and surface roughness. Reduced jounce travel combined with soft springs and low damping caused a progressive increase in suspension "bottoming" (roadwheels striking the bump stops) as the surface roughness or obstacle height increased. This condition became worse for this type of suspension as the vehicle weight was increased. However, the shock effects caused by suspension bottoming could be effectively reduced with increased damping. The test results showed that light damping provides the best ride on smoother terrains and progressively heavier damping is required as the surface roughness increases. The performance patterns demonstrated the potential value of adaptive suspensions that could sense changing conditions and automatically alter the damping levels to optimize the ride over all types of terrain.

Ride performance is a function of surface roughness, and shock performance is a function of obstacle height. Consequently, the distribution of surface roughness and obstacles in the area of operation is a significant factor on overall ride and shock performance.

Sprocket hp/ton is definitely a prominent factor in mobility/agility performance. Yet it is obvious that a vehicle with high sprocket hp/ton and poor suspension will be able to use that power only on smooth terrain surfaces where ride and shock are not limiting factors. Likewise, the mobility/agility advantages of high hp/ton are quickly diminished in deformable soils if the vehicle's ground pressure does not provide sufficient flotation to prevent excessive sinkage and soil motion-resistance; or in curves and sharp turns

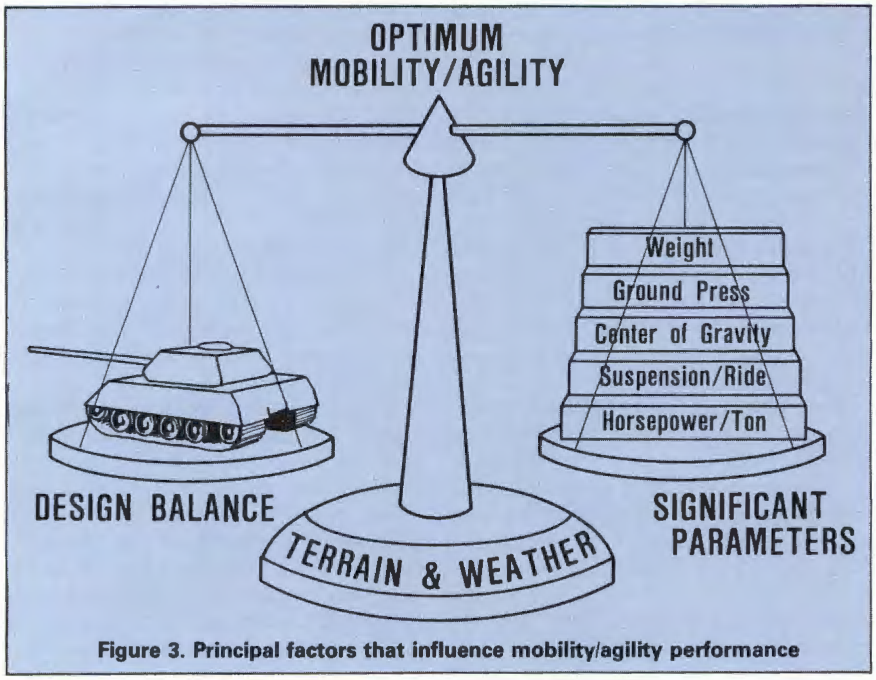

Figure 3. Principal factors that influence mobility/agility performance

during evasive maneuvers if the vehicle's center of gravity is too high for stability; or if the vehicle's dimensions prevent effective maneuvering in dense forests, such as those found in Germany and certain tropical areas.

Soil physics. A principal concern was to determine if the soil motion-resistance increased significantly at high speeds in a manner similar to the exponential increase in resistance offered by water to high-speed boats. If the increase was significant, there would be practical limits on power trains beyond which large increases in motion resistance would largely offset power increases, resulting in only small gains in speed. Until this program, power trains in cross-country vehicles had not permitted speeds where such soil resistance-rate effects were encountered.

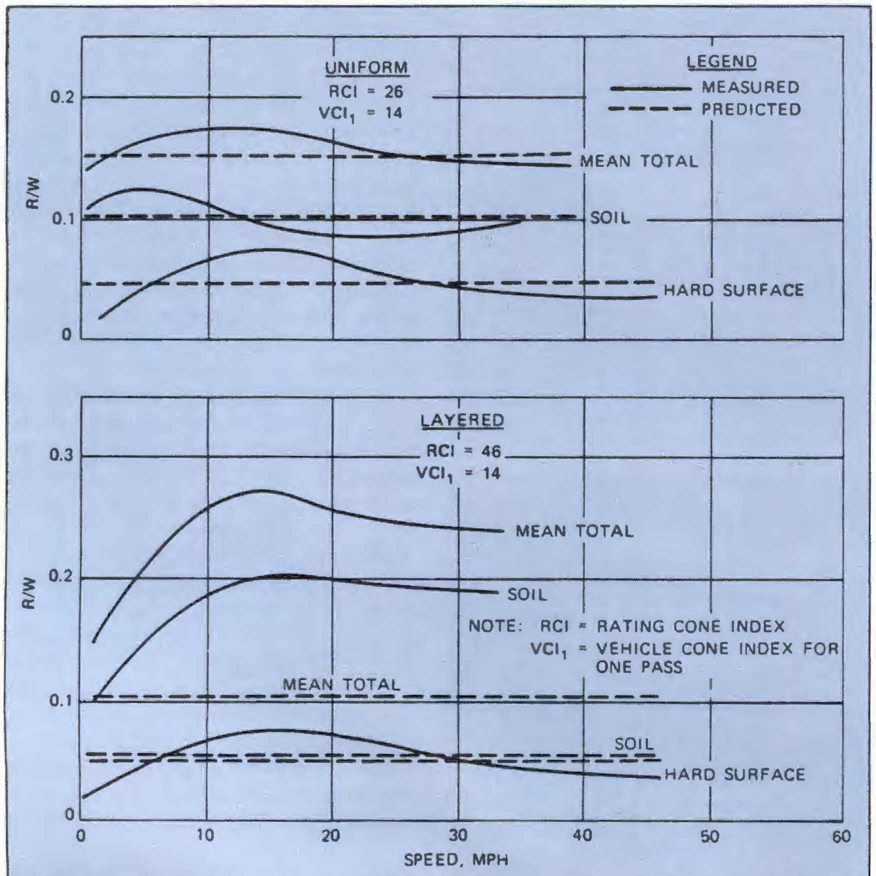

Figure 4. Comparison of measured and predicted motion resistance coefficients versus speed for two soil types (M113/2E Hotrod)

Figure 4 illustrates the effects of soil motion-resistance on speeds. The plots depict the motion-resistance coefficients R/W (motion resistance to gross vehicle-weight ratio) as a function of speed for two distinct soil conditions. The total resistance (the resistance on a firm, level surface, and the resistance to the soil) is shown for both the measured and predicted relations. The most important observation from these data is that over the speed range of 10 to 30 or 40 mph there appears to be no significant increase in motion resistance; i.e., up to at least 40 mph there is no evidence that increased power will not provide proportionately increased speeds in normal, weak-soil conditions. The upper plot shows the average results of four tests run in a soft, sticky soil (rating cone index [RCI] = 26) and compares with the prediction made using the present vehicle cone index (VCI) methods and relations.[6] The correlation is good. It is not good for the medium-strength, layered-soil condition (RCI = 46) shown in the lower plot. It is predicted that R/W = 0.10. The test logs note that in addition to a firm layer about 5 inches below the surface, the soil in these tests was extremely sticky and tended to clog the tracks and that the test area (continuously flooded for several months just before testing) was "spongy," suggesting that some viscoelastic response of the soil was absorbing substantial energy. These factors would increase the actual measured motion resistance.

There are no risk areas with vehicle-soil physics.

Tank drivers will use increased mobility. A comparison of the performance between the professional WES drivers and military drivers was used to determine the degree that trained military drivers would exploit the increased mobility capability of the HIMAG chassis. Because the WES professional drivers had been driving the HIMAG vehicle for more than 5 months in the previous engineering tests, and they were considered able to exploit the maximum performance capability of the vehicle, their performance was used as the reference for comparing the performance of military drivers. The evaluations were made from tests using two of the best HIMAG configurations, the *M60A1* and the *M113A1*. The tests were conducted

Table 1. Comparison of military drivers' ability to use maximum vehicle performance based on speeds established by professional drivers.

Vehicle		Secondary Road		Dirt Trails		Hog Hollow		Pipe Line		Tank Trails		Entire Course	
		F*	U**	F	U	F	U	F	U	F	U	F	U
HIMAG 2	***	95	85	92	78	94	79	98	81	98	80	95	79
HIMAG 5		96	99	99	83	88	83	92	85	82	80	90	87
M113A1		97	95	90	90	68	68	89	93	89	94	89	86
M60A1		95	92	88	81	92	82	86	76	79	75	88	81

*F—drivers familiar with the course. **U—drivers unfamiliar with the course. ***—percentage of established speed attained.

over a rugged, 20-km test course, composed of 189 distinctly different segments of terrain and five general terrain types. There were two groups of military drivers—a group familiar with the test course and a group that had never seen the course. All were equally well-trained in driving the HIMAG chassis.

Table 1 compares the ability of military drivers to exploit maximum vehicle performance with that of WES professional drivers. For example, military drivers who were familiar with the course reached 90 to 95 percent of the speeds achieved by WES drivers for both configurations of the HIMAG. But military drivers who were not familiar with the course attained only 87 percent of the speeds set by WES personnel for the HIMAG 2 and 79 percent for the HIMAG 5. The lower score is attributed to the unstable behavior of the lighter, tail-heavy HIMAG 2 that caused drivers who were not familiar with the course to exercise more caution.

The relative performance results show that the military drivers actually exploited more of the available mobility capability from the two HIMAG configurations than they did with mobility capability of two contemporary vehicles. These results clearly illustrate that trained military drivers who are familiar with an area will use 90 to 95 percent of the available HIMAG-level of mobility in tracked vehicles.

Trained military tank drivers will use the increased mobility available in high-performance tracked vehicles.

Levels of mobility. The single parameter definition, horsepower-per-ton, which is often misused to describe the *M60A1*, *M1*, and HIMAG mobility is not adequate. Eleven principal factors that limit mobility have been identified, including both vehicle and terrain charactertistics. These factors are listed below, and are used in the AMM to predict speed.[4]

- Insufficient soil strength
- Insufficient traction
- Obstacle interference
- Combination of terrain factors
- Ride (surface roughness)
- Soil/slope resistance
- Visibility
- Maneuverability (through forests or around obstacles)
- Vegetation (override resistance)
- Shock (obstacle negotiation)
- Linear features (streams, ditches, embankments, etc.)

An example of specifying a given level of mobility based on seven performance criteria that involve the eleven factors above is shown in Table 2. Comparisons of performance between the *M1* and the HIMAG 5 are shown for those criteria where data was available. A specified level of mobility, such as the *M1* mobility and the HIMAG mobility, can be rather accurately defined in terms of the combined minimum acceptable levels for each of the seven performance criteria; not by using any single criterion.

Level of mobility is a multiparameter definition.

Results of Model Simulation. Tables 3 and 4 compare the relative performance of eight selected vehicles for four distinct types of mobility in both dry and wet conditions in West Germany and Middle East terrains, respectively. The vehicles are ranked in each case according to performance. The four mobility types—dash, traverse, maneuver, and cross-country—are representative of those often encountered in tactical situations. The relative performance of the vehicles varies according to the type of mobility, the area of operations, and the terrain conditions. The variations show no particular pattern with respect to gross vehicle weight or sprocket horsepower-per-ton.

- Generally the HIMAG was a top performer except in the German cross-country terrain where its size severely restricted maneuverability through the denser German forests. The *M1* encountered the same problem.
- In most cases, all the lighter concept vehicles outperformed the *M1*.

Table 2. Minimum Performance Criteria for Specifying a Given Level of Mobility

Principal Vehicle Factors	Performance Criteria	M1	HIMAG 5
Suspension, power train	Ride: Speed, mph, over surface roughness		
	0.5 rms, in.	45.8	55.0
	1.0 rms, in.	45.8	53.0
	1.5 rms, in.	31.5	43.0
Suspension, power train	Shock: Speed, mph, over obstacle height		
	8-in.	45.8	55.0
	10-in.	45.8	55.0
Power train (hp/ton at sprockets)	Dash: Time, sec, for 500-m dash on hard surface	32.4	31.6
GVW, power train, track-ground contact area	Soft-soil: VCI_1	24	18
GVW, power train	Slope: Negotiate a 60% dry slope	Yes	Yes
Vehicle width (1.5 × width = NOGO)	Maneuver (forests): Speed, mph, through forest with 15-ft average spacing	*	*
Center of gravity, tread, track length on ground, power train	Maneuver (agility): Speed-made-good, mph, for maneuver (5 m by 100 m) on hard surface	35	*

Notes GVW = gross vehicle weight; rms = root-mean-square elevations; and VCI_1 = vehicle cone index (minimum soil strength for one pass).
*No experimental data available at this time.

- The *M1* demonstrated excellent maneuver performance (in open, level terrain) except in wet German terrain where its performance fell below that of the CFV.
- The *M113A1* and the *M60A1* were consistently the worst performers.

These results demonstrate that the *M1* always outperforms the two contemporary vehicles but generally falls below the performance levels of the HIMAG and the still lighter, concept vehicles. However, subsequent war gaming indicated these differences between the *M1* and the concept vehicles were not tactically significant. The results also reflect that vehicle performance depends upon the combined effects of the vehicle, mission, and terrain, and does not vary directly with weight or horsepower. Consequently, with proper attention to design, a lightweight, armored vehicle in the 16- to 20-ton range can achieve or surpass the mobility/agility of the *M1*.

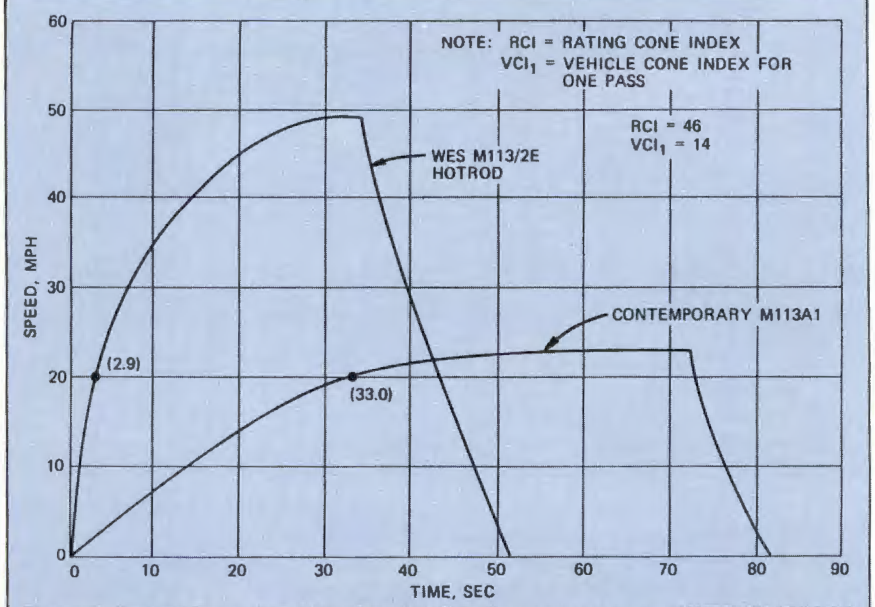

Figure 5. Comparison of acceleration-deceleration performance of WES M113A1/2E Hotrod and standard M113A1 on the same soil strength

Table 3. Comparison of the Relative Performance of Selected Vehicles at Several Levels of Mobility Based on Speed Predictions in West Germany Terrains

Dry Condition				Wet Condition			
Vehicles	GVW tons	SHP/ Ton	Avg Speed	Vehicles	GVW tons	SHP/ Ton	Avg mph
			Dash (500 m)				
HIMAG 5	42	21	38.0	HIMAG 5	42	21	32.2
CON 22 (PIP)*	21	26	33.6	CON 22 (PIP)*	21	26	30.7
CON 3	16	15	32.7	CON 3	16	15	27.4
CON 22	21	15	32.1	CON 22	21	15	26.8
M1	58	18	31.3	M1	58	18	25.3
CFV	23	16	27.9	CFV	23	16	24.5
M113A1	11	12	26.3	M113A1	11	12	18.9
M60A1	52	8	22.1	M60A1	52	8	16.8
			Traverse (25 km)				
CON 22 (PIP)*	21	26	21.8	CON 22 (PIP)*	21	26	16.4
CON 3	16	15	19.0	HIMAG 5	42	21	14.7
HIMAG 5	42	21	18.9	CON 22	21	15	14.0
CON 22	21	15	18.1	CON 3	16	15	13.4
M1	58	18	17.0	M1	58	18	13.0
CFV	23	16	16.6	CFV	23	16	12.7
M113A1	11	12	14.4	M113A1	11	12	11.4
M60A1	52	8	12.2	M60A1	52	8	9.2
			Maneuver (5 m by 100 m)**				
HIMAG 5	42	21	46.6	CON 22 (PIP)*	21	26	34.3
M1	58	18	43.9	CON 22	21	15	33.0
CON 22 (PIP)*	21	26	41.8	CON 3	16	15	32.5
CON 3	16	15	41.6	HIMAG 5	42	21	32.5
CON 22	21	15	41.2	CFV	23	16	31.6
CFV	23	16	34.0	M1	58	18	29.2
M113A1	11	12	20.5	M113A1	11	12	27.8
M60A1	52	8	21.9	M60A1	52	8	17.8
			Cross-Country (AMM, V_{90})†				
CON 22 (PIP)*	21	26	18.7	CON 22 (PIP)*	21	26	14.8
CON 3	16	15	17.3	CON 22	21	15	13.2
CON 22	21	15	17.1	CON 3	16	15	12.2
HIMAG 5	42	21	16.0	HIMAG 5	42	21	11.9
M1	58	18	13.8	CFV	23	16	8.7
CFV	23	16	13.7	M1	58	18	7.3
M113A1	11	12	10.6	M60A1	52	8	4.1
M60A1	52	8	9.0	M113A1	11	12	2.0

Note: GVW = gross vehicle weight, and SHP/Ton = sprocket horsepower per ton.
*Denotes up-powered version of CON 22.
**Denotes maneuvers of 5-m amplitude and 100-m wavelength on only level terrain with mild to medium surface roughness.
†V_{90} represents the average speed in the area after eliminating the worst 10 percent of the terrain.

Lightweight combat vehicles can be designed with mobility/agility equal to or greater than that of the M1.

Hit Avoidance. The results of the hit-avoidance tests revealed that a vehicle capable of performing fast, quick maneuvers can gain an additional measure of hit avoidance.[7] The major payoff in high mobility/agility vehicles is in performing fast, dash-to-cover tactics. The principal components in reducing hit probability are the time available to engage the target and the aiming errors. Figure 5 shows a comparison of the dash performance between the *M113 Hotrod* and the contemporary *M113A1* in a medium-strength soil (RCI = 46). The maximum speed of the *M113 Hotrod* was 49 mph compared with 23 mph for the contemporary *M113A1*. More important is the significant difference in the rate of acceleration. For example, the time required to accelerate from a standing start to 20 mph is only 2.9 sec for the *M113 Hotrod* compared with 33.0 sec for the *M113A1*. This quick acceleration permits abrupt speed changes, rapid stops to return fire, and quick starts, and may be more important than the maximum achievable speed per second.

Against opposing guns, a maneuvering vehicle moves out of the way of a projectile already in flight causing what is referred to as target-induced error. Likewise, a fast, agile target affects the ability of a gunner to accurately track the target in his sight; in this instance the type of error, which occurs before the round is fired, is referred to as a system-induced error. Finally, the fast, agile, target reduces ex-

Table 4. Comparison of the Relative Performance of Selected Vehicles at Several Levels of Mobility Based on Speed Predictions in Middle East Terrains

Dry Condition				Wet Condition			
Vehicles	GVW tons	SHP/ Ton	Avg mph	Vehicles	GVW tons	SHP/ Ton	Avg mph
Dash (500 m)							
HIMAG 5	42	21	41.4	HIMAG 5	42	21	38.6
CON 22 (PIP) *	21	26	34.0	CON 22 (PIP) *	21	26	33.2
CON 3	16	15	33.6	CON 3	16	15	32.6
CON 22	21	15	33.3	CON 22	21	15	32.3
M1	58	18	31.5	M1	58	18	30.6
CFV	23	16	28.0	CFV	23	16	27.4
M113A1	11	12	26.4	M113A1	11	12	25.7
M60A1	52	8	22.9	M60A1	52	8	21.9
Traverse (25 km)							
HIMAG 5	42	21	24.5	HIMAG 5	42	21	24.6
CON 22 (PIP) *	21	26	21.9	CON 22 (PIP) *	21	26	22.5
M1	58	18	21.3	M1	58	18	20.9
CON 3	16	15	19.9	CON 3	16	15	19.4
CON 22	21	15	19.5	CON 22	21	15	19.4
CFV	23	16	17.0	CFV	23	16	16.8
M113A1	11	12	14.3	M60A1	52	8	13.6
M60A1	52	8	13.9	M113A1	11	12	13.4
Maneuver (5 m by 100 m) **							
CON 22 (PIP) *	21	26	40.3	HIMAG 5	42	21	40.8
HIMAG 5	42	21	40.2	M1	58	18	39.3
M1	58	18	40.2	CON 22 (PIP) *	21	26	37.9
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CON 3	16	15	39.3	CON 3	16	15	37.1
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HIMAG 5	42	21	23.3	HIMAG 5	42	21	23.9
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M113A1	11	12	14.1	M113A1	11	12	13.6
M60A1	52	8	13.2	M60A1	52	8	12.6

Note: GVW = gross vehicle weight, and SHP/Ton = sprocket horsepower per ton.
*Denotes up-powered version of CON 22.
**Denotes maneuvers of 5-m amplitude and 100-m wavelength on only level terrain with mild to medium surface roughness.
†V_{90} represents the average speed in the area after eliminating the worst 10 percent of the terrain.

posure time to opposing gunners. These three factors—increased target-induced error, increased system-induced error, and decreased exposure time—created by a fast, agile, maneuvering vehicle decrease the probability of being hit. Further, a maneuver that minimizes exposure time while maximizing accelerations seen by the firer could be considered optimal[8]. However, reduced capability to effectively fire-on-the-move while maneuvering violently may significantly counter the gains in hit-avoidance and result in little net payoff for the latter tactic.

High mobility/agility provides an increased hit-avoidance capability, but the reduced effectiveness to fire-on-the-move while maneuvering violently may result in only a marginal payoff in survivability.

Conclusions. Based on the information presented in this study, it is concluded that:

- With careful attention to design balance, lightweight combat vehicles can be developed with mobility and agility equal to, or greater than, the *M1*.
- Increases in performance beyond *M1* levels, possible with power train components available in the near future, are relatively small and not tactically significant.
- Increased horsepower of up to at least 40 hp/ton at the sprocket will pay off in increased mobility and ability, even in relatively weak soils, provided other design features are kept in balance.
- Such increases can be achieved in properly designed combat vehicles ranging in gross weight from 16 to 58 tons.
- Properly trained military drivers will apply more than 90 percent of the mobility available in high-performance track vehicles.
- A fast, agile, maneuvering vehicle provides an increased hit-avoidance capability, but the reduced effectiveness of fire-on-the-move while maneuvering violently may result in only a marginal payoff in survivability.

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Marine Armor and

by Captains William B. Drenna

If a major conflict were to erupt in Europe within the next 2 weeks, the U.S. Army is confident as to where timely U.S. reinforcements would come from, how soon they would arrive, and how well-equipped they would be. This assurance is provided through the Army's prepositioned organizational materiel configured to unit sets (POMCUS) program. POMCUS was a result of identifying equipment and personnel necessary to successfully accomplish an assigned mission, i.e., defense of Europe. But what of other areas of strategic concern to the U.S.?

The U.S. has strategic concerns that encompass the globe and must be able to respond with the necessary military power whenever it is deemed appropriate. But timely response is not enough in today's myriad of worldwide scenarios. Once there, we must also be *successful*. Stationing U.S. forces in every locale of U.S. interest is not, nor can it ever be, the feasible solution. And, prepositioning materiel at land installations in these same locales is not a politically or financially prudent option.

Maritime prepositioning of materiel offers a partial solution to strategic mobility. To reduce reaction time, the U.S. has embarked on a long-term program similar to POMCUS to preposition perceived combat necessities (including artillery, tanks, fuel, ammunition, and support equipment) aboard dehumidified shipping. This program entails two sub-programs: the near-term prepositioning force (NTPF) program and the maritime prepositioning ships (MPS) program.

In 1964, materiel for an Army brigade was stored aboard dehumidified shipping located in Philippine waters and was used in Exercise QUICK RELEASE to test the viability of the forward deployed logistics (FDL) concept. Troops were airlifted to Okinawa where they married-up with the equipment of the FDL that had been moved by sea from the Philippines to the objective area. Though a feasible means of rapidly deploying a sizeable military force, FDL funding was scuttled due to political perceptions involving Vietnam escalation.[1]

Maritime Prepositioning. The valuable lessons learned from the FDL concept became the foundation for today's maritime prepositioning. Additionally, specific requirements for such a program were identified which apply to today's NTPF program:[2]

- A port that can handle one or more different types of shipping; i.e., roll-on/roll-off (RO/RO), lift-on/lift-off (LO/LO), breakbulk, and tankers.
- An adjacent airfield capable of handling large passenger aircraft, i.e., *C-5A Galaxies* and *C-141 Starlifters*.
- Sufficient staging areas at the port facility to handle the off-loaded equipment.
- Adequate bivouac sites for both the airlifted combat forces and the FDL debarkation personnel.
- A port facility controlled by a

repositioned Forces

, and Francis A. Schaller, USMC

friendly host nation or under military control of U.S. forces.

From the concepts and lessons learned with FDL and Exercise QUICK RELEASE, on 2 August 1979, former Secretary of Defense Harold A. Brown offered to President Carter maritime prepositioning as a part of the viable solution to global response.[3] It is not without coincidence that this form of prepositioning to reduce reaction time was reborn with the emergence of the rapid deployment joint task force (RDJTF). The MPS program was then programmed for long-term procurement and establishment stretching into the mid-1980's. However, in March 1980, with a marked increase in tension in the Middle East along the Indian Ocean/Persian Gulf littoral, a need for fielding this program more rapidly was recognized.[4] In addition to the direction from the Office of the Secretary of Defense to commence programming the MPS, an interim program to achieve maritime prepositioning in the near term was also directed—thus, near-term prepositioning force (NTPF).

There had already been an extensive amount of interservice planning concerning development of the MPS package when the Army, Navy, and Marine Corps began developing a force package for NTPF. After presentation of each service's package to the Joint Chiefs of Staff (JCS), responsibility for NTPF was awarded to the Marine Corps in March 1980, and selection of Military Sealift Command (MSC) vessels for the force began. These vessels included three RO/RO ships, two breakbulk ships, and two tankers—one to carry approximately 300,000 barrels of drinking water, and one to carry 225,000 barrels of petroleum products (POL).[5]

Creating the Force. The President wanted the NTPF to be on-station at Diego Garcia in the Persian Gulf in July 1980. The combined effort of all the Marine Corps major commands in conjunction with the Joint Chiefs of Staff, Navy, and MSC, enabled the Marine Corps to meet the target date, but the force's creation was not achieved without problems. However, since the force was established its equipment has undergone some changes. Three scheduled maintenance cycles have been performed, and problems related to items such as fuel, batteries, basic issue items, shortages, etc., have been corrected and more shipping has been added to the NTPF. The force now consists of 13 ships: three RO/ROs, three breakbulks, five tankers (one water and four POL), and two lash-barges.[6] Within the force, equipment is spread-loaded to increase equipment survivability, and longer lead times for scheduled maintenance are being considered (from the present 6 months to 12 months).

The NTPF now has equipment to initially outfit the requirements (including supplies and sustainability assets) for the 7th Marine Amphibious

A trio of prepositioned cargo ships lie in harbor at Diego Garcia, Indian Ocean.

Brigade (MAB). Supplies and equipment are also on hand for Air Force and Army units assigned to the RDJTF, of which the 7th MAB is a member.

Concept of Operation. The MPS program is based on the following concept:

- Prepositioned equipment and supplies on ships to support each of three MAB's will be at MPS sites at various locales around the world.
- The equipment in the MPS will be sealifted to a benign port or beachhead near the objective area.
- USMC personnel and helicopters will be airlifted to the objective area.
- The airlift, as well as the sealift, will be unopposed.
- USMC fixed-wing aircraft will be flight-ferried to the objective area.
- Personnel and equipment will be married-up at the port facility or beachhead.
- There will be at least 30 days of combat supplies for the reaction force within the MPS that includes some replacements for combat losses.

This concept fits the present NTPF with four major differences. First, the equipment of the MPS will be a collection of projected equipment requirements for the objective area. Second, the equipment of the MPS is not an "out-of-hide" asset, it is additional equipment procured only for MPS. Third, the shipping will be of advanced design to enhance on-loading, off-loading, and maintenance of the equipment while on board. And fourth, the vessels of the MPS force will be capable of off-loading equipment directly over a beach when port facilities do not exist, are unavailable, or are inadequate. This last difference is probably the most significant and of the greatest strategic value.

One strategic weak point with NTPF is the off-station time required to conduct equipment maintenance. Due to space confinements of current NTPF ship designs, cyclic maintenance cannot be performed without off-loading the equipment. On the other hand, the new MPS vessels will be constructed to enable maintenance crews to perform this cyclic maintenance aboard; and each ship will accommodate a maintenance crew, either civilian or military, that will stay aboard year-round to continually inspect and maintain equipment and cargo. With crews conducting continuous limited maintenance, and with proper self-maintenance of the force's vessels, MPS will be able to stay on-station until ship maintenance requiring port facilities and/or ship certification are necessary—probably biannually.

It is preferable to design and build ships for this program from the keel up; however, building 12 to 15 ships of this type under the present financial and time constraints is not feasible. The next best option is to buy or lease converted commercial shipping. This will allow the ships to be put into service more quickly and will be more cost effective in the long term. Congress is now monitoring this course of action.

Maritime prepositioning does *not,* nor does it intend to, replace amphibious operations upon hostile shores to establish or reestablish U.S. influence. Rather, maritime prepositioning provides the U.S. with a clear and identifiable reinforcement source for sustained and successful operations. We must first field a force with credible military might. The Marine Corps accomplishes this through task organization.

Amphibious Operations. It is imperative at this point to clarify the use of any maritime prepositioning vis-a-vis Marine Corps missions. As stated in the National Security Act of 1947, the Marine Corps is assigned the missions of seizure and defense of advanced naval bases, as well as land operations incident to naval campaigns. Amphibious operation, as defined in ATP-8, *Doctrine for Amphibious Operations,* is,

If necessary, Marines would mount an amphibious assault to secure a beachhead or port for the use of follow-up forces.

"An operation, launched from the sea by naval and landing forces involving a landing on a hostile shore." There are four types of amphibious operations: assault, raid, demonstration, and withdrawal.

If required, due to the lack of a benign or supportive port facility in the objective area, the Marine Corps would be called upon to perform in their time-honored manner of seizing such a port facility or beachhead. This initial amphibious assault would be conducted by a Marine air-ground task force (MAGTF). MAGTFs are task-organized in three basic sizes. The smallest, a Marine amphibious unit (MAU), is normally built around a reinforced infantry battalion or battalion landing team (BLT) and a composite Marine air squadron. The MAU has limited assets and normally will not conduct amphibious assaults on its own. However, it does provide an immediate reaction capability for crisis situations and is capable of relatively limited combat operations. The second, a Marine amphibious brigade (MAB), is normally built around a reinforced infantry regiment or regimental landing team (RLT), a provisional Marine aircraft group (MAG), and a Logistics Group. The largest MAGTF is the Marine amphibious force (MAF). A MAF is normally built around a Marine infantry division and Marine aircraft wing. The key word in each of these MAGTFs is *task organization.* With relative ease and rapidity, each MAGTF can be organized and established. There are three MAF staffs always in existence, and each one has the responsibility to maintain one MAB on an operational or nucleus basis. From this peacetime status of MAGTFs, the response capabilities of U.S. forces worldwide is increased. Thus, combined with maritime prepositioning, MAGTFs offer additional support to the rapid and credible military force problems facing the U.S. today.

All MAGTFs have four basic elements:

- *Command Element.* The MAGTF headquarters is the command element. It is composed of the commander, the general or executive and special staff sections, and the requisite communications and service support facilities.
- *Ground Combat Element (GCE).* The GCE is the ground maneuver element which has been tailored to operations in the objective area. It consists of combat and combat support elements, i.e., infantry, tanks, artillery, amphibious assault vehicles, etc.
- *Aviation Combat Element (ACE).* This element is also tailored with Marine fixed-wing aircraft, helicopters, Marine wing support group, air control group, and antiair warfare forces.
- *Combat Service Support Element (CSSE).* This element is task-organized to provide service support beyond the organizational capabilities of both the GCE and ACE.

A MAGTF of MAB or larger size, has considerable assets that make it a highly credible military force. With its own air cover, the ground maneuver element can readily and successfully conduct ground operations. Dependent upon the omnipresent factors of mission, enemy, terrain, troops available, time, and space; the actual contents of the GCE may be infantry, mechanized infantry, or tank heavy.

Role of Marine Armor. Just what kind of armor assets will be involved in the MAGTFs is a particular concern of those in the Marine armor community. Assets of the tank company assigned to a notional MAB (figure 1) would come from a tank battalion (figure 2); and this company (figure 3), when task-organized for a specific mission, could possibly include TOWs (figure 4) and additional maintenance support such as an additional *M88* tank-recovery vehicle.

The role of Marine tanks in an amphibious operation, or subsequent land operations, is threefold:

- *Maneuver element.* The tank unit, whether platoon, company, or battalion, can be organized to use its armor-protected firepower, shock, and mobil-

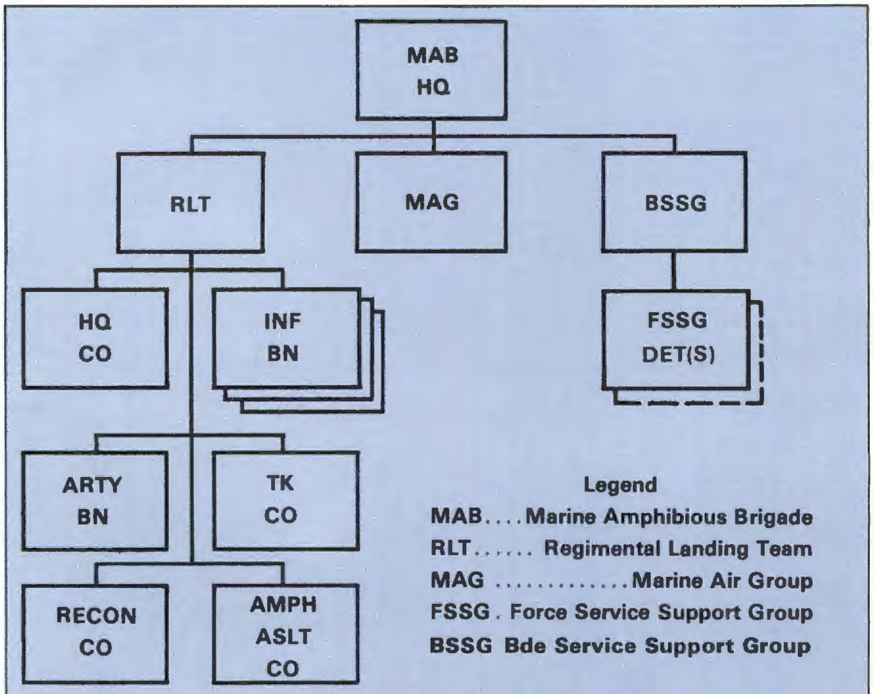


Figure 1. Notional Marine Amphibious Brigade

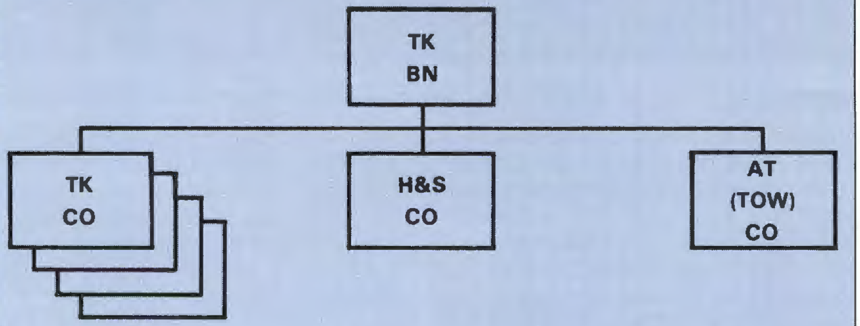


Figure 2.

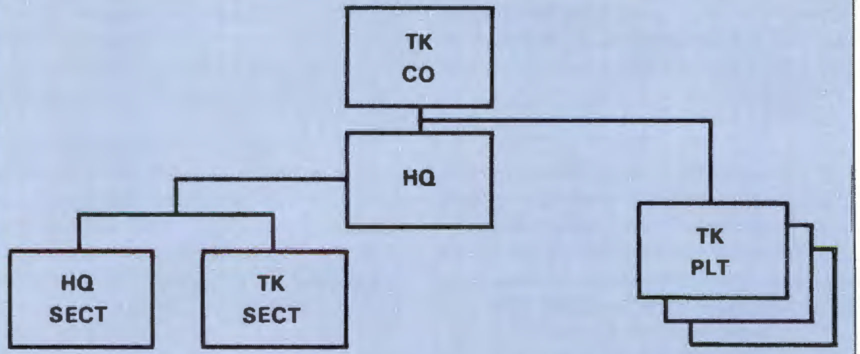


Figure 3.

ity to provide the MAGTF commander with all or part of a maneuver element.

- *Antitank protection.* Tank units participate in a MAGTF commander's countermechanized effort for protection of the landing force and beachhead.
- *Mechanized operations.* Task-organized with infantry, amphibious assault vehicles, and other combat assets, tank units can become the nucleus for, or a part of, a mechanized force.

In the amphibious assault, countermechanized efforts will probably be the predominant role for Marine tankers. Present-day ship-to-shore assets do not exist for moving large-scale, armor forces ashore during the initial assault. Therefore, after a beachhead is established, tank assets will be moved ashore to assist in defending and expanding the beachhead. If, however, the combat situation ashore is favorable, the MAGTF commander can readily employ his tank assets in a mechanized role or as a separate maneuver element. Regardless of the combat situation, the MAGTF commander cannot endanger the beachhead by not providing sufficient countermechanized protection. This is not to say that tank operations ashore will be easy or simple. The very nature of an amphibious assault makes all such combat operations violent, swift, and aggressive.

The more grandiose perception of major armor action is more likely to take place as greater armor assets are landed at the protected beachhead or port facility. Here enters the "maiden-in-waiting:" maritime prepositioned assets. With foresight and judicious prior planning, additional armor assets of a reinforced Marine tank battalion can be quickly moved into the operation area. Along with other combat assets and multipliers, the landing force can rapidly become a force that can establish or reestablish U.S. influence throughout the area of operations.

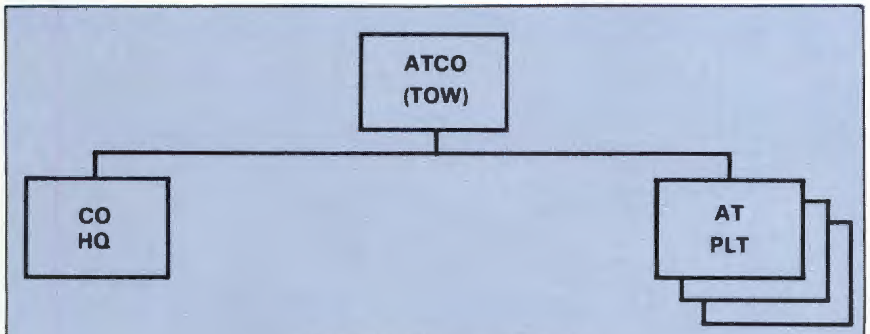
Marine Tanks in Offensive Operations. The employment of Marine tanks in offensive operations is similar to that of the Army. The Marine Corps has identified six types of offensive operations suited for tank employment: movement to contact, reconnaissance in force, coordinated attack, exploitation, pursuit, and raid.

Movement to contact is an operation that involves initial establishment of the beachhead. Unless unopposed, the landing itself will establish the contact in which the tanks will participate. If, however, the landing is opposed, the movement to contact is ideally suited for tank operations due to the tank's speed and flexibility.

A Reconnaissance in force is a combined arms operation involving Marine mechanized assets. This force has the ability to engage and disengage rapidly using the assets of the task-organized mechanized force. This form of offense will be used in subsequent land operations in addition to expansion and defense of the beachhead.

The Coordinated attack is the type of offense most frequently used in amphibious operations, and it is designed to provide maximum speed, mobility, shock, and firepower. The coordinated attack is used to expand the beachhead by breaking through the enemy's defenses and destroying his will to fight.

The exploitation, which follows the breakthrough, uses bold action to seize



(72 TOW Launchers Total)

Figure 4.

deep objectives such as communication centers, airfields, port facilities, and other key terrain, thereby providing additional security for the landing force.

Pursuit operations are an extension of the exploitation phase and are designed to apply pressure that will result in the eventual encirclement of enemy forces attempting to escape from the area of operations.

Raids strike deep into an enemy's rear for a specific reason other than holding or gaining key terrain. (See "The Airland Battle's Power Punch," *ARMOR,* September-October 1982.) It is an operation that requires a force that can move rapidly, strike hard with minimum risk and sufficient firepower, and then withdraw. An armored force has all of these capabilities and is ideally suited for raid operations.

Although these types of Marine offensive operations and their definitions differ slightly from those of the Army (movement to contact, hasty attack, deliberate attack, exploitation, and pursuit), their ultimate objective remains the same—destruction of the enemy with limited U.S. losses.

Marine Tanks in Defensive Operations. The Marine Corps employs two types of defense—position and mobile—which are similar in nature to the Army's strongpoint defense and dynamic defense.

Position defense is employed when the mission is to hold terrain for a specific period of time, the terrain to be defended is not suitable for mobile defensive operations, or when there are not adequate mechanized forces available to conduct the mobile defense. When employed in the position defense, tanks are a part of either the security force or reserve. As part of the security force, the tanks are used to detect, delay, destroy, disorganize, and deceive the enemy. In order to effectively accomplish a security force mission, terrain must provide favorable long-range, direct-fire engagements, numerous adequate routes to armor positions, and there must be sufficient infantry to provide close-in security for the tanks. As a part of the reserve, tanks are employed to provide depth to the defense, establish flank and rear security, and destroy enemy elements that have penetrated the forward edge of the battle area (FEBA). Only in extreme situations will tanks provide fire support to front line units while acting in a reserve role, for to do so would disclose the location of the reserve.

The *mobile defense* relinquishes terrain in order to position enemy forces where a counterattacking force can engage and destroy them. When employed in the mobile defense, tanks perform one of three roles; security force, fixing force, or attack force. As a part of the security force, tanks operate as far as 15 miles forward of the FEBA. The security force has the responsibility for providing early warning, preventing surprise, and developing the situation (similar to Army cavalry operations). The fixing force does not normally consist of armor. It is responsible for delaying, deceiving, disorganizing, canalizing, and forcing the enemy to mass. The attack force is task-organized predominantly with tanks, antitank, mechanized infantry, and highly-mobile, flexible, combat support and combat service spport elements. It is the attack force that engages the enemy in kill zones to destroy a numerically superior force.

Conclusion. This has been a brief review of strategic mobility for U.S. forces vis-a-vis maritime prepositioning and the role of the Marine Corps and its armor in such situations. The current status of U.S. strategic mobility is far better than it was 5 years ago when it relied heavily on POMCUS. Through such mediums as RDJTF, NTPF, MPS, and the established MAGTFs, the ability for rapid and successful U.S. response to global events has increased tenfold.

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CAPTAIN WILLIAM B. DRENNAN, USMC, was commissioned from the University of California, Los Angeles. He served as a tank platoon leader, motor transport officer and intelligence officer for 3d Tank Bn., and as assistant operations officer for 1st Tracked Vehicle Bn and series officer and company commander at San Diego. He is an AOAC graduate and is now with the 1st Tank Bn, 1st MarDiv., Camp Pendleton, CA.

Footnotes

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[4] Daniell, private interview, Wash., D.C., May 1982.

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The Soviet Tank Mystique

by Major Raphael A. Riccio

With the appearance of the Soviet *T-54* medium tank in 1949, and with the introduction of every new Soviet tank since, there seems to have been almost an air of paranoia in U.S. armor circles concerning the threat posed by whatever Soviet tank was in question.

This concern has stemmed not only from the huge numbers of Soviet tanks that have already been produced, but from the perceived qualitative superiority as well. The issues of quantity and quality have, at times, become hopelessly intermingled. Many writers concede that Soviet quantitative superiority serves as both the premise to argue for qualitative superiority as well as serving as the conclusive proof of such superiority. Clearly, however, the number of Soviet tanks in no way argues for their quality. Quite the opposite is very possibly true.

Although it would be difficult to prove, especially as one has to rely on Soviet statements and admissions, the Soviets themselves may realize that in a one-on-one confrontation against U.S. tanks, their own vehicles would not fare well. In fact, their philosophy, based on WW II experiences, reflects the attitude that *numbers,* not quality, win.

By placing their reliance on sheer numbers, the Soviets tacitly admit that the U.S. and other Western tanks are inherently superior to theirs.

The most recurring themes hold that Soviet:

- Tank design is more advanced than that of the U.S.
- Tanks are simple, rugged, and reliable.
- Tanks are superior to U.S. tanks.

All the foregoing statements are, at the very least, exaggerated, and should be examined in a realistic context and an objective perspective.

Undoubtedly, the *T-34* was the most successful tank ever conceived by the Soviets. It was an excellent tank for its time. It was simple, reliable, and rugged, and embodied many features that were clearly superior to the contemporary U.S. *M4 Sherman* tanks. The *T-34* had a better engine, a more powerful gun, better armor obliquities, and better mobility and agility than the *Sherman.*

Although the *T-34* brought the Soviets to the forefront of the armor field in WW II, in many respects, they never again matched the overall excellence of the *T-34* from which the *T-54/55* and *T-62* evolved. It is significant to note that the *T-34* was based on the *Christie* tank, an early U.S. design. Its engine, which was a dieselized version of a French Hispano-Suiza aircraft engine, underwent successive modifications and was used on all Soviet medium tanks through the *T-62.*

Thus, the *T-34* cannot be pointed to as an original Soviet design, although the Soviets must be credited with skillfully exploiting existing Western technology to suit their own needs.

Since the advent of the *T-54,* the general controversy concerning U.S. and Soviet armor refers to main (or medium) battle tanks (MBT). Thus, the datum point for a discussion of the relative merits and demerits of Soviet and U.S. tanks is the 1949-50 time frame, when the *T-54* and *M47* made their respective appearances. At that time, these tanks, and their successors, were seen as the chief contenders in any Soviet-American ground conflict.

It must be recognized at the outset, that both of these tanks were evolved from earlier tanks (the *T-54* from the *T-34* and *T-44,* and the *M47* from the *M26* and *M46*). For the next 25 years, all Soviet and U.S. MBTs evolved from these vehicles.

The *T-54* was a typical example of Soviet armor design philosophy. It maximized firepower and mobility somewhat to the detriment of armor protection, and crew considerations. Protection was achieved largely through well-designed armor surfaces and a very low silhouette, especially when compared to the *M47.*

The *T-54*'s 100-mm main gun was larger than the 90-mm main gun on the *M47,* but the *M47* had more advanced fire control equipment. The V-54 diesel engine of the *T-54* was superior to the gasoline engine of the *M47* in fuel consumption and range. Diesel fuel constitutes far less of a fire hazard than gasoline, but the Soviet magnesium alloy engine housing was prone to catch fire in combat.

Two factors that have an impact on armored vehicle mobility and agility are power-to-weight ratio (PWR) and ground pressure. PWR is an expression of the horsepower-to-ton ratio. (See "Engines for Combat Vehicles," *ARMOR* November-December 1982). Ground pressure is a measure of the pressure that a track's bearing surfaces exert on the ground. These two factors, when properly balanced (ideally, a high PWR and a low ground pressure) greatly influence a vehicle's speed, maneuverability, and ability to overcome obstacles and to traverse soft ground.

The PWR of the *M47* was much better than that of the *T-54* (17.6 vs. 14.4), although the Soviet tank fared better in the area of ground pressure (11.52 psi for the *T-54* vs. 13.3 psi for the *M47*). The *M47* had a measurably greater road speed than the *T-54*, but the 80-mile range of the *M47* was ridiculously low compared to the almost 300-mile range of the *T-54*. The low silhouette and compact dimensions of the *T-54* produced a smaller target at the expense of crew comfort and resulted in early fatigue. The tight dimensions also meant a much smaller basic load of main gun ammunition (43 vs. 71 rounds).

In 1952, the U.S. introduced the *M48,* whose hull and turret were different than that of the *M47,* although the armament, engine, transmission, and suspension were those of the *M47*. The first really significant improvement in the *M48* series came in 1955 with the adoption of the *AVDS-1790-2* diesel engine on the *M48A3*. The engine increased cruising range to almost 290 miles, but horsepower dropped to 750, with a consequent decrease in PWR to 15.9. Road speed, however, matched that of the *T-54*. Production of the Soviet *T-55* began in 1958. It was fielded with an uprated engine that shifted speed and PWR slightly to the Soviets' favor.

However, the advantages enjoyed by the *T-54/55* were short-lived. With the introduction of the U.S. *M60*-series tanks in 1960, the Soviets were faced with a very solid and reliable weapon system. The U.S. adopted the British 105-mm main gun, which, coupled with U.S. fire control equipment, made it a potent adversary. It was, and is, in its successive modifications, an outstanding fighting vehicle that has been proven in combat. Its chief shortcoming, with respect to the *T-55,* and later the *T-62,* is in its PWR (15.3 for the *M60A1* vs. 16.1 for the *T-55*).

The Soviets attempted to meet the threat posed by the *M60A1* by introducing the *T-62* in 1964. It mounted a 115-mm, high-velocity, smoothbore gun with an extremely flat trajectory. This weapon system caused much concern in Western circles, but even though the 115-mm gun was a formidable weapon, it was not without accuracy problems.

The Soviets attempted to improve mobility in the *T-62* by increasing engine power to 580 hp, giving it a PWR of 19.2, and a road speed just slightly higher than that of the *M60A1*. The engine, however, was the original design used on the *T-34,* and when it was pushed to its operating limits, experienced serious vibration problems.

In addition, the *T-62* incorporated what can best be described as "gadgetry" in the form of some rather complicated mechanical arrangements with its cannon, one of these being an automatic ejection system for spent shell casings. As soon as the main gun fires, it automatically depresses to its maximum limit, lining up the breechblock with an ejection port in the rear of the turret. When the breechblock opens, the casing is ejected through the open port.

This is a good system on paper, but has a few major drawbacks, aside from the complexity that it adds to the main gun system. First, the time needed to depress the gun and then to elevate it back to the proper firing attitude decreases the rate of fire, even though the procedure is automatic. Second, if the system is out of register, the spent casing will not clear the port and will ricochet violently about the cramped confines of the crew compartment and will probably cause equipment damage or personnel injury.

Surely, if such a system had been adopted on a U.S. tank, Congress and other assorted critics would have had a field day. Because the Soviets have done it, however, there are apologists who describe such lunacy as "technical innovation" or "advanced design."

Having considered some detailed aspects of the *T-54/T-55/T-62* evolution and the *M47/M48/M60* evolution, we arrive at a somewhat logical point from which to look at and assess current Soviet and U.S. tank strengths and deficiencies.

One of the accusations consistently leveled against U.S. tanks is that silhouettes are too high; both in absolute terms and in terms relative to Soviet tanks. This is the type of facile statement that, on the face of it, is unchallengeable, and that gains credibility by repetition. The truth is that this is an observation that ignores a number of factors, all of which are important.

First of all, it ignores the obvious fact that Soviet and U.S. tank designs are based on radically different philosophies. Soviet design takes very little cognizance of human engineering factors. The U.S. builds a tank around its crew. The Soviets first lay down the criteria for the vehicle, build the tank, and then fit the crew to it, as is evidenced by the height restrictions placed on Soviet crews.

The Soviets accept reduced ammunition stowage capabilities and limited depression and elevation angles for their main guns, as well as the lack of crew amenities, in order to reduce vehicle size and mass. These conditions are simply unacceptable in U.S. tank design.

The second fact, which is ignored, is that the advantages ascribed to low silhouette are predicated upon engagements in open, flat terrain. In actuality, on hilly or broken terrain, or where vegetation is available, the so-called height disadvantage of U.S. tanks rapidly disappears. This height and the greater depression capability of the U.S. main gun may well provide an advantage over the larger-caliber Soviet main guns.

It is world-wide tank doctrine that tank commanders seek the protection afforded by concealment or by defilade positions. Putting an *M60A1* in defilade very quickly reduces its silhouette and its ability to depress the main gun to a greater degree than Soviet tanks greatly enhances its flexibility.

"The question, however, can still be raised as to how the M1 Abrams compares with the T-64, T-72, and T-80. If precedent is any indication, the M1 is the better tank."

In a European environment, the height of the *M60A1* would, in many instances, enable the commander to identify targets before the opposing commander would be aware of the presence of the U.S. tank. Operational experience between Israeli and Arab armor (read that as U.S. and Soviet tanks) in the desert has shown that Soviet tanks tend to kick up greater amounts of dust when firing.

Because the main gun on Soviet tanks is close to the ground, the tanks suffer significantly greater obscuration problems than do U.S. tanks in a similar environment.

The size and lethality of main gun armament has been an area of continuing action-reaction between the U.S. and the Soviets. The Soviets have consistently had larger caliber main guns than U.S. tanks. For the foreseeable future, the Soviets will have an even larger caliber gun (125-mm on the *T-64* through *T-80* vs. the 120-mm projected for the *M1E1*). Large caliber does not necessarily equate to a better weapon. Caliber is not the sole factor determining a gun's effectiveness. Ammunition, rangefinding, sighting, and gun laying equipment all play important roles in determining whether or not the gun's caliber has any overriding value.

Although the Soviets place a great deal of emphasis on mobility and have managed to achieve a PWR and ground pressure generally better than that of U.S. tanks, the mobility of Soviet tanks has been only marginally, if at all, better than that of U.S. tanks. The live, suspended-track system used on U.S. tanks is generally conceded to be superior to the dead, flat-track system used by the Soviets. This appears to have been proven by the Soviet adoption of a suspended-track system on the *T-64* and subsequent tanks.

The transmissions used by the Soviets also have a negative impact on the mobility of their tanks. They have retained a manual-shifting transmission and clutch that is more efficient in transferring engine power to the drive sprocket than is an automatic transmission or torque converter, but it is not as flexible. Manual shifting tends to burn out clutches, and Soviet tanks apparently suffer a high percentage of clutch problems, especially when precise maneuvering is required.

What has been said thus far should, as a minimum, cast very serious doubt on the premise that Soviet tanks from the *T-54* through the *T-62* were markedly, if at all, superior to corresponding U.S. tanks. In truth, combat between foreign armies using Soviet and U.S. armor has shown U.S. tanks to be superior, even when outnumbered.

The question, however, can still be raised as to how the *M1 Abrams* compares with the *T-64, T-72,* and *T-80*. If precedent is any indication, the *M1* is the better tank.

Looking at the three classical components, firepower, protection and mobility of the tank as a weapons system, we can speculate as to the merits, or lack thereof, on both sides.

The evolutionary process of the *T-34* apparently ended with the *T-62* (although there is some speculation that the *T-72* is a highly evolved *T-62*). In 1964, the Soviets began series production of the *T-64,* but it was not until 1975 that any substantial details began to emerge. The *T-64* ultimately turned out to be the first new Soviet MBT since the *T-34*. In addition to a new hull and turret, it mounted a new, partially-rifled, smoothbore 125-mm main gun, an automatic loader, a new engine, new suspension system, and improved fire control system.

Then, in November 1977, the Soviets unveiled the *T-72,* which came as somewhat of a surprise following the *T-64* as closely as it did. Both of these tanks have a number of similar features and were apparently developed on parallel paths. Both have the same main gun armament, but have different fire control systems; their turrets are similar but not identical, as is the case with their suspension systems; their engines are totally different, although the transmissions are probably the same.

Because the Soviets are so secretive and security conscious, the appearance of these two tanks within such a short period of time leaves many questions unanswered.

At one point, it was felt that the *T-64* would be the replacement for the *T-62*. Later, it began to appear that the *T-64* would be issued only to Soviet units. Then, with the appearance of the *T-72,* the theory was advanced that the *T-64* may have been only an interim tank between the *T-62* and *T-72*. Most recently, however, speculation has been that the *T-72* was originally conceived as an "export" tank, but is now being used by the Soviets in lieu of the *T-64* on a stopgap basis until the *T-80* appears.

The *T-64* continues to be plagued by a number of problems that were not overcome during the testing phase. It is unclear whether the main gun of the *T-64* (and *T-72*) is experiencing problems, or even if it is reliable. It is likewise unclear as to the reliability of the *T-64*'s new engine. Similarly, doubt exists as to the precise composition of both the hull and turret armor on both vehicles.

It is predicted that the *T-80* will probably:

- Mount the same 125-mm main gun.
- Use armor technology stolen from the British (Chobham armor).
- Weigh about 45 tons.
- Be powered by an engine developing about 1,000 hp.
- Have a variable hydropneumatic suspension.

Both the *T-64* and *T-72* continue to reflect the Soviet preference for firepower and mobility over protection. The 125-mm main gun fires two types of antiarmor ammunition and high-explosive fragmentation ammunition.

Rangefinder and fire control system on the *T-64* and *T-72,* although probably not identical, are theorized to be much more effective than equipment on the *T-62*. The equipment may be either electro-optical or laser devices. The gun and fire control system is coupled with an automatic loader. The autoloader eliminates the need for one crew member (the loader), reducing crew size to three.

The benefits of the autoloader are somewhat arguable. The rate of fire and probably increased ability to fire accurately on the move must be balanced off against the possibility of a mechanical or electrical failure rendering the entire system useless. The elimination of one crew member may also be detrimental because normal maintenance and crew duties must be performed by three rather than four men.

The Soviets have increased the mobility of both the *T-64* and *T-72* by adopting larger engines (750 hp and 775 hp respectively) and by abandoning the dead, flat-track system with large road wheels. They opted for the live, suspended-track system used by the U.S. since WW II.

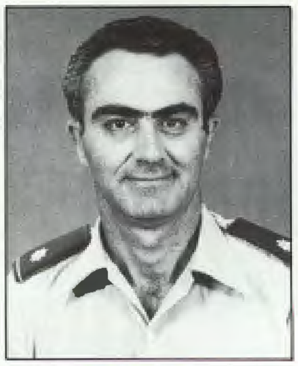
The PWR for both tanks is well above that of the *T-62*. At 38 tons, the *T-64* has a PWR of 19.7, and the *T-72* at 41 tons has a PWR of 18.9. The new suspension and greater PWR should increase the mobility of both vehicles.

There is ample evidence to indicate that the *T-80* will use special armor similar to that used on the *M1,* that will make it a tougher vehicle to defeat. If the *M1* and the *T-80* are using basically identical armor technology, they are going to be basically equal with respect to protection.

The design of the *M1* was predicated upon a more balanced blend of firepower, mobility, and protection. The current production version mounts the same 105-mm main gun as does the *M60*-series tanks, but the *M1E1* is scheduled (beginning in 1984) to mount a German-designed Rheinmetall 120-mm main gun. This gun, with its updated ammunition and advanced fire control system, should perpetuate the situation of U.S. main guns being smaller than contemporary Soviet guns, but which are fully capable of facing Soviet opponents.

The mobility and agility of the *M1* is provided by a 1,500 hp AVCO *AGT-1500* turbine engine that, despite teething problems, appears to be working out satisfactorily. This gives the *M1E1* a PWR of 26.8. The *T-80* is expected to mount an engine developing about 1,025 hp that will provide a PWR of about 23 (based on a weight of 45 tons).

The *M1,* with the 120-mm main gun, should easily outmatch the *T-64* and *T-72*; and it should roughly equal the *T-80's* main armament. All considered, it really is difficult to make a case for the superiority of Soviet tanks over U.S. tanks on the basis of history, analysis, or operational experience.



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Standard Prepare-to-Fire Checks

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A tank is a complex piece of machinery. So much so, that just getting it ready to shoot is a major activity. In fact, the technical manual (TM) for an *M60A1* tank lists well over 200 separate checks as part of the routine before-operations preventive maintenance checks and services (PMCS), and the prepare-to-fire checklist and its discussion in FM 17-12, *Tank Gunnery*, is 14 pages long. If you try to use the TM, you will find the checks are awkward to use and located throughout several different manuals.

The usual response by tank battalions has been to develop comprehensive prepare-to-fire checklists of their own. Unfortunately, these checklists are commonly too long to be practical when the tank is on the ready line of a tank range or operating in the field. Consequently, many tank commanders have developed their own abbreviated checks, but since each tank commander has a better idea, no two are alike. Standardization simply does not exist, and moving even a well-trained crewman to another tank can produce much initial confusion.

This lack of practical, standardized prepare-to-fire checklists suitable for use on the ready line of a tank range routinely costs crews engagements. These lost engagements are especially painful on the Tank Crew Qualification Course (TCQC). Recognizing this problem—from painful

1. **TC commands:** PREPARE-TO-FIRE

TC's checks and actions
_____Cleans exterior lens
_____M36 ballistic shield
_____TC's instrument lights
_____105D mounting wedge

Gunner's checks and actions
_____Remind loader to check replenisher tape
_____Clean interior sights
_____Gunner's ballistic shield
_____Instrument lights
_____Remind TC to check 105D mounting wedge

Driver's checks and actions
_____Cleans periscopes
_____Lower seat
_____Close hatch
_____Master battery ON

Loader's checks and actions
_____Replenisher tape
_____Breechblock crank stop
_____Breech clear
_____Coax mount & coax mounted
_____Ammo loaded & stored

2. **TC commands:** CHECK FIRING SWITCHES

TC's checks and actions
_____M68 override trigger
_____Coax override trigger

Gunner's checks and actions
_____Main gun switch ON
_____Coax trigger ON
_____All coax triggers good
_____All M68 triggers good
_____All gun switches OFF

Driver's checks and actions
_____Start engine
_____Insure radio OFF

Loader's checks and actions
_____Close breech
_____Insert circuit breaker
_____M68 safety on FIRE
_____Coax safety on FIRE
_____Stow circuit tester

3. **TC commands:** CHECK GUN CONTROLS

TC's checks and actions
_____Power traverse and elevation

Gunner's checks and actions
_____Turret into operation (ACUTES)
_____Zero pressure
_____Azimuth indicator accuracy
_____Elevation quadrant

Driver's checks and actions
_____Stand fast

Loader's check and actions
_____Turret clear
_____Turret unlocked
_____Hull ammo secure

4. **TC commands:** CHECK FIRE CONTROLS

TC's checks and actions
_____M85 cupola check
_____Cupola power ON
_____Range/knob binding
_____Computer switch ON
_____Various range checks
_____Boresight rangefinder
_____Boresight M85
_____Rangefinder established zero

Gunner's checks and actions
_____Range correction on 0
_____Computer operation
_____Boresight 105D
_____Established zero set
_____Ammo indexed

Driver's checks and actions
_____Stand fast

Loader's checks and actions
_____Open breech
_____Load coax
_____Load main gun

5. **TC commands:** CHECK COMMUNICATIONS

TC's checks and actions
_____Intercom
_____Mask on
_____Intercom
_____Mask off

Gunner's checks and actions
_____Intercom
_____Mask on
_____Intercom
_____Mask off

Driver's checks and actions
_____Intercom
_____Mask on
_____Intercom
_____Mask off

Loader's checks and actions
_____Intercom
_____Mask on
_____Intercom
_____Mask off

6. **TC commands:** REPORT

Crew responds:
TC READY GUNNER READY DRIVER READY LOADER READY

Figure 1. Prepare-to-Fire Checklist

prior experience—we developed a standardized prepare-to-fire checklist system for the 2d Battalion, 5th Cavalry.

As we worked through our initial attempts, it became apparent that three different checklists were required: one comprehensive checklist that covers all items that must be correct before the tank leaves the motor pool; an abbreviated list (sort of a prepare-to-takeoff check) for making crucial, last-minute checks on the ready line; and a very brief "prepare-for-the-next engagement" checklist to be used between engagements.

Even the first checklist is a departure from the norm (figure 1). It attempts to organize the checks in a logical sequence that coordinates the crew's activities. For example, in the first check, the tank commander commands PREPARE-TO-FIRE. He then executes his tasks, and announces each as he does so. The gunner makes his checks, but announces them only after he hears TC READY. Once the gunner announces GUNNER READY, the driver and loader announce their checks in turn. When this final check is complete, the tank moves off to the range.

Arriving on the ready line, the tank commander announces PREPARE FOR FINAL PREPARE-TO-FIRE CHECKS. Using the abbreviated checklist (figures 2-5), the tank commander then performs checks 1 through 8 on his checklist, announcing each as he does so. His checklist, which is covered with acetate and mounted on the turret wall, is keyed to the checklists posted at each crew position. Each crewman follows along his checklist and then announces his checks in turn, following a standard sequence—tank commander, gunner, driver, loader. While the system looks complicated, it actually only takes about 3 minutes for a practiced crew to complete all the checks. Once the commander announces CREW READY, the tank is ready for the initiation of the next set of checks, which are also taped in appropriate places on the turret wall. When the tank crew examiner (TCE) announces the type of ammunition to be pre-loaded for the next engagement, the procedures in figure 6 are executed.

The entire check for the next engagement takes about 20 seconds and it ensures that the battlesight ranges are correct and that the tank is not going to fire a SABOT round with HEAT indexed in the computer. It also has an added dividend, it impresses the TCE.

Once the checklists have been posted in turrets and their use explained, crews must drill with them. Initially, a number of senior noncommissioned officers may resist using them, but even they will become believers after one or two runs. To encourage crews to use the checks and to help teach how to use them, we developed a competition based on the prepare-to-fire crew drill, rating both how snappy and how accurately the tasks were executed. Then, on the Tank Crew Proficiency Course (TCPC), we used a through-the-sight video system that also provided a tape recording of all the crew chatter. To qualify on any engagement, the prepare-to-fire checks also had to be executed correctly. Similarly, on all preliminary tank tables (VIIC, VI, and VII), successful accomplishment of these checks as part of the crew duties evaluation was mandatory to qualify the engagement. (Incidentally, crew chatter, fire commands, etc., can be recorded by using an ordinary cassette recorder attached to the "hot loop" terminals on the *AM-1780*/VRC.)

Obviously, these checks will have to be modified for other model tanks, and they are a long way from perfect. Our point is not that these cannot be improved upon, it is that some effort to standardize this kind of key activity is necessary, at least within a battalion, and this is our stab at it.

Does it work? Well, a lot of things go together to make a successful gunnery cycle—good leadership, planning and organization, and detailed, repetitive training. But we are convinced that a fair number of engagements on our last

1. **Crew reports.**

2. **TC commands:** PREPARE FOR FINAL PREPARE-TO-FIRE CHECKS

3. **TC's checks and actions**

_____Computer switch ON
_____Rangefinder coincidence good
_____Momentary hold switch ON
_____M85 safety switch ON
_____Ballistic shield UP
_____Radio/intercom ON
_____Protective mask installed
_____TC's instrument light ON

3. **TC commands:** CHECK PROTECTIVE MASK

Crew responds: _____ GUNNER UP _____ DRIVER UP _____ LOADER UP

TC commands: ALL CLEAR

4. **TC commands:** CHECK COAX FIRING TRIGGERS

Gunner responds:
_____ELECTRICAL TRIGGERS UP
_____MANUAL TRIGGER UP

TC responds:
_____M85 MANUAL TRIGGER UP
_____M85 ELECTRICAL TRIGGER UP
_____TC OVERRIDE UP

5. **TC commands:** CHECK MAIN GUN TRIGGERS

Gunner responds:
_____ELECTRICAL TRIGGER UP
_____MANUAL TRIGGER UP
_____MANUAL BLASTER UP

TC responds:
_____TC OVERRIDE UP

6. **TC commands:** CHECK GUN CONTROLS

Gunner responds:
_____POWER
_____MANUAL CONTROL UP
_____ELECTRICAL CONTROL UP

Loader responds:
_____CLEAR

TC responds:
_____POWER
_____TC OVERRIDE UP
_____CUPOLA CONTROL UP

7. **TC commands:** CHECK FIRE CONTROL

TC announces:
_____RANGEFINDER ONE TWO HUNDRED

Gunner responds:
_____COMPUTER ONE TWO HUNDRED

Continue check at 1400, 1600, 2000, 2200, 2400

8. **TC announces:** CREW READY

Figure 2. Tank Commander's Ready Line Checklist

level-I gunnery were saved by these checks. In fact, we could not identify a single engagement that was lost because of a crew failure to properly execute prepare-to-fire checks or to index the correct ammunition. We believe the successful execution of these checks played a major role in allowing us to break all the existing III Corps gunnery records in our last tank gunnery.

In short, training for gunnery involved much more than teaching tank commanders to issue proper fire commands or gunners to obtain correct sight pictures. The most basic of all activities—preparing the tank to fire—is the critical task in which crews must be trained first. A standardized prepare-to-fire check system—at least at battalion level—is essential to good gunnery training.

1. **Crew reports.**
2. **TC commands:** PREPARE FOR FINAL PREPARE-TO-FIRE CHECKS

Gunner responds:

_____TURRET POWER
_____MAIN GUN SWITCH ON
_____COAX SWITCH ON
_____COMPUTER CIRCUIT BREAKER ON
_____COMPUTER RESET BUTTON ON
_____INSTRUMENT LIGHTS ON
_____RANGE CORRECTION KNOB ON
_____PERISCOPE BALLISTIC SHIELD UP
_____PROTECTIVE MASK INSTALLED
_____ALL SIGHTS CLEAR
_____GUNNER READY

Note. The remainder of the checklist posted at the gunner's station is identical to items 3 through 8 of figure 2.

Figure 3. Gunner's Ready Line Checklist

1. **Crew reports.**
2. **TC commands:** PREPARE FOR FINAL PREPARE-TO-FIRE CHECKS

Driver responds:

_____ALL GAUGES IN GREEN
_____BRAKES GOOD
_____MASTER BATTERY ON
_____GAS PARTICULATE ON
_____PROTECTIVE MASKS INSTALLED
_____DRIVER HATCH CLOSED
_____ALL VISION BLOCKS CLEAR
_____DRIVER READY

Note. The remainder of the checklist posted at the driver's station is identical to items 3 through 8 of figure 2.

Figure 4. Driver's Ready Line Checklist

1. **Crew reports.**
2. **TC commands:** PREPARE FOR FINAL PREPARE-TO-FIRE CHECKS

Loader responds:

_____REPLENISHER ROUGH AND SMOOTH
_____CIRCUIT TESTER INSTALLED
_____MAIN GUN ON
_____COAX ON
_____BREECHBLOCK CRANK STOP TO REAR
_____TURRET UNLOCKED
_____ALL AMMO SECURE
_____TURRET CLEAR
_____PROTECTIVE MASK INSTALLED
_____LOADER READY

Note. The remainder of the checklist posted at the loader's station is identical to items 3 through 8 of figure 2.

Figure 5. Loader's Ready Line Checklist

TC Commands: PREPARE FOR A SABOT (or HEAT) ENGAGEMENT

TC responds:

_____COINCIDENCE GOOD
_____RANGE ONE SIX HUNDRED (or ONE ONE HUNDRED)

Gunner responds:

_____SABOT (or HEAT RETICLE)
_____RESET AND CIRCUIT BREAKER OK
_____RANGE ONE SIX HUNDRED (or ONE ONE HUNDRED)
_____SABOT (or HEAT) INDEXED
_____GUNNER READY

Driver responds:

_____ALL GAUGES ARE IN THE GREEN
_____DRIVER READY

Loader responds:

_____MAIN GUN AND COAX SAFETY ON
_____SABOT (or HEAT) LOADED
_____REPLENISHER ROUGH AND SMOOTH

TC announces:
CREW READY

Figure 6. Prepare for Next Engagement Checks.

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Sidi Bou Zid—A Case History of Failure

by Captain William R. Betson

Many officers are unaware of, and uninterested in, the tactics that brought success to Hannibal at Cannae or to von Manstein in the Ukraine. Neither have they taken the time to study the blunders committed by their own predecessors that precipitated disaster to American arms, such as those committed by Major General Lloyd Fredendall and Major General Orlando Ward at Sidi Bou Zid. What possible use, these skeptics may ask, is there in studying a battle fought nearly 40 years ago? We need to prepare for the next war, they may say, not refight the last.

The battle of Sidi Bou Zid has many characteristics which commend it to such study. It was the first major defensive battle fought by U.S. armored units in WW II and the Americans were outnumbered by the Germans. Neither side enjoyed total air supremacy, although the enemy was able to gain local air superiority occasionally.

American ground-air efforts were controlled by II U.S. Corps headquarters, which was inexperienced in handling troops in combat, and was attempting to defend a wide frontage with troops of mixed nationalities. The U.S. forces consisted of the Regular Army 1st Armored Division (1st AD) augmented by the 168th Regimental Combat Team (RCT), a brigade-sized National Guard infantry unit. The quality of equipment was approximately equal. Although the Germans had an advantage in tanks and antitank guns, the U.S. superiority in artillery, infantry weapons, and general levels of issue redressed the balance. Finally, the II Corps would fight its battle in the desert, with a corps of a different nationality (French) on the flank, and with a higher headquarters also of a different nationality. The Germans also had foreign nationals (Italian) in their forces. In short, the action about to be conducted by II U.S. Corps possessed many of the characteristics that would face a U.S. heavy corps, should one be committed to combat with NATO forces in the future.

The Situation. Before describing the actual battle, a brief description of the strategic situation is necessary. Following their invasion of North Africa in November 1942, allied forces under the command of General Dwight D. Eisenhower had driven rapidly eastward attempting to capture the Tunisian ports of Bizerte and Tunis, thereby cutting the supply lines of Rommel's famed *Afrika Korps,* then fighting in Egypt. However, due to logistical problems, inexperience, and a brilliantly improvised German defense, the allied forces failed. By early February 1943, these allied units, now called the British First Army, were on the defensive all across their front, bringing up supplies and reinforcements while preparing to resume the offensive.

Intelligence indicated that the enemy forces in Tunisia, now reinforced by Rommel's army that had returned from Egypt, would use this lull to try to attack and defeat the British First Army before allied units, in turn, could be reinforced by their units from Egypt. Available information suggested that the attack would fall on the center of the allied line, a sector held by XIX French Corps. Basing his decisions on this information, Army commander, General Sir Kenneth Anderson, thickened this part of the front and positioned his reserve of a British

Armored Division and a U.S. combat command (CC) (a brigade-sized unit). This intelligence estimate was to prove to be incorrect and would have a critical effect on the operation.

II Corps, the southernmost of the three allied corps in line, had the dual mission of defending in sector and of protecting the flank of XIX Corps, where, as mentioned, the main attack was expected. To accomplish this mission, II Corps had the 1st AD (-), the 168th RCT, a British armored cavalry regiment,[1] and miscellaneous French units of about division strength called Force *Welvert*. II Corps determined that the most likely enemy avenue of approach was through the Faid Pass to Sidi Bou Zid, and assigned this sector to its most powerful unit, the 1st Armored Division, reinforced by most of the infantry RCT. The remainder of the corps front was screened by the armored cavalry regiment and a number of battalion-sized elements constructed from Force *Welvert* and various U.S. detachments. No real corps reserve existed except for some engineer, tank destroyer, and infantry units assigned to rear area security.

The Allies were correct in assuming that the Germans would attempt to take advantage of the lull in the British First Army's operations to attack the Allied force before reinforcements from Egypt arrived. Unfortunately, Allied intelligence had guessed wrong as to the point of attack. Axis plans called for an attack in II Corps' area by three armored divisions. Although these were rather weak divisions, they still possessed considerably more combat power than II Corps. Hence, a well-conducted U.S. defense would be necessary.

The Germans, at this time, had not established a coherent system of command in Tunisia. The three German divisions (one included Italian formations) were controlled by two different armies. The main attack, consisting of the 10th and 21st *Panzer* Divisions, would strike through Faid Pass to Sidi Bou Zid. A supporting drive by a division-sized element from the *Deutsche Afrika Korps* of *Panzer Armee Afrika,* would strike the southern portion of II Corps' front. Although the objective of the attack was not agreed upon by the two armies involved, it was generally hoped that a severe blow could be dealt to the green American units from which they would be slow to recover.

This violation of the principle of unity of command, however, would cause the Germans to hesitate in following up their initial victories. This failure would make the Allied disaster less serious than it might have been. But it is not with the German failure that we are concerned. The German main attack, driving out of Faid Pass, would initially smash the 1st AD in a 2-day battle. It is this short fight with which this account will deal.

U.S. Defensive Plans. Although the Allied high command had failed to anticipate the location of the German assault, the dispositions of II Corps looked good on paper. II Corps had correctly surmised the main enemy avenue of approach in its sector, and the 1st AD placed there should have been able to slow the main enemy drive until British First Army reserves could be shifted from the north to help. Unfortunately, however, all was not well with the U.S. command. Neither the corps commander, Major General Lloyd R. Fredendall, nor the commanding general of the 1st AD, Major General Orlando Ward, were on the best of terms. Fredendall thought Ward incompetent and often bypassed his division commander and gave orders directly to the division's combat commands. A British historian and former general describes Fredendall as "a prime specimen of the traditional over-ripe, over-bearing, and explosive senior officer in whom the caricaturists have always delighted."[2] Perhaps Fredendall's personality can best be appreciated by reading the following order given to a combat command commander in 1st AD:

> "Move your command, i.e., the walking boys, pop guns, baker's outfit and the big fellow to M, which is due north of where you are now, as soon as possible. Have your boss [the division commander!?] report to a French gentlemen, whose name begins with a J, at a place, which begins with D, which is five grid squares to the left of M. Further, CC B will enter corps command net NLT 0900."[3]

In keeping with his concept of how to run a corps, and his distrust of Ward, Fredendall's orders to his division commander regarding the defense of Sidi Bou Zid were exceedingly specific, down to the precise placement of tank companies and artillery batteries.[4]

Under these uncertain and personality-clash ridden circumstances, General Ward commenced his defense planning. Of its 10 organic and 3 attached maneuver battalions, 1st AD would have only 7 available for the defense of its sector. Three were detached with CC B to army reserve, two to the force screening the corps' flank, and one conducting rear area security operations.[5] Ward consequently consolidated his attached RCT with CC A, 1st AD,[6] and placed his remaining two CCs in line with the division's 81st Armored Reconnaissance Battalion (ARB) guarding his southern flank. One light tank battalion and one armored infantry battalion were held in division reserve. The stronger CC A, with three maneuver battalions, occupied the most likely avenue of approach—the area around Sidi Bou Zid.

The defense of this sector, you will remember, had been prescribed in detail by the corps commander. CC A, therefore, had almost no discretion in its defense plan. The avenue of approach from the German-held Faid Pass (map 1) consisted of two parallel roads that passed between the two hill masses. Corps directed that one infantry-heavy battalion combat team (BCT) be placed on the northern hill, a reinforced infantry battalion on the southern, and that a reinforced armor battalion be held in reserve. CC A organized for combat as shown in figure 1.[7]

CC A elements were deployed as shown on map 1, and on corps maps it must have looked ideal. Unfortunately, Fredendall and the corps staff did not really appreciate the terrain. The two hill masses were not mutually supporting; in fact, they were approximately 8 km apart. Therefore, instead of two mutually supporting battalion strongpoints guarding the exits from Faid Pass, 1st AD merely had two isolated outposts in the desert; and the mist and fog of February's weather compounded the problem.

The German Plan. About to descend upon these outposts were two veteran *Panzer* divisions. These divisions, the 10th and 21st, were commanded in this operation by the Chief of Staff Fifth *Panzer* Army, General Heinz Ziegler, Ziegler's scheme of maneuver for this effort, code-named *Fruehlingswind* (Spring Wind), called for 10th *Panzer* to attack Sidi Bou Zid directly through Faid Pass. Meanwhile, the 21st *Panzer* would emerge from Maizla Pass, about 15 miles to the south (the area screened by the 1st AD's, 81st ARB), swing behind the U.S. position at Sidi Bou Zid, and strike it from the rear. If all went well, the U.S. armored CC in the area would be caught and crushed in the pincer movement.

10th *Panzer,* commanded by General Fritz von Broich, was a proud and veteran formation. Instrumental in Guderian's famous breakthrough at Sedan in May 1940, it had long years of experience in France and Russia before being transferred to Africa. For this operation, however, because of the lack of full support given this maneuver by the army commander, the division would consist of only four maneuver battalions and one heavy tank company (Mk VI *Tigers)*, reinforced by antitank and artillery units. Von Broich divided this force into three brigade-sized *kampfgruppen* (KG) (battlegroups). The first unit to attack would be KG *Gerhardt,* consisting of a reinforced tank battalion and a reinforced mechanized battalion, which would exit the pass, swing north around the northern hill guarding the exit (Djebel Lessouda), and strike the U.S. position from the rear (map 2). The second group, KG *Riemann,* consisting of a mechanized battalion (heavily reinforced with engineers, additional infantry, and antitank units), and the heavy tank company, would follow KG *Gerhardt* but continue straight up the road to Sbeitle and strike the U.S. position from the front. The third group, consisting of a motorcycle battalion, plus the divisional engineers and antitank units, would be in reserve.

21st *Panzer* had been the first German division in Africa and had perhaps more desert experience than any formation on either side. For this operation, it was under the command of Colonel Hans Hildebrandt and contained the equivalent of seven maneuver battalions.[8] Hildebrandt organized two KGs: KG *Stenkhoff*, (armor-heavy with two tank and one mechanized battalions), would execute the planned left hook, swinging all the way around the U.S. position to attack the rear (map 2) and KG *Schuette* (with one tank and one mechanized battalion) would drive due north and strike Sidi Bou Zid from the south. The 21st *Panzer's* flank would be guarded by a reconnaissance battalion, and nonmotorized elements of the division—approximately a battalion in strength—were to hold Faid Pass until Sidi Bou Zid was reached by the rest of the division.

The plan was set to commence on 14 February. If all went well, nine reinforced German battalions would strike CC A, 1st AD from all sides and destroy it.

The Battle. CC A, 1st AD commanded by Brigadier General Raymond E. McQuillan, recognized the problems inherent in the corps' plan that had been thrust upon him. To attempt to maintain some contact between its scattered task forces, CC A's plan called for each reinforced infantry battalion to dispatch tank and antitank elements to positions in the plain beween the hill masses during the day, and for aggressive infantry patrolling to cover that area at night. Hopefully, the nighttime patrols or the units in the daytime blocking positions, supported by artillery observed from the hill masses, could delay the enemy long enough for the brigade reserve (the 3/1st AR (+)) to move to the threatened location.

Obviously, this plan was at its weakest at dawn when the infantry would be coming in from patrol and the armor would be heading out. Not surprisingly, dawn was the time the Germans attacked. At around dawn on 14 February 1943, G/31st AR(+) left Djebel Lessouda to accomplish the daytime mission.

Company G, under the command of Major Norman Parsons, was reinforced by elements of the regimental reconnaissance company and A/701st Tank Destroyer Battalion. As Parsons moved his force through the misty desert to his daytime positions, he ran smack into the veteran 10th *Panzers* moving out of Faid Pass.

Apparently, Parsons' tank was one of the first destroyed (perhaps he was leading). Unfortunately, all communications with the task force and its supporting artillery went with him. In a brief but violent action, Company G was quickly overrun.

Although neither the 2/168th BCT or CC A knew precisely what had occurred, the sounds of a tank battle convinced them a significant action had taken place. Consequently, General McQuillan ordered his reserve, the 3/1st AR (+), under command of Lieutenant Colonel Louis V. Hightower, to advance toward Poste de Lessouda to clear up the situation.[8] As the 3/1st AR (+) was leaving its assembly area, it was struck by a heavy enemy air strike. After absorbing some losses and overcoming the resulting confusion, the force moved out. After a short distance, it was stopped cold by long-range tank fire from KG *Reimann's Tiger* tanks. The *M3 Grants* of the 3/1st AR were unable to close the range sufficiently to be effective.

Meanwhile, at CC A's headquarters, reports showed the situation rapidly deteriorating. As visibility improved, 2/168th BCT reported approximately 80 enemy armored vehicles moving north in front of its position and that nothing more had been heard from G/3/1st AR. Next, CC A was informed

2/168th BCT
- 2/168th Inf (−)
- G/3/1st AR (Med Tks)
- Rcn Co/1st AR
- Plt/A/701st TD Bn
- G/91st AFA

3/1st AR (+)
- A/701st TD Bn (−)

3/168th BCT
- 3/168th Inf
- E/2/168th Inf
- AT Co/168th Inf
- Cannon Co/168th Inf
- Plt/109th Eng
- Rcn Plt/168th Inf

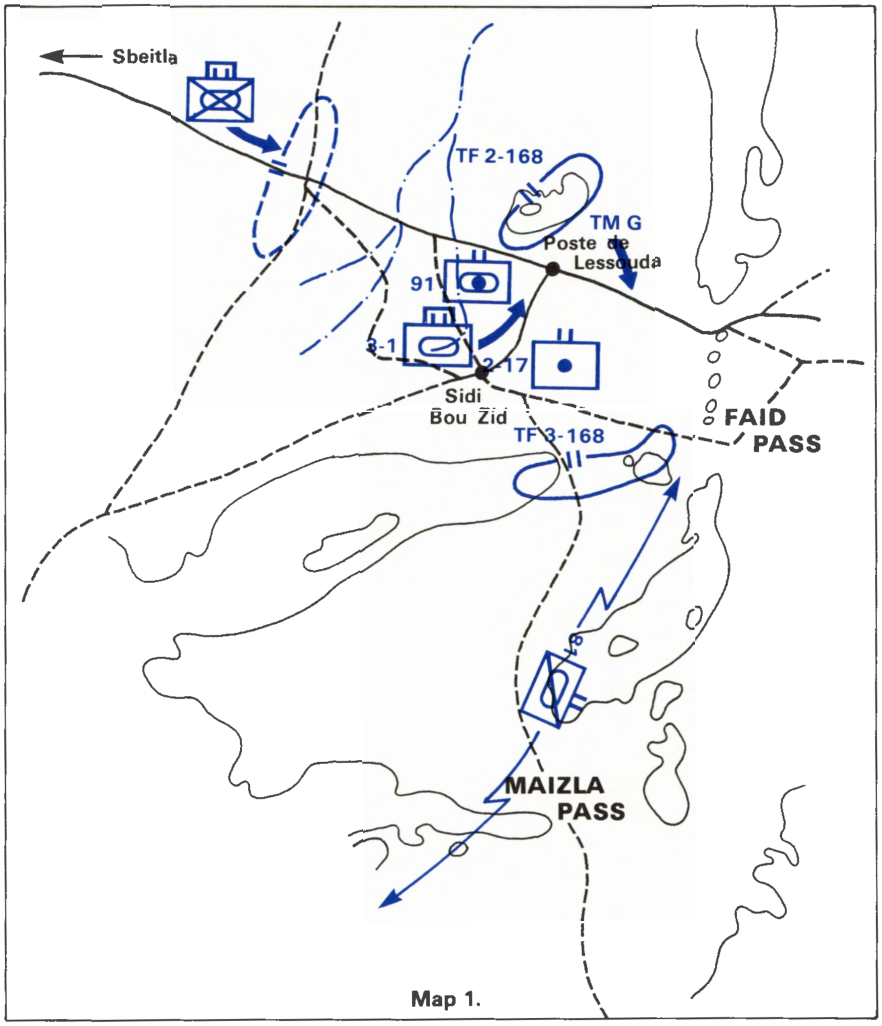
CC A Control
- 91st AFA Bn (−) (105-mm SP)
- 2/17th FA Bn (155-mm towed)
- Elms/443d CA (AAA)

Legend

TD—Tank Destroyer
CA (AAA)—Coast Artillery (Antiaircraft)
AFA—Armored Field Artillery
AR—Armored Regiment
BCT—Battalion Combat Tream

Note. The 2/168th BCT was commanded by the executive officer of the 1st AR, the headquarters of which was attached to CC A.

Figure 1.



Map 1.

that the enemy force (KG *Gerhardt)* was now *behind* the 2/168th BCT and had scattered B/91st AFA. The Germans now appeared to be moving south toward the main road to Sbeitla. Then the commander of the 3/168 BCT, Colonel Thomas D. Drake, called General McQuillan to report that a second large enemy force was driving between the two infantry forces, heading for the 2/17th FA's position. Drake reported observing the artillerymen panicking and fleeing.

"You don't know what you're saying," McQuillan replied. "They're only shifting positions."

"Shifting positions, hell," answered Drake, "I know panic when I see it."

McQuillan then hastily ordered this towed artillery unit to withdraw to safer positions. But as the shaken battalion was getting underway, it was struck by an air attack and totally destroyed, with every gun lost.

Hightower, commander of the 3/1st AR (+), was now in danger of being cut off. He directed his Company H (+) to delay the northern enemy formation while the rest of his force fell back slowly toward Sidi Bou Zid. In this action, he was ably supported by the 91st AFA (−), firing in a direct-fire role. The tankers fought their way back slowly and relatively skillfully, but with heavy loss.

Meanwhile, to the south, 21st *Panzers* emerged from Maizla Pass at 0600 and moved slowly north, the soft sand making the going hard for the *Afrika Korps* veterans. The 81st ARB, which was supposed to be screening this flank, failed entirely in its early warning mission. It was not until 0940 that a report reached division from C/1/81st ARB that 20 unidentified vehicles were emerging from the pass, a report that hardly described the advance of a *Panzer* division! Later that morning, A/1/81st ARB was cut off and captured with all its vehicles.

By noon, KG *Schuette* was approaching the 3/168th BCT from the south, but KG *Stenkhoff,* with a longer way to go, would not approach Sidi Bou Zid until late afternoon. The poor trafficability of this route would save the survivors of CC A.

The division commander, General Ward, at first did not consider the situation to be serious. Nevertheless, seemingly as a precautionary measure, most of the division reserve, the 1/6th BCT (3 armored infantry companies and 1 light tank company), was attached to CC A and ordered to begin movement toward Sidi Bou Zid. However, by noon, the seriousness of the situation became apparent at division when a report was received that the 3/1st AR had lost half its tanks. When KG *Schuette* approached the 3/168th BCT from the south, it was learned that the force from Maizla Pass was much stronger than the 81st ARB had reported, Ward saw that CC A was in trouble. He ordered the 1/6th BCT to form a blocking position on high ground 11 miles northwest of Sidi Bou Zid. CC A was ordered to withdraw its mobile elements through the 1/6th BCT to avoid being cut off. It was recognized that the 2/168th and 3/168th BCTs could not get out due to their lack of transport, and they were ordered to hold strongpoints until relieved by counterattack.

While the division commander was reaching these decisions, the 3/1st AR (+) was fighting for its life against superior forces. Lieutenant Colonel Hightower's command performed yeoman's service that day. While headquarters and service elements of CC A and the survivors of the artillery battalions packed up and withdrew, the 3/1st AR, now the size of a company, fiercely resisted probes from the 10th *Panzers* pushing southward toward Sidi Bou Zid. In the late afternoon, CC A's western movement was threatened by the advance elements of KG *Stenkhoff* moving up from the southwest. Hightower rushed over in his command tank and personally knocked out several enemy vehicles and drove off the rest. A parting enemy shot, however, destroyed his tank, but he and his crew escaped. Given respite by this sharp action, the exhausted and harried survivors of CC A passed through the lines of the 1/6th BCT.

Thus, through the hard fighting of the tankers of the 3/1st AR, the survivors of CC A, which, according to the Official History, "might have been pursued and perhaps destroyed," were able to get away.[10] This is certainly an optimistic assessment of the battle. Of the five battalions under the control of CC A, two were now cut off and surrounded, one (the 2/17th FA) had been totally destroyed, and the two remaining (the 3/1st AR and the 91st AFA), were so reduced as to be combat ineffective. Losses included 14 tanks, 10 of the 12 tank destroyers in A/701st TD Bn, and 9 of the 12 105-mm pieces of the 2/17th FA.[11] Nevertheless, the efforts of the 3/1st AR had saved many trained tankers and artillerymen (albeit without their weapons systems) and the smashed battalions could be more easily rebuilt.

The first phase of the battle was over, but the 1st AD, though chastened, had not yet given up the fight.

The American Counterattack. The reaction to these events at II Corps and First Army had been cautious. The 10th *Panzer* had not been identified during the fighting; therefore, it was thought that the enemy's tank strength, variously estimated at 90-120, could have come from the 21st *Panzer* alone.

The II Corps and First Army staffs, not knowing that the 10th *Panzers* had been committed, still insisted that the main attack would eventually be made by the 10th *Panzers* in the center. Hence, the only major reinforcement sent to the 1st AD was a tank battalion (2/1st AR) from army reserve. Orders issued by the various headquarters reflect the total misreading of the situation by the Allied high commanders. The Army directive to II Corps stated, "As regards action in the Sidi Bou Zid area, concentrate on clearing up the situation there and destroying the enemy." This cavalier assessment of the strength of the German force was also evident in division headquarters as reflected by Ward's plans for a counterattack. He selected Colonel Robert I. Stack's CC C to conduct the attack, saying, "This force will move south, and by fire and maneuver, destroy the enemy armored forces which have threatened our hold on the Sbeitla area."[12]

This order, which seems somewhat offhand in tone, is hard to reconcile with the fact that division *knew* that the force that had struck Sidi Bou Zid had at least 90 tanks.

This is certainly the greatest American blunder of the battle. For this attack, CC C would consist of the 2/1st AR, the 3/6th Armored Infantry, G/3/13th AR and supporting artillery and tank destroyers. CC C was, in fact, smaller than CC A, which was routed in a defensive battle by the very German forces CC C was supposed to destroy! That enemy force, I reiterate, was estimated *at the time* to be of *divisional* strength.

As one historian put it, "If ever there was a repetition of the Charge of the Light Brigade at Balaclava this was it. How it was thought that this small force would rescue two infantry battalions over 13 miles away with even one, let alone two, *Panzer* divisions ready to dispute its passage is hard to imagine."[13]

The American commanders could not have failed more completely to see the battle.

These failures of the division and corps commanders were compounded by the reckless manner in which CC C conducted its attack. One would assume, considering the disastrous occurrences of the 14th, that CC C's advance would be cautious. Instead, it assumed the characteristics of a cavalry charge. The CC C plan called for an advance southeast with the line of departure being Djebel Hamra (the position of the 1/6th BCT) in a column of battalions. The tank battalion would be in the van followed by the 68th AFA (SP). The 3/6th BCT, followed by a reserve tank company, would bring up the rear. The 75-mm half-track tank destroyers of B/701st TD were grouped on the wings of the lead battalion. Apparently, no thought was given to the front or, more importantly, flank security.

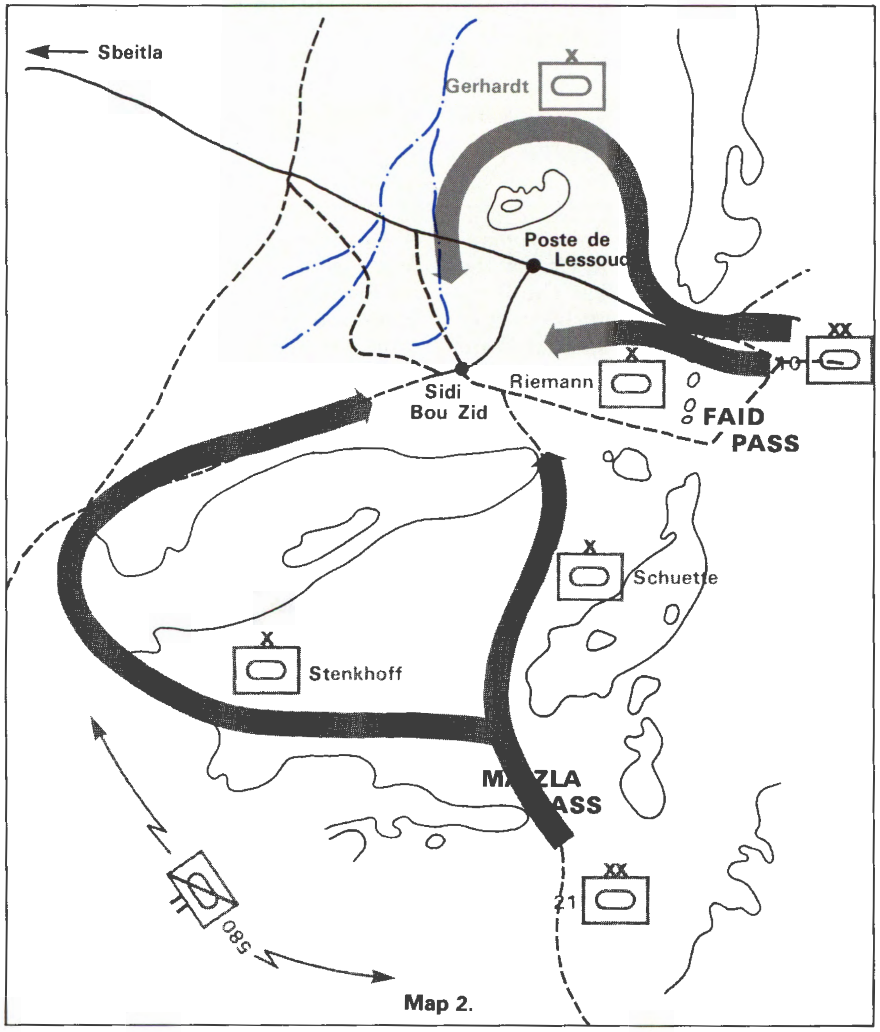
Colonel Stack established his command post atop Djebel Hamra, from which place he could observe the movement of his unit all the way to Sidi Bou Zid. Lieutenant Colonel James D. Alger, commander of the 2/1st AR, would be in tactical command of the advance. This interesting command arrangement would have tragic consequences.

The long distance some of the attacking units, especially the 2/1st AR, had to travel, coupled with enemy air strikes that repeatedly hit the brigade assembly area, caused the attack to be delayed until about 1240 hours, 14 February, when the brigade moved southeast in a large mass, with its elements maintaining *precision* formation. To the inexperienced soldiers of "Old Ironsides," the hundreds of vehicles moving as if on parade through the flat desert expanse must have looked impressive.

To the Germans it looked suicidal.

Antitank batteries were swiftly massed in front of the attacking force while elements of KG *Gerhardt* circled around to strike the northern flank of CC C. KG *Stenkhoff* did the same to the south. Airstrikes and artillery barrages were called in to divert American attention from these maneuvers. The German tactics worked like a charm.

CC C's axis of advance crossed three wadis that could only be crossed at certain points. At the first wadi, the platoon of tank destroyers on the northern



Map 2.

***Tiger I* with 88-mm gun**

wing of the formation was destroyed by an air attack. At the second, the lead tank company spotted an enemy antitank battery, knocked it out, and overran it. This initial success, however, proved to be ephemeral. Enemy artillery had now become more effective and airbursts forced the tankers to button up, further restricting their visibility.

As the third wadi was reached, things started to go seriously wrong. Suddenly, heavy, long-range antitank fire swept the lead tank companies with devastating effect. To make matters worse, as the 68th FA deployed and the 3/6th BCT passed through them, another air strike ensued that caused casualties and confusion in both battalions. About this time, the flanking attacks by the Germans struck home and a furious melee ensued in which Lieutenant Colonel Alger's tank was knocked out.

To the credit of the 1st AR, no rout ensued. Company E moved to check the northern pincer while Company F delayed the southern. But the Germans merely extended their left and right hooks westward to try to bag the entire American force. The second southern pincer was thrown back momentarily by furious fire from the 68th AFA. Unfortunately, CC C's reserve (G/3/13th AR), dispatched to deal with the northern enemy force, went too far to the northwest and missed the enemy. Most of the American forces then attempted a rapid withdrawal.

Meanwhile, back at Djebel Hamra, Colonel Stack had failed to fully appreciate the situation. At 1645, as the second pincer movement was closing around his advance elements, he reported to division that it would be *doubtful* if he could reach the trapped infantry battalions *before sundown*. A conversation with Lieutenant Colonel Alger, who had gotten to another radio, didn't clear things up. Alger reported that the situation was *in hand* and that he would give further details later.[14]

Alger, who was in the midst of a tank battle and who had just survived the destruction of his own tank must not have been aware of the situation to his rear. Things were certainly not *in hand*. (Alger himself would be captured a few minutes later.) The brigade was in retreat. By 1740, the 3/6th BCT, mauled but intact, protected by the guns of the 68th AFA, managed to escape. But the 2/1st AR was not so lucky; the pincers slammed shut behind them. Four tanks managed to slip through and escape, as did a couple of dismounted crews, but, as for the rest of this fine battalion, no further word was heard.

The failure of the American counterattack left the two surrounded infantry units near Sidi Bou Zid without hope of relief. Consequently, these units were ordered to abandon their equipment and attempt to escape and evade the enemy and return to friendly lines. The attempt by light infantry to accomplish such a task in the desert achieved predictably poor results. Although the 2/168th BCT managed to get over 200 men back to friendly lines, none of the considerably larger 3/168th BCT made it.

The decisive defeat incurred by the 1st AD at Sidi Bou Zid had far-reaching consequences. The Allied high command concluded that a general withdrawal of the southern half of the allied line was necessary. A new line would be established along the Grande Dorsale mountain ranges some 50 miles to the west. The center of the new II Corps line would be Kasserine Pass. Although the Germans would inflict further defeats on allied elements in the week to come, their failure to energetically follow up their success at Sidi Bou Zid enabled the allies to recover and re-form.

The Lessons. Sidi Bou Zid was the opening act in the drama that would become known, somewhat spuriously, as the Battle of Kasserine Pass, a name synonymous with the American Army's traditional unpreparedness for war.

Today we might not have an opportunity to learn from our mistakes in battle as did "Old Ironsides" in 1943. We must learn our lessons from the past, now, recognizing that some of the techniques of defensive battles by armored and mechanized units may have changed in 40 years, *but the principles remain the same.*

What caused the series of reverses around Sidi Bou Zid that resulted in the destruction of six U.S. battalions and the mauling of two more? The answer does not seem to lie in the morale of the units involved, or the quality or dedication of the troops (an *excuse* which we are, unfortunately in my view, hearing today), or the state of individual training. A German chronicler of the *Afrika Korps* remarks that the Germans were impressed by how hard the American tank crews fought.[15] The 68th and 91st Artillery Battalions performed in a manner that certainly would have made their forebearers of the Mexican and Civil Wars proud. The proud traditions of the regiments involved were not sullied in the defeat at Sidi Bou Zid.

Part of the reason for failure is obviously the superior German execution of small unit tactics. This was certainly to be expected as a function of the variance in experience level. But small unit tactics are overwhelmingly dependent upon weapons systems and local conditions. Experience is unmistakably the best teacher here. Study of these techniques has the least applicability to our purposes. (This is not to say that *no* insights can be garnered from such study.) Further, the extent of the U.S. defeat cannot be blamed on the *greenness* of our troops alone. Their stout resistance proved otherwise.

If one cannot lay the blame at the feet of the troops or their junior leaders, it is obvious then that American leadership at the colonel and general officer level was poor. Despite the strategic surprise achieved by the Germans in *Fruehlingswind,* the ratio of forces was not that disparate, certainly less than what U.S. troops might be expected to face in future battles. The Germans never managed to mass their nine attacking battalions in a coordinated effort at Sidi Bou Zid. The 21st *Panzer* made no effective contribution until CC A was beaten. The battle was not *won* by the Germans, it was *lost* by the Americans, who never adhered to the defensive fundamental of concentration at the critical time and place (the new FM 71-100 phrase for the old *principle of mass)*. The Germans beat one, and then two, tank companies in succession because 3/1st AR was never really massed and was, as a result, defeated in detail.

This failure resulted from the total inability of the U.S. commanders, from army to brigade, to *see the battlefield.* This, in my view, is the most important fundamental of defense. A commander is impotent if he has no *feel* for what is going on. He cannot concentrate, exploit the defender's advantages, or fight his units as a team if his appreciation of the situation is fundamentally flawed. Such was the case at Sidi Bou Zid. It was not until the destruction of CC C in its ill-fated counterattack that corps and army realized the strength of the enemy forces. This can be partially blamed on the failure of the 81st ARB and the apparent misinterpretation of ULTRA radio intercepts at theater level.[16]

But the reports from the battlefield seem to this observer (albeit with all the advantages of hindsight) to have given clear indications that a strong enemy force was at Sidi Bou Zid. Nevertheless, in their insistence that the enemy would behave as predicted, the Allied command never reacted adequately. This failure is most dramatically demonstrated by the hopeless commitment of CC C to the counterattack. The only excuse for this move, which can only be described as the height of folly, is a *total* misreading of the situation by Ward and Fredendall.

"Today, we do not have the excuse of the lack of institutional experience . . ."

At the combat command level, certain actions were taken that prevented the commanders from seeing the battle. CC A's plan for nighttime patrolling and daytime battle position occupation was at its weakest at dawn when the patrols came in and the tanks went out. Dawn, of course, is the most likely time of attack. *If* CC A had continuously employed covering forces or occupied a combat outpost line, it could have been warned of the location and direction of the enemy approach and massed its armor to defeat it. Instead, one-third of the command's tanks were thrown away.

Similarly, CC C's failure to provide adequate front and flank security resulted in that unit putting its head into a noose. The location of the CP behind the attacking force, prevented the commander from exercising the control necessary to provide for an escape. The lead tank battalion commander could not be expected to fight his battalion and at the same time have a feel for the brigade situation.

"But we should not forget that new methods of warfare sometimes obscure the applicability of these old principles . . ."

Furthermore, the American units had never fought as a team. Tanks and infantry were expected to fight two separate, though related, battles (a practice that, in my view, is being repeated ominously in the Infantry School's present "fire from" and "defend" defensive tactical doctrine). CC A's defensive plan clearly viewed the night as the realm of the infantry and the day as belonging to the tanks and tank destroyers. An all-arms, permanently-manned, covering force in the plain east of the hill masses could have avoided the dawn break in security.

Other errors are obvious—such as the neglect of the 81st ARB to adequately cover the Maizla Pass, and Major Parsons' failure to provide for an alternate means of communication for his team. Certainly this study abounds in examples of how not to do it. It is true that the commanders of the units involved in the Battle of Sidi Bou Zid made mistakes, sometimes grievous ones, but this should not be allowed to obscure the fact that the men were dedicated troops who were trying to do their duty to the best of their ability. After all, two battalion commanders had their tanks shot out from under them and three were captured. The U.S. Army in 1943 had little experience in defensive battles with armor, and some lessons needed to be learned. Certainly, violations of the principles of war, such as their neglect of security and failure to mass, are indictments of their ability. But we should not forget that new methods of warfare sometimes obscure the applicability of these old principles and they must be relearned the hard way.

Today, we do not have the excuse of the lack of institutional experience, nor will we have time to relearn old lessons. The best way for our officer corps to prepare for the future may be the study of the failures of their predecessors, not just their successes. Perhaps, then, those men who, despite their earnest efforts, failed to do their duty in 1943, can, by their example, fulfill that duty today.

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He recently received his masters degree in diplomatic history from the University of Pennsylvania, and in June 1982 joined the Staff and Faculty, USMA.

Footnotes

[1] The unit, the 2d Derbyshire Yeomanry, is the size of a U.S. squadron.

[2] H. Essame, Patton: *A Study In Command,* New York, 1974, p. 67.

[3] George P. Howe, *Northwest Africa: Seizing The Initiative In The West,* Washington, D.C., p. 378.

[4] *After Action Report: 1st Armored Division*—3 Feb 1943 to 18 Feb 1943.

[5] The 1st AD's maneuver battalions were organized as follows:

CC A—3/1st AR, 2/168th Inf, 3/168th Inf.
CC C—3/6th Armd Inf, G/3/13 AR.
Division Reserve—1/13th Armor, 1/6th Armd Inf.
Division Control—81st ARB detached to:
CC B—1/1st AR, 3/13th AR (–), 1/168 Infantry.
Army—CC B, 2/1st Armor, 2/13th Armor, 2/6 Armd Inf.

The Division also had the 601st (–) TD battalions attached, and tank destroyer companies were parceled out among the division units.

[6] This practice was not as unusual at it may seem to us. The 168th Inf was a regiment, commanded by a colonel, whereas Combat Command A was commanded by a brigadier general, and under early armor doctrine was expected to have regiments under its control.

[7] See Howe, pp. 409-412.

[8] *Ibid.,* p. 411.

[9] Richard Collier, *The War In The Desert,* New York, 1977, p. 163.

[10] Howe, p. 415.

[11] *Ibid.*

[12] *Ibid.,* p. 418.

[13] W.G.F. Jackson, *The Battle for North Africa: 1940-1943,* New York, *1958,* p. 335.

[14] Howe, p. 421.

[15] Paul Carell, *The Foxes of the Desert,* translated by Mervyn Savell, New York, 1958, p. 335.

[16] See David Irving, *The Trail of the Fox,* London, 1977, p. 244. Irving's account is the first I have seen which attributes Eisenhower's and Anderson's failure to send more reserves to II Corps to faulty analysis of the famous ULTRA intercepts. Unfortunately, Irving's source is unclear.

PROFESSIONAL THOUGHTS

The Price of Leadership

The most effective leaders are those whose focus of concern and daily actions are directed *down* the chain of command. The leader *serves* his soldiers. His purpose is to create an environment that allows each of his soldiers to grow professionally. He is the coach and the teacher of his subordinates.

Good leaders are not arrogant but are supportive of their subordinates. They create mutual trust that is built upon confidence that the leader will subordinate his personal interests to the welfare and the mission of the unit.

Recently, I had the misfortune to go through a chow line behind a unit leader, who asked for a larger portion than that called for by the menu and provided to the soldiers. His large portion meant some soldier did not receive a full serving. This small, selfish act was a glaring example of this officer's poor understanding of his leadership responsibilities. He was unable to subordinate his appetite to the welfare of his soldiers, thus indicating that he was inadequately trained or lacked the self-discipline required of a leader. Leaders are expected to exhibit a generous spirit in their daily conduct. And, above all else, to be professionals. The finest definition of professionalism is captured in the words of Vince Lombardi, the famous football coach, who said, "The quality of a man's life is in direct proportion to his commitment to excellence, regardless of his chosen field of endeavor." Professionalism is a commitment to excellence that is met daily. It is a commitment that acknowledges the leader's responsibility to be a teacher, a coach and the custodian of good order and discipline within the unit.

Membership in the profession of arms is a proud calling, and a noble profession when each of its members accepts his membership as being predicated upon *self-sacrifice,* which fully epitomizes the meaning of leadership. The basis for this unique calling of the profession of arms is best captured in the words of LTG Sir John Winthrop Hackett, who observed that: "The soldier has an unlimited liability contract." Whereas those in other callings within the civilian sector have specified legal limits set upon their commitments, the soldier's duty is not done until his mission is complete. As long as the soldier lives and wears the uniform, the unlimited liability contract exacts a higher standard that is uncompromising and is relaxed only in death—or upon retirement.

The special commitment of the professional soldier is recognized in a number of ways, among them the Uniform Code of Military Justice, which sets soldiers apart from all others in society.

Obedience is the test of our commitment. It requires each soldier to subordinate his will to the authority placed over him. When leaders cross the line of departure they do not look back. They accept obedience even though it places a unique demand on their leadership.

When sacrifice is made, every leader expects that sacrifice to serve the best interests of his country's defense, the unit, and the proper execution of the unit's mission. Subordinates share these same expectations of their leaders. They expect their leaders to have mastered the fundamentals of their profession. They can only subordinate their will to the leader when he has won their confidence through the demonstrated mastery of his profession. They, too, can accept sacrifice but not in the execution of ill-conceived orders and poorly executed plans.

Sacrifice takes many forms. A soldier accepts the daily sacrifice of heat, cold, dust, and mud in the execution of his duty. These sacrifices are borne lightly when he understands why his sacrifice is made, and his time is not squandered by the failure of his leaders to properly plan his training and the maintenance responsibilities of his unit. Time is the most precious resource of the soldier, for time is life, measured in seconds, minutes, hours, days, weeks, and years. When leaders fail to properly execute their responsibilities to schedule, plan, and lead, they squander the most precious possession of their subordinates, their lives.

Soldiers want to excel, but they cannot excel unless their leadership is dedicated and sets demanding standards that force each individual to sweat and grow and reach new levels of accomplishment. We fail the soldier when he is not forced to do so.

Leaders sometimes fail to recognize this in the mistaken belief that they do the soldier a favor by being permissive and by not establishing rigorous standards. Such permissiveness is poisonous to the unit. It encourages lax attitudes and it causes the soldier's performance to be unworthy.

The soldier is idealistic. He expects that his service to his country will be challenging and he considers his service to be noble. However, service to one's country cannot be noble if it is characterized by flabby muscles, missed targets, haphazard inspections, property not accounted for, and soldiers who are unsure of the skills of their MOS. In short, the soldier's service to his country cannot be noble unless the leader sets high standards then coaches and trains his soldiers to meet those standards. The leader who makes them stand tall, work, sweat, grow, and be proud is the leader whom they will follow.

The leader who allows them to "get by" not only fails them, he fails himself and the Army. The leader must set the standards in every area of endeavor charged to his responsibility. The higher he sets his standards, the prouder his soldiers will be and the greater will be the unit's *esprit.*

Setting high standards and teaching his soldiers to meet those standards will take a leader far in the Army, but his ultimate contribution will rest on his values and the trust he builds in his unit. His contribution will rest upon his ability to make the right decision when confronted by hard choices.

Those decisions will frequently be difficult, and will involve the proper use of resources, the counseling of young soldiers, and the proper reporting of the manner in which units have performed.

A unit's confidence in their leader will ultimately rest upon their trust in that leader. If he has the courage to accept responsibility for his unit and to make the hard decisions, his soldiers will recognize it and will trust him. If he fails, no amount of hard training will compensate for their lack of confidence in his leadership.

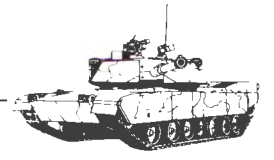
We each have an inner compass of values that keeps us pointed down-range, but we need to continually reinforce them. What are those values upon which we depend? They are religious values, they are commitment to duty, honor, and country, and they are the loyalty that we share with our fellow soldiers and our loyalty to our unit. These values constitute the core of our professional character and we cannot lead if we are not true to them. The reason is very simple: soldiers are idealistic. They reject corrupt leadership and they will not follow a leader without integrity.

Personal integrity also involves another attribute of good leadership—that of accepting responsibility. In the 18th century Lord St. Vincent observed that responsibility is the test of man's courage, and one of the finest examples of courage and capacity to accept responsibility for a unit was provided by Robert E. Lee when Pickett's Charge failed at Gettysburg. Lee observed the attack and saw it break against the Union center. He moved among the survivors as they streamed back across the valley, and he understood the meaning of their failure to break through the Union position. His remarks following that failure help us understand the meaning of responsibility.

Lee met General Pickett with these words, "General Pickett, place your division in rear of this hill and be ready to repel the advance of the enemy should they follow up their advantage." Pickett answered tearfully, "General Lee, I have no division now; Armistead is down, Garnett is down, and Kemper is mortally wounded." "Come, General Pickett," Lee responded, "This has been my fight, and upon my shoulders rests the blame. The men and officers of your command have written the name of Virginia as high today as it has ever been written before . . . your men have done all that men can do. The fault is entirely my own."

Responsibility means total acceptance of the men we lead. Their victories are theirs, their failure is ours—the men who lead them. This is the price of leadership.

ANDREW P. O'MEARA
Colonel, Armor
Commander, 1st AIT/OSUT Bde
Fort Knox, KY



Tanker's Direct Fire Commands

The modern armor battlefield continues to increase in violence and intensity. Engagement ranges increase and engagement time decreases. The rising efficiency of wire-guided missiles will place even greater demands on our tactical doctrine. Survival today is measured in seconds.

Confronted with these facts, several questions must be asked. Does the currently accepted method of directing platoon direct-fire weapons take into account the increased capability of the newest generation of armor which can move across the battlefield at speeds of forty km/hr, firing on the move? Is our present doctrine for avoiding an ATGM by dodging the missile and then engaging its source with direct fire weapons, or going to ground, really an effective counter measure, and does the present technique of directing platoon fires reduce the engagement time to the necessary minimum?

The best way to suppress an ATGM is to preferably kill or, at least, force the operator to take cover. The firepower that a tank platoon can generate is substantial, but how about the placement of those rounds and the reaction time? Two or more 150-mm HEAT rounds going off near a *Sagger* position would very probably throw off the gunner's aim, or, at least, obscure his target for a few critical seconds. If the missile is launched from a vehicle, there is always the likelihood of hitting it with the *M1's* new primary direct fire sights and stabilization system. Even if the enemy target isn't hit, the dirt and smoke from the round's impact might obscure his target . . . you.

The unit that can put the most accurate and heaviest volume of fire on the enemy will win. Speed and violence of attack are the keys to victory.

Assuming that these are valid points, the next question is, how can these problems be solved? The answer lies partly in the procedure for calling indirect fire: it must be short and precise; it must convey all the necessary information—direction, target location, and method of engagement, in as short a transmission time as possible.

For example, you are leading your tank platoon (traveling overwatch) as an element in pursuit of a withdrawing enemy formation. Suddenly, your left flank TC spots the backblast of a *Sagger*-type weapon being fired. No one else has seen the weapon's signature. The TC has nine seconds to react . . . Using his override, he traverses left, aims quickly at the smoke and fires his main gun, having determined by educated guess that the weapon was out of range of his machine guns. At the same time the rest of the platoon hears in their radios, "Target, three o'clock, linear, *Sagger*, Fire!" The other TC's traverse to three o'clock, pick up the smoke in their sights and, using battle sight, engage with their main gun, each firing one round. Depending on their location in the formation each one aims left or right of the initial round. Being unsure of a kill or effective suppression, the left flank TC transmits "Repeat, Fire", and five more rounds impact in the target area. The TC who initiated the fire command completes it unless the platoon leader intervenes on the radio.

Corporal Ivan Tankovich was surprised by the enemy tank firing a main gun round at him and ducked when the HEAT round exploded nearby, showering him with dirt. He was killed by the following salvo which, even though he fired his weapon remotely, covered his area of concealment.

Using this technique, I will describe how I believe a platoon, or larger unit, would be able to deliver well-aimed immediate fire on any target within range. The advantages of this method are the flexibility, simplicity, clarity and, most important, the speed which it can be employed.

Briefly described, the tankers direct fire command, (TDFC), is a means of directing the simultaneous fires from vehicle-mounted weapons at a target or targets, as directed by the platoon leader, or any TC, in the least possible time, with the fewest words. This technique is based on the assumption that all the vehicles are moving, or pointed, if stationary, in the same direction. If they are in laager, a common direction would have to be designated beforehand. If moving, turret orientation would remain as described in FM 17-12. The TDFC has five elements: 1: the warning, 2: the target direction, 3: the shot group pattern, 4: the target description, and 5: the command to fire.

The warning alerts the unit that a firing order will follow. The word "Target" will suffice. The target direction is determined by the clock method and points out the approximate direction of the target to the other vehicles.

The shot group pattern follows. If the target is an enemy vehicle and presents a clear shot it would be a point target and the TC's would concentrate their shots. If for some reason the initiator of the command is unsure of the location of the target, or a linear shot group is more appropriate, he can call for a linear pattern. The command words are "point," and "linear." Further fine tuning could be achieved by including other decriptive words such as "vertical-linear" which would produce a linear pattern on a vertical axis. At this point I must stress that to be effective this method of command must be kept short and simple. Speed is all important.

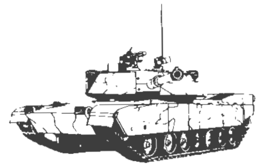
The fourth element is the target description. By describing the target, the TC will further reinforce the third element (shot group pattern) of the TDFC. If the target description is "T-72" the other TCs can make an educated guess that it is a point target. If it is "ten T-64's", that would be a linear target. The target description is actually more important if a second salvo is called for. The first shot fired by all vehicles should be whatever is in the barrel. While traversing and firing that all important first shot in an ambush situation, the loader, knowing what kind of target is being engaged can select a more appropriate round for the second salvo, if necessary. It could be argued that by putting the target description in the first part of the firing order, the loader would have the chance to reload the correct type of ammo. This might be true if the gun tube was pointed well away from the target. What about a direct front engagement? I believe that getting off a round, any round, is far better than the perfect round five seconds later. I'll grant the fragmentary effect of a sabot round may leave something to be desired, but I'll bet it makes the devil's own noise when it goes by. I might point out here that the first two elements of the TDFC contain all the necessary information to get off the most critical first salvo should radio transmission be cut short.

The last element of the firing order is the command to fire. Obviously, expecting the unit to wait and fire exactly at the same moment is unrealistic in battle. Therefore the inclusion of the word "fire" should be defined as a release to fire at will (as fast as you can).

So far I have discussed the reaction to ambush, a situation which actually bred the TDFC. How is the TDFC employed as a standard platoon fire command? Actually, there is little difference. The target description would reflect the array of targets, i.e., four tanks, three BMP's, dismounted infantry, and the platoon leader would not fire his main gun until completing the platoon fire command.

Given the vast superiority of the Soviets in every category save determination to win, we must fight using our weapons to their greatest potential. The *M1* is the finest tank in the world today. Employing a platoon fire command that takes advantage of its speed and mobility is a must.

GEORGE GRAVES
Second Lieutenant, Armor
Fort Bliss, TX



There Are No Excuses for Poor Training

The demand for well planned and executed training has never been more important than during the current decade. New and sophisticated weapons systems, recent public demands for improvement in the Army's readiness posture, and the lack of key noncommissioned officers, have combined to create one of the Army's toughest training challenges. All too often, however, company commanders fail to meet this challenge as effectively as they should, citing numerous reasons—excuses, for such shortfalls. With over 6 years experience as a company commander and operations officer of tank and infantry units on three continents, I am convinced that training excuses are unnecessary obstacles to the planning and execution of quality training.

One of the reasons given by company commanders as a basis for failing to conduct good training is the lack of people for scheduled training. This excuse is perhaps the most common, and the easiest to overcome. Having used this excuse myself, while serving as a company commander, I can fully understand the basis for its use. I also remember the day I came to the realization that a commander seldom if ever has all of his people available for training, but, nevertheless, remains responsible for providing the best possible training for those present. Bolstered by the satisfaction of this self-discovery, I immediately embarked on a training program with more vigor than before—undaunted by the absences of a few soldiers, and adamantly reluctant to use their absence as an excuse for poor training.

The commander is responsible for planning and conducting the best possible training for everyone in his company, regardless of the number present. Company commanders frequently use the absence of training time for failing to conduct adequate training. The imposition of mandatory training activities upon the company by higher headquarters is most often cited as the cause for leaving little time for company commander-directed training activities. Therefore, good training cannot be conducted because there is insufficient time left for the more important training tasks. Regarding this excuse, I offer the truism that higher headquarters always have, and always will, direct selected training activities to be incorporated into subordinate commander's training schedules. Additionally, commanders must accept the fact that the training required by higher headquarters is entitled to be of no less quality than those tasks designated by the company commander. There are sufficient hours in a day, week, or month, to conduct good training provided the use of available time has been well planned.

I know of few training activities directed by higher headquarters that specify how training is to be conducted. Rather, the commander is given the mission, and alone determines how he will accomplish the tasks. Time, then, is a commander's planning variable, and it is determined by, among other things, an assessment of the unit's training readiness at any time. By identifying strengths and weaknesses, and establishing priorities for those areas in greatest need of improvement, a commander can determine the amount of time needed to improve in a subject area. Through careful planning, and making good use of available time, commanders normally can find some space on the already ambitious training schedule to accommodate company level training tasks. Often, the subjects selected by the company commander can easily be incorporated into the training tasks directed by higher headquarters. In any event, the lack of time for use at the company commander's discretion cannot be considered a valid reason for the failure to conduct good training, but merely an unneeded excuse. Commanders who combine mandatory and elective training tasks into single or multiple training opportunties generally create a more interesting and challenging training environment. Excuses are unnecessary for these commanders and, more importantly, their efforts produce better-trained soldiers.

Insufficient training resources is often used as an excuse for ineffectively training, but the abundance of training devices is exceeded only by their tremendous cost. Nevertheless, the unavailability of a particular device is often used as an excuse for conducting less than quality training, and one wonders what was done to develop soldier proficiencies before the development of devices. While some training devices can significantly improve certain training opportunities, they represent only one of many tools available to a commander. In the absence of specific devices, a commander who aggressively seeks other acceptable and innovative alternatives generally discovers solutions that provide first-class training opportunities.

Insufficient training areas and ranges is another of the lame excuses for conducting less than quality training. While some new weapon systems do require modification of some ranges and training areas, it never ceases to amaze me the number of ranges and training areas that are available, but unused on a weekly basis. Experience, then, would seem to indicate that the argument for more training areas and ranges is far from valid, serving instead to support unwarranted excuses. Commanders who plan their training thoroughly and aggressively in seeking better ways to enhance soldier readiness, either find the training areas needed, or adjust their activities to the areas available. The results of this approach produce quality training opportunities, not excuses.

When company-level training fails to measure up to the challenges, complaints about the lack of people, time, and resources are only excuses that hinder training. These excuses can be overcome with a positive attitude and detailed planning, therefore, they are not the cause of poor training. Commanders are.

Once commanders accept the fact that they will seldom have a perfect training environment, they will thoroughly analyze the training tasks, both directed and self-determined, allocate available time, and use available resources. They will not need excuses for poor training, and they will be well on the way to providing the quality training their soldiers need to meet the challenge of the eighties.

NED C. STOLL
Major, Armor
Fort Riley, KS

Recognition Quiz Answers

1. **ASU-85 (USSR).** Air droppable self-propelled antitank gun. Crew: 4; combat weight: 15,500 kg; power-to-weight ratio: 13.5 bhp/ton; maximum road speed: 45 km/hr; maximum road range: 260 km; armament: 1 x 85-mm gun, 1 x 7.62-mm coax machinegun, 1 x 12.7-mm AA machinegun.

2. **Scorpion FV101** (UK). Tracked combat reconnaissance vehicle. Crew: 3; combat weight: 8,000 kg; power-to-weight ratio: 23.91 bhp/ton; maximum road speed: 80.5 km/hr; maximum road range: 644 km; armament: 1 x 76-mm gun, 1 x 7.62-mm machinegun.

3. **BTR-60PB** (USSR). Armored personnel carrier. Crew: 2 + 14; combat weight: 10,300 kg; power-to-weight ratio: 17.47 hp/ton; maximum road speed: 80 km/hr, (water) 10 km/hr; maximum road range: 500 km; armament: 1 x 14.5-mm machinegun, 1 x 7.62-mm machinegun.

4. **Spahpanzer Luchs** (FRG). Armored amphibious reconnaissance vehicle. Crew: 4; combat weight: 19,500 kg; power-to-weight ratio: 20 hp/ton; maximum forward road speed: 90 km/hr; (reverse) 90 km/hr, (water) 9 km/hr; maximum road range: 800 km; armament: 1 x 20-mm cannon, 1 x 7.62-mm machinegun.

5. **T-62** (USSR). Medium tank. Crew: 4; power-to-weight ratio: 14.5 hp/ton; maximum road speed: 50 km/hr; maximum road range (with additional fuel tanks) 650 km; armament: 1 x 115-mm gun. 1 x 7.62-mm coax machinegun, 1 x 12.7-mm AA machinegun (T-62A only).

6. **ZSU-23-4** (USSR). Self-propelled AA gun. Crew: 4; combat weight: 19,000 kg; power-to-weight ratio: 20 hp/ton; maximum road speed: 44 km/hr; maximum road range: 260 km; armament: 4 x 23-mm cannon.

OPMS-EPMS

Armor Officer Assignments Branch

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Officers desiring to know about their upcoming assignments may call the Armor branch at:

AUTOVON: 221-6340/6341/9698/9658
COMMERCIAL: (202) 325-

From front to rear:

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Career Management Field 19 Review and Analysis

The Advanced Noncommissioned Officer Course (ANCOC) Selection Board recently reviewed the files of 19E, 19D and 19K staff sergeants within the zone established for consideration for attending ANCOC. Those staff sergeants selected for promotion who had not attended ANCOC were automatically designated to attend with no further board action.

Consequently, the files the panel reviewed were of those soldiers not selected for promotion to sergeant first class, so they were of lower quality. Despite this, the panel found many fully qualified NCOs in the zone and had no difficulty identifying top soldiers to attend ANCOC. Upon completion of the selection process, the board provided the following assessments and observations concerning the CMF 19 career field and the soldiers serving in Armor specialties.

The Board found that the physical fitness of CMF 19 staff sergeants is good. There are few limiting profiles, however, and some evidence of overweight. Nevertheless there is an obvious interest in physical readiness among the soldiers. Overweight and physically unfit soldiers did not fare well in competition with their peers.

Although many staff sergeants have completed the Basic Noncommissioned Officer Course (BNCOC), many others have not, and have been given on-the-job education (OJE) credit for skill level 3 training. It is not clear if attendance at BNCOC correlates to better performance.

Skill Qualification Test (SQT) results are generally current, the board found, and many soldiers have SQT scores recorded for 1981. A current high SQT was very much an advantage in the Board's findings.

It was found that extensive duty outside the MOS resulted in reduced competitiveness. The most highly regarded duty was in leadership positions within the MOS and it was found that other critical duty assignments such as motor sergeant, personnel service NCO, range NCO, and instructor, if repeated, lessened the chances for selection for attending the ANCOC [and consequently for promotion].

It was noted that armor soldiers, especially in MOS 19E, move frequently and that time spent in USAREUR is high. The board also reviewed CMF 11, and the comparison in overseas service and shorter turnaround time in CONUS for CMF 19 soldiers was obvious.

The board found that CMF 19 files are not as well maintained as they should be. Too few have the required photographs and too many files have not been verified by the soldier. Also, it was noted, that awards are too seldom given for extended periods in leadership positions, for which the EER indicates an award should be given. The board found that EERs are generally less well written for line assignments than for staff assignments. EERs prepared by platoon sergeants and platoon leaders are often poorly written, the board found.

The board noted that there are many good staff sergeants in CMF 19, especially in MOS 19E, who were not selected for promotion. However, next year's board should have a good selection of schooled and experienced staff sergeants from which to choose.

The board noted that those staff sergeants who have not served, or are not serving, as tank commanders or platoon sergeants should do so. Successful duty in leadership positions was the most highly regarded criterion of the selection board.

The Board stressed that files must be complete and up-to-date, with pictures, the latest SQT score, and a statement of height and weight. The absence of such information reduces an individual's competitiveness for schooling and promotion.

Establishing and maintaining complete personnel files and accurate Forms 2 and 2-1 must be emphasized in the units. Also, commanders must insure that NCOs review and verify their files at least before every board action.

Two consecutive assignments away from troops should be strongly discouraged, the board noted. The greatest leadership challenge appears in the tank battalions and cavalry squadrons. Staff sergeants should be assigned to those battalions and squadrons to be competitive for promotion, the board advised.

Annual Review of Official Military Personnel File

Although the annual review of your Official Military Personnel File (OMPF) is not mandatory, you will be wise to do so.

At the very least, you should review your OMPF when you become aware that your records are to appear before a Department of the Army Selection Board. This should be done at least 120 days before the board meets. Also, you should review your OMPF at any time a material change has been made in your records which may have been directed by the Army Board for the Correction of Military Records or the Department of the Army Suitability Evaluation Board.

To review your records, write to:

Commander
Enlisted Records and Evaluation Center
ATTN: PCRE-RF-1
Fort Benjamin Harrison, IN 46249

There is no charge, but only written requests (no telephone requests) complete with your name, social security number, and address will be honored. The Branch will send you a microfiche copy of your records.

Updating DA Form 2-1 (Personnel Qualification Record)

Paragraph 5-3, AR 640-2-1 requires military personnel offices (MILPO) to prepare and forward to the Infantry/Armor Career Branch a complete copy of DA Form 2-1 for each armor soldier in grades E6 through E8 upon completion of their annual records review, which is accomplished during the soldier's birth month.

DA Form 2-1 is the primary assignment tool used by assignment managers and career advisors to make assignments that best meet a soldier's career needs, preference, and the needs of the Army. DA Form 2-1 information, which exists no where else, may dictate selection of a soldier for a particular assignment. This information includes, but is not limited to:

- Assignment history
- Previous duty positions
- Military and civilian schools attended
- Current height and weight
- Aptitude areas test scores
- Overseas tours completed
- Assignment limitations
- Location of dependents
- Awards and decorations
- All Additional Skill Identifiers and Skill Qualification Identifiers held.

Without a *current* personnel qualification record available at Branch, the potential exists for making an assignment which does not consider the "whole person." Such an assignment can work in many ways to hinder a soldier's career and can cause dissatisfied soldiers and is not in the best interest of the Army.

news notes

New FISTV Exceeds Test Goals

The Emerson Electric Company Fire Support Team Vehicle (FISTV) has demonstrated a mission reliability of .92 in recent tests at the U.S. Army Proving Ground, Yuma, Arizona. The system locates and designates targets within 40 meters circular error probable (CEP) at a range of 3,000 meters. The FISTV is based on the *M113* APC and locates targets and provides target designation information for all indirect fire using Ground Laser Locator Designator (GLLD). Other FISTV subsystems include day/night sights, north seeking gyro, digital message device, and 4 VHF radios.

Seeks 704 Tank Destroyer Battalion Vets

The 704th Tank Destroyer Battalion Association is looking for former unit members who served during the following periods: 15 Dec 1941 to 15 October 1945; 30 July 1951 to 25 February 1953, and 25 February 1953 to 1 April 1957.

Ex-704th members should know that their unit was awarded the French Croix de Guerre with Palm (twice) and the French Fourragere as per General Orders dated 12 January 1982.

Unit veterans may contact Rich Bowman, 71 Route 25-A, Smithtown, New York, 11787 for further information. Phone: (516) 265-2560.

Georgia Guard Gets New ITVs

The 48th Infantry Brigade, Georgia Army National Guard, recently received 51 antitank *M901* Improved TOW Vehicles (ITVs) as part of the "Total Force Policy" in which Guard resources are included with U.S. regular forces in the event of war.

During an emergency situation, the 48th becomes the 3d Maneuver Brigade of the 24th Infantry Division (Mechanized), a part of the Rapid Deployment Force.

Radar Monitoring System Unveiled

The Army's AN/MSQ-103A TEAMPACK radar monitoring system is in production and the first unit was unveiled at Fort Monmouth, NJ. The TEAMPACK provides an updated radar surveillance which locates and identifies enemy groundbased radars. It was developed by the Emerson Electronics & Space Division. The unit is shown mounted on an XM-1015 chassis but can be mounted on the M35 utility truck, light armored vehicles, the jeep and other types of combat vehicles. Battlefield surveillance, air defense, and counter mortar/battery ground based radars are detectable by TEAMPACK.

Halon Extinguishers For *M60* Series

Halon gas automatic fire suppression systems now under test at the Aberdeen Proving Ground are slated for early retrofit to *M60* series tanks, replacing the present CO_2 systems.

Sunbelters Reunion

The Sunbelt Chapter, 43d Infantry Division Association, will hold its annual reunion 28-31 January 1984 at the Ramada Inn South, Orlando, FL. Contact Joe Carey, PO Box 3192, Nalcrest FL 33856.

BOOKS

THEORIES OF LEARNING AND INSTRUCTION, edited by Ernest R. Hilgard. The National Society for the Study of Education, Chicago, Illinois. 1964.

Using the work of 15 experts on theories of learning and instruction, this book is one of the more readable that has appeared in its field and provides consideration and evaluation of the various aspects of learning and instructional theories. Hilgard traces the development of the aspects of learning and instructional theories from 1900 to the early 1960s.

Of special interest are three sections dealing with psychological and linguistic analyses of reading instruction; the relationship between learning theory and educational practices, and Hilgard's postscript on Learning Theory in Relation to Education.

The volume is recommended for any beginner in the field of learning/instructional theory.

RON PRITCHARD
Education Specialist
Fort Knox, KY

NATO, TURKEY AND THE SOUTHERN FLANK, A MIDEASTERN PERSPECTIVE. AGENDA PAPER # 11, by General Ishan Gurkan. National Strategy Information Center. 1980. 67 pages.

An apt, complementary piece to Agenda Paper # 10, *The Soviet Threat at NATO's Northern Flank,* this paper establishes the geo-political vulnerability of the alliance's soft underbelly.

Turkish General Gurkan sees his nation as the lynchpin to security of the southern flank of NATO. The myriad other problems there—such as Greek threats to withdraw completely from NATO are discussed. The essay wants to clearly recommend that US-Turkish relations, which have slipped badly over the past few years, be overhauled. Now!

Suggested Western response to the threat to NATO's southern flank would be to be particularly solicitous of Turkey and Greece; that they be treated as equal partners with our other, more centrally located, Western allies.

ARTHUR W. McMASTER
TRADOC
Fort Monroe, VA

SHARPE'S GOLD by Bernard Cornwell. The Viking Press, Inc., New York. 250 pages. $13.95.

There isn't anything approaching an *M1* in this book. The mobility factor is limited to the short, deadly charge of cavalry. The grunts (riflemen) of the Light Company of the South Essex Regiment provide the firepower, and they are commanded by Captain Richard Sharpe, a tough, ex-sergeant commissioned in the field by Wellington.

Sharpe's Gold is the second of 10 volumes that will take Captain Sharpe from the Battle of Talavera, Spain, in 1809, to the climactic Battle of Waterloo, Belgium, in 1815.

This is nothing more than adventure reading and, as such, rates high. Lots of small unit actions and a plan by Wellington to steal a vast horde of Spanish gold to finance his campaign in Portugal when funds from England are not forthcoming. Sharpe, of course, steals the gold. With the help of Teresa, a woman of the guerillas.

If you have an interest in the Napoleonic Wars, read this one, and the others as they appear. *Sharpe's Company* is due in June.

R.E. Rogge
Master Sergeant (Retired), USAF
Lebanon Junction, KY

VIETNAM WAR LITERATURE by John Newman. The Scarecrow Press, Inc., Metuchen, NJ. 1982. $10.00.

This is a beginning attempt to catalogue all the stories, books and articles relating to the Vietnam War and is based upon the Vietnam War Literature Collection at Colorado State University in Fort Collins. The author has divided the book into novels, story collections, short stories, poetry, miscellaneous work, drama, and works not seen.

Many people do not understand the Vietnam War and do not wish to be reminded of it. These stories and novels, while fiction, are based upon real incidents and they make a discussion of the war and its incidents a bit easier for the layman to understand. It may also make it easier for the Vietnam veteran to discuss the war, perhaps from a third person viewpoint. It is a good reference for someone just beginning to understand and study the Vietnam era. However, I feel that if you don't include some of the nonfiction about the Vietnam War in your reading, you will end up with a very slanted view of the situation.

WILLIAM L. HOWARD
Lieutenant Colonel, Armor
Spring Lake Heights, NJ

SHARPE'S COMPANY, by Bernard Cornwell. The Viking Press, Inc., New York. 280 pages. $14.95.

The third of a promising ten-volume series, *Sharpe's Company* continues to lead its followers toward the climatic Battle of Waterloo.

The central figure, Captain Richard Sharpe, who earned a battlefield commission from Wellington, is embroiled with his past in the guise of Sergeant Hakeswill who once had him flogged, and the reluctance of Whitehall and its bureaucratic fumbling on his commission to captain. If that's not enough, an ex-girlfriend who's trapped within the walled city of Badajoz, Spain, is exposed to the ravages of the soldiers once they break through the city's defenses.

Sharpe's Company refreshes the reader's knowledge of what seige warfare is all about, and the deadly costs involved. Bernard Cornwell continues his excellent portrayal of the nineteenth century, and it is shown in the amount of research needed to write so realistically. As past reviewers have commented, the historical accounting may be shocking in parts, but the series is thoroughly entertaining reading that cannot be put down until the end. What is also delightful is the anticipation of the next episode.

CHARLES E. GRIFFITHS
Major (Retired), Infantry
Radcliff, KY

THE RISE OF MODERN WARFARE, 1618-1815, by H. W. Koch. Prentice Hall, Inc., Englewood Cliffs, NJ. 1981. $29.95.

Koch, a senior lecturer at the University of York, has produced a lavishly illustrated and colorful book with period paintings, maps and portraits and photographs of weapons. It must be emphasized that this is a "coffee table" book, not an exhaustive study of its subject. It is a companion book to his book on medieval warfare, published in 1979, and covers the major European and North American conflicts from the Thirty Years War through Napoleon.

A. HARDING GANZ
Ohio State University
Newark Campus
Newark, O

SMALL ARMS & CANNONS, Bracssey's Battlefield Weapons Systems & Technology, Vol. V, by C.J. Marchant Smith and P. R. Haslam. Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, NY, 10523. 1982. $17.50.

This book provides an overview of the military requirements for small arms and cannons. It provides the professional soldier with a basic understanding of their weapons and is written in the style of a primer with self-test questions following each chapter. The appendicies with the question answers and glossaries are very useful.

A basic introduction to the technology involved is given while retaining an easy-to-read format.

DONALD J. BUTZ
Battelle's Columbus Laboratories

STEEL ON TARGET

The Marine Corps legend began in Robert Mullan's Tavern at the corner of King Street and Tun Alley, Philadelphia, in November of 1775. The legend has grown so that, today, the Corps is larger than many of the world's armies, with a reputation unmatched by most for fighting spirit.

Within the Corps, there is a special breed, proud and few, who comprise their armor force. Smaller in numbers, corps-wide, than the tankers in one Army armored division, their history, nevertheless is as unique as that of their Army Cavalry and Armor colleagues. Horse-mounted Marines, along with the 2d Cavalry fought Seminole Indians in Florida in 1837. Nine years later, "Fauntleroy's Dragoons," a mounted company of Marines and sailors maintained the lines of communications between Yerba Buena and Monterey, California during the war with Mexico. Horse Marines patrolled the streets of Peking in 1927 and chased bandits in Nicaragua in 1928.

But it was the Pacific campaigns in World War II that tested the steel of the "Old Breed." In July 1942, Marine tankers, mounted in M3 Stuart light tanks, met the Japanese for the first time at Tulagi and Guadalcanal. One year later, on New Georgia, they busted bunkers for the Army's 43d Infantry Division as it drove to capture the heavily-defended Japanese airfield on Munda point. In the Central Pacific, M4 Shermans of the 2d Marine Tank Battalion went in with the fifth wave on the fire-swept beaches of Tarawa. Marines in Shermans also shared the hell that was Saipan, Guam, and Iwo Jima. On Pelelui they slugged it out tank-to-tank with Japanese armor. Tank-infantry teams, supported by engineers, used flame, high explosives, and cannon fire to clean out enemy caves and bunkers on Okinawa.

In 1951, MacArthur put out the call and the "New Breed" answered it. Marine armor in their M26s plugged the holes in the Pusan Perimeter, went ashore at Inchon and fought a rear guard action in the breakout from the Chosin Reservoir.

Marines in M48s went ashore in Lebanon in 1958 and into Santo Domingo in 1965. In 1968, they held the line at Khe Sahn and pushed through the rubble that was Hue.

Marine tankers, whether Old Breed or New, are special. They get that way not by leading cavalry charges or tank sweeps, but by looking out for their own—the Marine rifleman. Whenever the fight is sharpest and need is the greatest the call goes out, "Send us a few good men!" Answering the call, mounted Marines always settle the issue, once and for all.

The future of Marine armor is as exciting as its past. The Abrams tank and light armored vehicle will provide more armor-protected firepower and mobility to the Corps than ever before. Coupled with the Cobras and Harriers of the Air Wings and guns of the fleet, this "Force in Readiness" stands prepared today to meet the challenge and is "proud to bear the title of the United States Marines."

Good Shooting!

1st Tank Battalion

Lineage

Activated 1 November 1941 at Camp Lejeune, NC, as 1st Tank Battalion; assigned to 1st Marine Division. Deployed July 1942 to Wellington, New Zealand. Redeployed October 1945 to Tientsin, China. Relocated May 1947 to Camp Pendleton, CA. Deployed July-August 1950 to Pusan, Korea. Participated in defense of Korean Demilitarized Zone, August 1953-March 1955. Relocated April 1955 to Camp Pendleton, CA. Deployed August 1965 to Camp Hansen, Okinawa, and detached from 1st Marine Division. Redeployed March 1966 to Chu Lai, Republic of Vietnam. Relocated March 1970 to Camp Pendleton, CA; reassigned to 5th Marine Amphibious Brigade. Reassigned April 1971 to 1st Marine Division.

Campaign Participation Credit

World War II
Guadalcanal
New Guinea
New Britain
Peleliu
Okinawa

Korea
Pusan Perimeter
Inchon-Seoul
 Chosin Reservoir
East-Central Front
Western Front

Vietnam
Chu Lai
Da Nang

Decorations

Presidential Unit Citation with one Silver and two Bronze Stars; Navy Unit Citation Korea 1952-53; Meritorious Unit Commendation 1968; China Service Medal; Asiatic Pacific Campaign Medal with one Silver and one Bronze Star; WW II Victory Medal; Navy Occupation Service Medal with Asia clasp; National Defense Service Medal with one Bronze Star; Korean Service Medal with two Silver Stars; Armed Force Expeditionary Medal; Vietnam Service Medal with two Silver Stars; Korean Presidential Unit Citation; Republic of Vietnam Meritorious Unit Citation for Civil Action.

2d Tank Battalion

Lineage

Activated 20 December 1941 at San Diego, CA as 2d Tank Battalion; assigned to 2d Marine Division. Deployed November 1942 to Wellington, New Zealand. Relocated August 1946 to Camp Lejeune, NC. Reassigned May 1958 to Force Troops, Fleet Marine Force, Atlantic.

Campaign Participation Credit

World War II
Tarawa
Saipan
Tinian
Okinawa
Occupation of Japan
 Sept 1945-June 1946

Cuban Missile Crisis
 Oct-Dec 1962

Decorations

Presidential Unit Citation Streamer: World War II, Tarawa-1943; Asiatic-Pacific Campaign Streamer with four Bronze Stars; World War II Victory Streamer; Navy Occupation Service Streamer with one Bronze Star; Armed Forces Expeditionary Streamer.

3d Tank Battalion

Lineage

Activated 16 September 1942 at San Diego, CA, as 3d Tank Battalion, 3d Marine Division, Fleet Marine Force. Relocated September 1943 to Camp Pendleton, CA. Deployed January 1943 to Warkworth, New Zealand. Relocated December 1945 to Camp Pendleton, CA. Deactivated 7 January 1946. Reactivated 5 March 1952 at Camp Pendleton as 3d Tank Battalion, 3d Marine Division. Deployed August 1953 to Camp Fuji, Japan. Redeployed February 1954 to Camp McDill, Japan. Redeployed September 1957 to Camp Hansen, Okinawa. Detached January 1958 from 3d Marine Division, assigned Fleet Marine Force. Reassigned December 1963 to 3d Marine Division. Redeployed July 1965, assigned to Republic of Vietnam. Redeployed October 1969 to Camp Hansen, Okinawa. Redeployed July 1976 to Marine Corps Air Ground Combat Training Center, Twentynine Palms, CA.

Campaign Participation Credit

World War II
Bouganville
Guam
Iwo Jima

Vietnam
Chu Lai
Da Nang
Phu Bai
Dong Ha
Chan Lo
Quang Tri

Decorations

Presidential Unit Citation with one Bronze Star; Meritorious Unit Citation; Asiatic Pacific Campaign Streamer with four Bronze Stars; World War II Victory Streamer; National Defense Streamer with one Bronze Star; Korean Service Streamer; Vietnam Service Streamer with two Silver Stars; Vietnam Cross of Gallantry with Palm.