

ADVANCED OFFICERS CLASS NO. 1

DATE: 1 May 1948

MILITARY MONOGRAPH

TITLE: Medium Artillery in the Jungle - Direct Support.

SCOPE: A combat example depicting a typical jungle operation in which a medium artillery battalion was successfully employed in a direct support role.

A discussion and comparison between the 105mm howitzer and the 155mm howitzer relative to the concept that the medium howitzer be adopted as the direct support artillery weapon of the U. S. Army.

41-81

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Major

Cav.

## INTRODUCTION

Preparedness: The watchword of National Security. Having recently emerged from the greatest and most devastating armed conflict heretofore known to the world, some means must be taken to assure that such chaos does not re-occur, and if it does, we should find ourselves adequately prepared. Throughout history, we find remarks concerning 'The War of Tomorrow'. We have only to look at the sequence of events today to become cognizant of the fact that conditions as they are could readily hurl the world into war, whether it is desired or not. As long as distrust between nations exists, force will be the deciding factor. This force is none other than armed conflict. How are we to go about achieving this National Security which we seek? Allow me to quote General Eisenhower:

"We will not seek unilateral security by world domination or by preventive conquest of a nation that we might fear is preparing to attack us. Those two courses are repugnant to our way of life. Concern and measures for our own defense, however, offer no threat to another nation and violate none of our own traditions. In its essence, our security program must be defensive. Security provisions, however must aim at the increase of offensive capacity, for offense is still the most effective defense once conflict begins." <sup>1</sup>

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1. General of the Army, Dwight D. Eisenhower, extracts from "Final Report of the Chief of Staff, United States Army to the Secretary of the Army, 7 February 1948", p.3.

Contrary to the concepts of some 'arm chair' strategists, the success or failure of any country involved in a future war, will depend a great deal upon the ground soldier and his ability to seize and hold ground. Due cognizance must be given of the other arms, Air Force and Navy, for it is through the combined efforts of all that ultimate victory will be attained.

The task of the ground forces becomes more and more complicated as military concepts change and materiel is developed. The officers, of our Army, who command such ground forces and who will be successful are those who, not only possess the requisite of Leadership but those who, master a thorough knowledge of not only their basic arm, but the employment of combined arms as well.

A change in concept is an important matter in waging a successful war. We must learn to accept those which have been proven sound and to continuously seek others which will add materially to success. It has been said by many that, "we live too much in the past". This I refute, because it is only through the experiences gained in the past, that corrections can be made which will be applied in the future.

"Even the great Napoleon Bonoparte once said: 'It is not some familiar spirit which suddenly and secretly discloses to me what I have to say or do in a case

unexpected by others: it is reflection, meditation." 1

At this time, it is my desire to offer a change of concept. The Army has adopted the doctrine that the light artillery, 105mm howitzer, be the direct support weapon of our front line troops. It is my conception that a weapon of heavier caliber, the 155mm howitzer be adopted for this role.

The current thought at The Artillery School is, "For the present, all infantry division artillery will be towed, but we feel that this is an interim measure, and that the tendency is toward self-propelled weapons." 2 For that reason, this writing will pertain principally to towed artillery in the infantry division. Due to the fact that my experiences were confined to operations in the South Pacific Theater, this concept will be presented, principally, as it applies to jungle warfare.

More and more, it becomes axiomatic that superior fire power wins battles. In accordance with this, we must leave nothing unturned in our quest for an increase in this vital factor, regardless of how detailed

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1. Major D. H. Donovan, "Lessons of War Through the Ages", Military Review, (June 1947), p. 101.

2. Editor, "Artillery Tactics", The Field Artillery Journal, (July-August 1947), p. 242.

it may appear. Even though the reorganization of the infantry division gives us an increase in this respect, it will still be insufficient in future engagements. Here is where the artillery comes in. True, the fire power of this arm too has been increased by the addition of two guns per firing battery. This can be furthered by replacing the 105mm howitzer with the 155mm howitzer. This would be a definite step forward in achievement of the necessary decisive violence to destroy any adversary; fire power. We must get it down where it can do the most good, down to the infantry. We have the materiel available so all that is required is a doctrine.

Allow me to relate a combat example, of World War II, in which this concept was applied by an infantry division in a typical jungle operation. The example is based upon Operations Reports of the participating units. <sup>1</sup>

#### COMBAT EXAMPLE

In compliance with Operation Memorandum Number 107, Headquarters XIV Corps dated 14 July 1944, and Operation Memorandum Number 30, Headquarters Americal Division dated

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1. a. "Report of Operations of Americal Division",  
30 April 1944 - 31 December 1944.

b. "Report of Operations of 221st Field Artillery  
Battalion", 30 April 1944 - 31 December 1944.

15 July 1944, the 164th Infantry moved a force of one battalion with attached units into the upper Laruma River Valley with the mission of relieving all elements of the 37th Infantry Division then occupying trail blocks and outposts in the area. The 164th Infantry completed the relief on 17 July. Supporting troops consisted of one battery of light artillery, 245th Field Artillery Battalion; one section of 4.2 mortars, 82nd Chemical Battalion; one squad of the 25th War Dog Platoon; one Officer and 100 native carriers of ANGAU (Australia-New Guinea Administration Unit).

MISSION: The primary mission of the upper Laruma River Valley operation was the establishment of a base camp which would facilitate accomplishment of the following:

1. Reconnaissance of the Kariana-Igiaru-Mageriaopaia area.
2. Maintain trail blocks closing hostile routes of approach.
3. Destruction of enemy forces.
4. Place harassing fires upon known enemy positions.

TERRAIN: An analysis of the terrain in this area is necessary in order to become fully cognizant of the many difficulties encountered by the assaulting forces

and the complexities of the supporting artillery in delivering accurate and effective fires which are so vitally required in close support of any operation.

Generally, the terrain is extremely mountainous. The principal streams are the Laruma, the Doyobie and the Marabie Rivers. These rivers, and their many tributaries, flow quite rapidly down narrow gorge like valleys. Heavy tropical rains, occurring practically every day, cause these streams to become swollen to such extent that fording becomes very difficult, particularly along that portion of the Laruma River south of the Doyobie River junction.

The hills between the stream lines are high knife-like ridges with precipitous slopes. All hill masses are covered with dense forests and very heavy jungle undergrowth. Movements, in this area, are restricted to stream beds or ridge lines.

Roads were non existent until the division engineers constructed a passable road along the Numa-Numa trail as far north as the artillery position. At the place where this trail leaves the Laruma River, it rises abruptly and follows a series of knife like ridges. It was along this trail, and approaches thereto that the Japanese established road blocks and strong defensive positions.

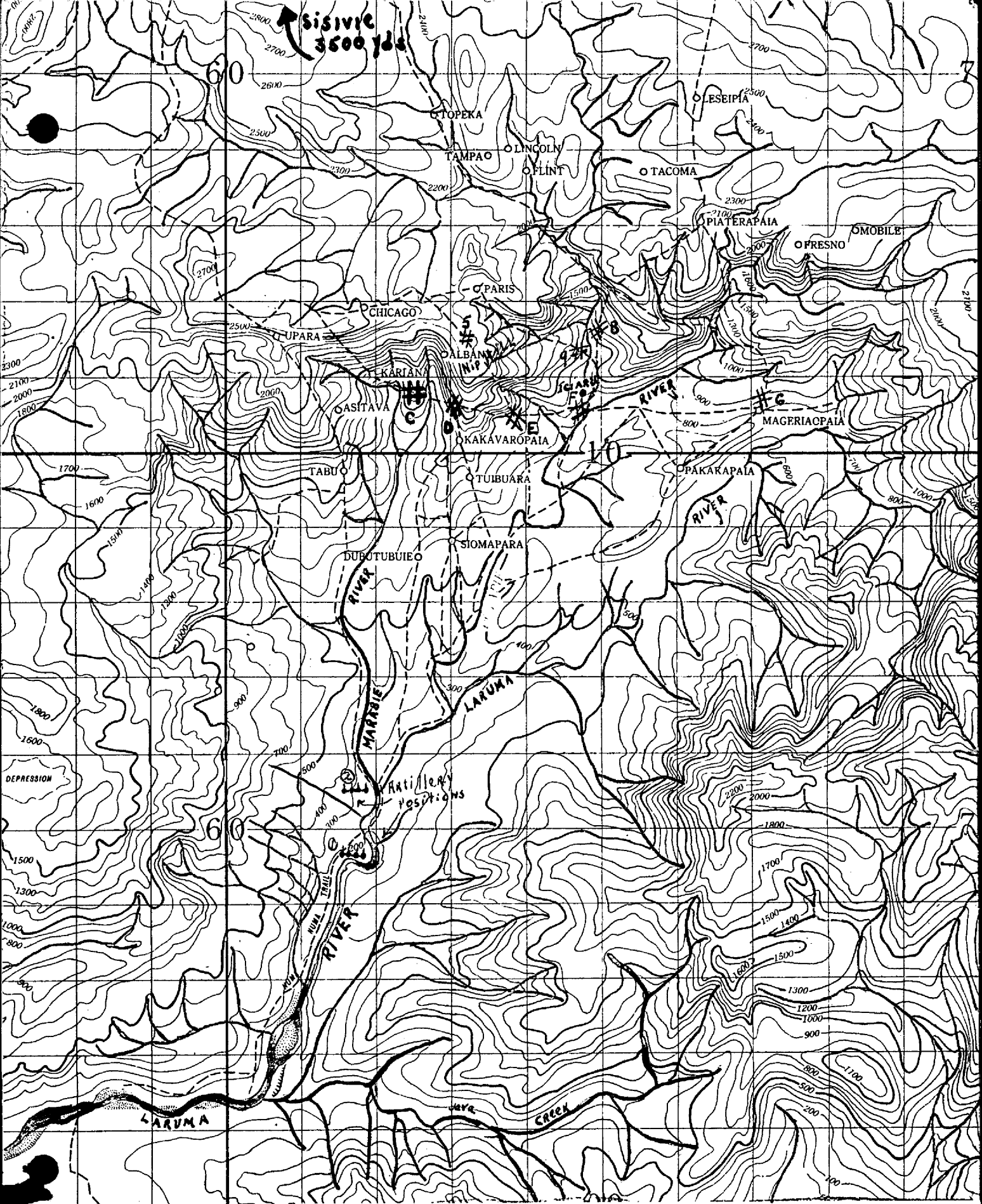
Attacking these prepared positions could be extremely costly as the approaches must be along the ridges in column formation. Deployment off of the trail was impossible due to the steep slopes.

The importance of this area lies in the fact that it provides the only avenue of approach from the central east coast of Bougainville and would be the most logical route for enemy reinforcements.

Upon taking over the already established road blocks, the 2nd Battalion, 164th Infantry immediately began to push reconnaissance forward. The enemy was well organized on the high ground (Nip Hill) north of Block D (see map) and plans were made to keep this point under constant observation and to employ mortars and artillery in "softening up" action. This hill was attacked by E Company on 20 July. An advance of 200 yards was made and a portion of the ridge was secured. A battalion O. P. was established here. Feeler patrols were conducted by this battalion until their relief by the 1st Battalion, on 28 July. The enemy in position on Nip Hill still held on to their defenses and remained very active.

The 1st Battalion was relieved on 6 August by the 3rd Battalion. At 0630 7 August, the enemy, of an estimated company strength, launched an attack on road





LARUMA RIVER VALLEY, BOUGAINVILLE, SOLOMON ISLANDS  
 Area of Operations, Americal Division

blocks C, D and the one on Nip Hill. A fierce battle ensued and the Japanese forces had succeeded in effecting a slight penetration of the position on Nip Hill and the left flank of Block D. A counterattack was launched and the hostile forces were driven off.

Battery A, 221st Field Artillery Battalion<sup>1</sup> relieved Battery C, 245th Field Artillery Battalion at approximately 1200 7 August. With this relief, the 221st Field Artillery Battalion assumed direct support of the operation, utilizing one battery at a time. A Fire Direction Center was established by the battalion and an Observed Firing Chart was set up. Due to the inherent inaccuracies of the available maps in both horizontal and vertical control, this type firing chart proved much more successful than any other. All fires during this operation were high angle.

The enemy fires, consisting of mortars, grenades and rifles increased in intensity in the early part of the night 7-8 August. At approximately 2100, he attempted to infiltrate into our positions. / Artillery and mortar fires were brought down and the attempts were stopped. Throughout that night, the artillery fired close in

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1. Medium Artillery Battalion (155mm howitzer) of the Americal Division.

harassing missions which served adequately in neutralizing enemy activity on the hill.

From 8 to 16 August the troops manning the road blocks maintained their defense and sent out daily reconnaissance patrols. Forward observers with these patrols directed artillery fire upon such targets as enemy bivouacs, supply trails, and enemy patrols, with excellent observed results. In one instance, on 15 August, a friendly patrol sighted an enemy O. P. on Nip Hill which was directing mortar fire upon our positions. A precision adjustment was made on this target and it was knocked out, with a direct hit, after firing seven rounds. Enemy held villages were fired upon, by artillery, as patrols found that they were occupied. Later patrols into these villages proved the superior effectiveness of these fires.

The 2nd Battalion relieved the 3rd Battalion on the morning of 16 August. Battery C, 221st Field Artillery Battalion relieved Battery A, 221st Field Artillery Battalion on 17 August. A long range patrol was sent out, by this battalion, to reconnoiter the Sisivie Area, approximately 8000 yards due north of Upara (see map). This patrol revealed that the enemy was reinforcing this position and had organized a strong defense. On 22 August,

eight tons of bombs were dropped on this target.

Daily local patrols met with stiff enemy resistance and oftentimes artillery fire was brought down in their support. Numerous firefights occurred at the road blocks, as the enemy continually attempted infiltration. The close support rendered by the artillery was an important factor in stopping these efforts and succeeded in neutralizing and even knocking out some of the enemy's machine guns and mortars. Effective night harassing missions prevented hostile forces from using their habitual night infiltration methods.

On 25 August, the 1st Battalion, 164th Infantry took over the positions in this area. They pushed patrols north of the village of Mageriaopaia, from Block F, cutting the trail to Piaterapaia and established road Block G on 28 August. A combat patrol worked up the trail from Block C, through Kariana and Chicago and attacked the enemy position on Nip Hill from the north, thus completing a successful envelopment and driving the enemy from the hill.

In this action the highest degree of coordination was achieved between the artillery and the infantry and necessarily so, as the supporting fires required were dangerously close to friendly forces. These fires ne-

cessitated not only preciseness on the part of operating personnel, but the ultimate in accuracy of the weapons as well. Harassing fires were maintained in this area throughout the night 28-29 August.

Patrol information revealed that the trail leading to Piaterapaia was being utilized by the enemy, to a considerable extent, as a main supply route. This brought about a decision to interdict the trail. On 28 August, an Air Observer, adjusted 10 concentrations along the trail from Block G to and including Piaterapaia. These concentrations were later used to good advantage in assaulting the village.

Battery B, 221st Field Artillery Battalion replaced Battery C on 30 August 1945. The 182nd Infantry relieved the 164th Infantry on 2 September. From this date to 16 September, the regiment, like the preceding one, employed a single battalion at one time. Long range patrols were conducted. The enemy activity was not aggressive and few contacts were made. Artillery participation, during this period, consisted chiefly of night harassing missions and close support of patrols whenever contact was made with the enemy. On 15 September one patrol ran into a large enemy bivouac along the trail leading southwest from Piaterapaia. Observed

fire was adjusted and a devastating shelling followed. Patrols reported the area completely neutralized and considerable enemy dead. It apparently was an enemy assembly area.

On 16 September the 221st Field Artillery Battalion was replaced by the 246th (light) Field Artillery Battalion, Battery B of the former being relieved in position by Battery C of the latter.

A friendly patrol was ambushed in the area north of Block 5 on 25 September. This patrol was extricated after an intense fire fight, and the action revealed that enemy forces were manning strong positions on commanding ground. Attacks in company strength failed to successfully dislodge the Jap troops. On the night 27-28 September, the enemy of estimated company strength, attacked a position which was occupied by a reinforced platoon of the 182nd Infantry. The friendly platoon was well dug in and tenaciously held on to the position despite the fact that they were outnumbered. Close-in fighting ensued all through the night and at daybreak, the unsuccessful enemy withdrew to his defensive positions.

On 29 September, in conformance with Operation Memorandum Number 43, Headquarters Americal Division,

the entire 182nd Infantry Regiment was moved to the Laruma River Valley. The mission given this force was to surround and annihilate all enemy in that area.

A plan was made for the encirclement of the entire area and operations began on 29 September. At this time, we again see the medium artillery being brought into the scene with Battery A, 221st Field Artillery Battalion moving to the sector to reinforce the fires of the 246th Field Artillery Battalion. The 1st and 3rd Battalions blocked all possible approaches from the east, south and west. The 2nd Battalion, less Company E moved northwest from Block C, swung east then came south toward Block 8. Meanwhile, Company E moved east from Block D, then north at Block F to meet the battalion. The envelopment was completed on 2 October. After three days of aggressive action, within the circle thus established, the enemy positions were destroyed.

During this phase of the operation, the medium artillery delivered sporadic harassing fires into the enemy held area. The neutralization fires of both batteries, in conjunction with the infantry mortars, played a very important role in the mopping up of the enemy forces.

Earlier patrols and air observers reporting considerable enemy activity in the Piaterapaia-Leseipia area,

attention was turned in this direction on 7 October. Again, the 2nd Battalion was selected to do the job. The battalion, less Company E, was to move north from Block 8, turn east and attack Piaterapaia from the north. Company E was to move east to Mageriaopaia, then north to attack the village. This company met stiff resistance when it reached a point approximately 400 yards south of the objective. Here is where the previously fired-in artillery concentrations became of assistance. They were used as a guide for the infantry as well as for neutralizing the trail ahead. The plan, when both forces were in position, was for Company E to attack first to create a diversion. The battalion minus was then to attack from the north. However, it was not completed as the battalion minus, through faulty guides, encountered extremely difficult terrain and could not get to the trail leading to Piaterapaia. The forces were ordered to return on 9 October.

The artillery direct support mission again went to the medium battalion with Battery A, already in position, relieving the light battery on 11 October.

On 14 October, the 182nd Infantry was relieved by the 132nd Infantry. Battery B replaced Battery A on the same date. With this change of artillery batteries, a



new position was selected at the junction of the Marabie-Laruma rivers. This was necessitated by increased enemy activity in the Sisivie area, which called for heavier support than infantry mortars. The new position decreased the range by one thousand yards and permitted low angle fire, in one direction, by firing along the river and by considerable clearance of large trees. The adjusted range to the majority of targets in this area was approximately fourteen thousand yards.

The mission given to the 132nd Infantry was three fold:

1. Organize and hold the line Upara-Kariana-Igiaru-Mageriaopaia.
2. Destroy the enemy now holding commanding positions in the vicinity of Piaterapaia.
3. Harass the enemy in the Sisivie area.

The 1st Battalion was designated to defend the line as outlined in (1) above, and the 3rd Battalion was assigned that part of the mission concerning the Piaterapaia area. The 2nd Battalion was held in regimental reserve initially and sent patrols to Sisivie.

In execution of its mission, the 3rd Battalion sent a patrol out to reconnoiter for a new route to the Piaterapaia area. This patrol was successful in finding a

route, northeast from Mageriaopaia, which would permit a surprise attack on Piaterapaia from the east. This route had not previously been used. On 20 October the battalion passed through Mageriaopaia and reached Fresno on 23 October, three days later. This village was unoccupied.

While the 3rd Battalion was tediously working its way northeast, patrols from the 1st Battalion harassed the enemy from the south. The forward observer with the patrols kept close watch over the area and, assisted by an air observer, was successful in knocking out several critical enemy pillboxes. All enemy troop movements from the north were taken under fire by the air observer, thus preventing large scale reinforcements and supply movements. In one instance, this observer picked up considerable activity in the vicinity of what he described as a supply dump. Several direct hits were attained on this installation and it immediately broke out into flames, and was demolished. Artillery concentrations were fired on the mornings of 23, 24 and 25 October. These had a specific purpose in the achievement of surprise. When the preparation for the attack was fired on the morning of 26 October, the enemy apparently suspected nothing amiss until he was attacked.

The artillery preparation began at 0600 on the morn-

ing of 26 October. The assault echelon, Companys K and I moved out at 0615 to cut the trail north of Piaterapaia. This was accomplished without incident. The preparation lifted at 0630 and the attack was launched. Company I proceeded north on the trail to cut off a possible counterattack from Leseipia, and Company K attacked to the south. In the attack on Piaterapaia, the latter company met light resistance from the enemy outguards, but forged ahead only to be stopped at the main battle position, where a fierce fire fight took place.

Company I, in advancing north, surprised several outposts which were promptly disposed of. Further advance disclosed well prepared enemy defensive positions, on the ridge, which were unoccupied. Hastily, these were occupied by our forces as scouts reported that enemy troops were approaching. Apparently, the enemy intending to reoccupy these positions, were not aware of the presence of our troops. They were completely caught by surprise by a terrific volume of fire as they came up the slope. This enemy force was practically wiped out.

After being stopped, Company K made no further advance against the enemy stronghold the remainder of

the day. Artillery support became a vital necessity, and, in order to have the required effect, it had to be brought down dangerously close to friendly troops. Everybody was on the 'spot'. It must be remembered that all artillery fires were high angle and that it was being fired not over friendly troops but toward them, and with 155mm howitzers. This necessitated the highest degree of caution on the part of all concerned, to the last man.

The enemy launched a counterattack which was completely disrupted by a devastating artillery concentration. Immediately following this, the forward observer, fired in a protective barrage, which was two-hundred yards in front of the company.

A second counterattack was thrown by the enemy, at 1400 the same day. Again the artillery barrage came down and successfully stemmed the attack at its outset. One gun was adjusted upon an enemy mortar, by the air observer, and it was destroyed by a direct hit. A volume of harassing fire was maintained upon the enemy throughout that night. The following morning, 27 October, it was discovered that the enemy had evacuated the village.

Company I was attacked, on the morning of 27 October,

by what was estimated to be a company of hostile troops, presumably the same force which had evacuated Piaterapaia. This attack was accompanied with mortar and heavy machine gun fire. Artillery was brought to bear on the enemy and the attack was successfully repelled. At this time, a protective barrage was fired in for this company.

The 2nd Battalion relieved the 3rd Battalion on 29 October. Patrols were active during the next several days with a marked increase in artillery fires in close support. Harassing fires were maintained at close proximity to our positions each night in order to prevent infiltration. Enemy activity and troop movements were taken under fire by both air and ground observers. In one instance, precision adjustments were made on two enemy pillboxes. These were very close to our lines. They were completely destroyed with direct hits and were never reoccupied. An enemy counterattack, in strength, hit our positions at 0420 on the morning of 9 November and was instantly disrupted by machine gun fire and an accurate artillery barrage. Following this, additional defensive fires were adjusted and harassing fires were placed on hostile positions throughout each night.

A friendly patrol ran into an enemy bivouac, estimated to be a company, late the afternoon of 11 October. Surprise artillery fire was brought down upon the target and the effect was devastating. Later patrols, in the direction of Leseipia, adjusted artillery upon a supply and ammunition dump, which was hit and set afire. Concentrations were adjusted upon installations in Leseipia, by air observer, and this village was almost completely demolished.

In the Sisivie area, several long range patrols continually harassed the enemy with mortar and artillery fire. In conjunction with the forward observer, the air observer, adjusted fires upon enemy installations. Despite the extreme range, the artillery fire was very effective and achieved excellent results in denying the area to the enemy, and in destroying his installations.

Leseipia was not attacked in strength by our forces but village and surroundings were so effectively neutralized by artillery fire that further hostile counterattacks were not attempted.

The Americal Division, on 27 November, was relieved in the upper Laruma River Valley by elements of the Royal Australian Army.

The following extracts from After Action Reports are

relative to this operation:

"The cooperation between artillery and infantry, in this action was exceptional and the confidence that the infantry placed in their supporting artillery was most gratifying." <sup>1</sup>

"At the Laruma River operation, both medium and light artillery was used. Best results were attained from use of the medium battalion because of the longer range, greater explosive power and jungle penetration qualities. Dense jungle and extremely rough terrain necessitated the use of high angle fire." <sup>2</sup>

This recount depicts a normal jungle combat operation. From this it can readily be seen that the demand upon artillery support was paramount to success. In such terrain, in order to attain the maximum effect, artillery must have the capacity to uncover the enemy and then to assist the infantry in destroying him. The mere sounds of shelling have little or no effect upon a force well dug in under the cover of huge trees, roots and undergrowth. He must first be uprooted and driven out. For infantry to do this task would be foolhardy and costly in lives. Why do this when we have a weapon which can do the job efficiently and without endangering lives.

Another fact is definitely brought out, that of

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1. Report of Operations, Headquarters Americal Division, 30 April 1944 - 31 December 1944.

2. Ibid.

accuracy. It can be seen that opposing forces usually do not have a great interval between them. This means that close support artillery will have to be brought down in close proximity to friendly troops. High angle fire, such as was delivered in this operation, has its inherent inaccuracies due to range dispersion and a large error cannot be tolerated in this type of situation. Some say that the explosive effect from a 155mm projectile is too great to be allowed in close support. Let me ask this question, "Is a man, in a foxhole, more safe from a projectile which explodes fifty yards away than he would be if the projectile burst within his foxhole?"

#### DISCUSSION

Now let us consider the most important characteristics which artillery in direct support of infantry must possess and make a comparison of the two weapons along such lines.

1. FIRE POWER: We have seen that fire power is one of the most important factors when considering ground action. For a lack of a better definition of this term, I think of it as the ability of a unit to deliver accurate and intense fire with such devastating effect as to accomplish neutralization or destruction of a hostile force in combat. In order to properly analyze this factor, I



will break it down into several sub factors:

a. Shock Power: Ability to deliver a sudden violent attack of such weight that the initial impact produces the main effect. Surely the violence produced by the sudden explosion of eighteen 155mm shells would have a greater paralyzing effect upon the recipients than the same number of 105mm projectiles. To bear this out, let us compare the amount of explosive filler contained in each projectile. In the 105mm shell, the filler weight is 4.84 pounds. In the 155mm shell, it is 15.13 pounds, almost three times as much.

b. Rate of Fire: The prescribed rates of fire are as follows:

(1). 105mm howitzer: 1

Normal - 2 rounds per gun per minute.

Maximum - 4 rounds per gun per minute.

(2). 155mm howitzer: 2

Rapid bursts - 3 rounds per gun per minute.

Prolonged fire - 1 round per gun per minute.

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1. T.M. 9-335, War Department, 19 August 1944, p. 14.

2. T.M. 9-331, War Department, 22 November 1943, p. 8.

These rates, as set up, have been determined by the Ordnance Department to extend the life of materiel. The ability of the gun crews to exceed this depends entirely upon the training and teamwork within the crew. In numerous cases, due to circumstances, these rates have been exceeded with both weapons. I can recall reading an article in 'The Field Artillery Journal', several years ago, in which one cannoneer practically scoffed at another who had previously made a boast of firing ten rounds per minute from a medium howitzer. Of course, such excessive rates do cause undue wear of the tube, but these weapons were still delivering accurate fires toward the end of the war when the 105mm howitzers were shooting the lands from their tubes along with the projectiles. Granted, the rate of fire of the light howitzer exceeds that of a medium howitzer but, which do you prefer, to be shot at and hit ten times with an air rifle or once with a .22 rifle, at a range of fifty yards?

c. Neutralization Effect: The degree of effectiveness achieved by fire in causing severe losses, preventing movement or action, producing limited destruction of materiel, and, in general, destroying the combat efficiency of the enemy.

Let us initially consider the relative effects of the projectiles from these weapons as pertains to their ability to cause casualties to personnel. A casualty is supposed caused by a hit with at least 58 foot-pounds of energy. It is not necessarily death but incapacitation. The following figures have been derived from calculations based upon data prepared by the Ordnance Department: <sup>1</sup>

Firing at a range of 4500 yards, to attain casualties of 60% of the personnel, in an area 200 yards by 100 yards, the following number of rounds are required:

(1) Men standing on flat unshielded terrain:

	105mm Howitzer	155mm Howitzer
Low Angle:	41 rounds	33 rounds
High Angle:	25 rounds	21 rounds

(2) Men standing, rolling terrain, country fields:

Low Angle:	82 rounds	66 rounds
High Angle:	50 rounds	42 rounds

(3) Men prone, flat terrain, no shielding:

Low Angle:	123 rounds	99 rounds
High Angle:	75 rounds	63 rounds

1. Terminal Ballistic Data, Volume III, Bombs, Artillery and Mortar Fire and Rockets, Office of the Chief of Ordnance, September 1945, pp. 100 and 103.

(4) Men prone, rolling terrain, country fields:

Low Angle:	164 rounds	132 rounds
High Angle:	100 rounds	84 rounds

The above figures were concerned with exposed personnel, but we shall also have to consider personnel who are in foxholes or open trenches. In this case, air bursts are definitely much more effective. The following calculations were based upon a ten degree foxhole, as this is believed to be the most commonly encountered and also corresponds to the shielding afforded men in a prone position on rough terrain. A ten degree foxhole is defined as a foxhole in which the occupant thereof will, on the average, be unharmed by fragments which have less than a ten degree angle of fall. <sup>1</sup>

Firing at a range of 5000 yards, to attain 60% casualties to personnel in ten degree foxholes, in an area 200 yards by 100 yards, the following number of rounds are required:

105mm Howitzer - 335 rounds.

155mm Howitzer - 271 rounds.

The same effect could be achieved with less rounds

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1. Terminal Ballistic Data, Volume III, Bombs, Artillery and Mortar Fire and Rockets, Office of the Chief of Ordnance, September 1945, po. 65, 117 & 119.

if a greater charge was used giving a flatter trajectory and resulting in a better fragmentation pattern.

However, charge six was used for the light howitzer and charge five for the medium howitzer in order to keep the elevation above two hundred mils.

Now let us take under consideration some facts concerning fragmentation of the respective projectiles. A comparison of Tables I and II, attached, <sup>1</sup> shows that the preponderance of effective fragments and the average number of effective fragments per square feet, at any given distance, is greater for the 155mm shell. It is readily seen that this preponderance of fragmentation has a direct bearing on the casualty inflicting ability of the projectiles.

In considering casualties to enemy personnel as regards neutralization, we must remember that such fires will not only affect his infantry, but artillery as well. If we place effective counterbattery fire on the hostile artillery, we prevent him from manning the guns. The more effective our fire is in causing casualties to enemy artillerymen the better our chances of accomplishing our

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1. Terminal Ballistic Data, Volume III, Bombs, Artillery and Mortar Fire and Rockets, Office of the Chief of Ordnance, September 1945, pp. 75 and 79.

TABLE I  
155 mm HE SHELL, M107  
CASUALTIES

Distance from burst (ft)	Total number of effective fragments	Average number of effective frag- ments per sq ft
r	N	B
20	1,460	0.291
30	1,400	0.124
40	1,360	0.0676
60	1,280	0.0283
80	1,190	0.0148
100	1,130	0.0090
150	990	0.0034
200	900	0.0018
300	767	0.0007
400	669	0.0003
600	540	0.0001

"This table gives the number B of effective hits per square foot of target area at a distance r feet from the burst. The numbers B are averages for different directions from the burst. They are properly applied only to a considerable number of bursts with random orientation of the projectile axis relative to the target."

TABLE II  
105 mm HE SHELL, M1  
CASUALTIES

Distance from burst (ft)	Total number of effective fragments	Average number of effective frag- ments per sq ft
r	N	B
20	1,160	0.231
30	1,115	0.0986
40	1,072	0.0533
60	996	0.0220
80	932	0.0116
100	875	0.0070
150	745	0.0026
200	642	0.0013
300	513	0.0004
400	433	0.0002
500	358	0.0001

"This table gives the number B of effective hits per square foot of target area at a distance r feet from the burst: The numbers B are averages for different directions from the burst. They are properly applied only to considerable number of bursts with random orientation of projectile axis relative to the target."

mission.

d. Destruction:

(1). Artillery Materiel: Generally, the degree of destruction sought is such as to put the piece out of action temporarily, discounting casualties to personnel, as that has been discussed previously. Such damage as perforation of a counter recoil gas cylinder or even destruction of sighting equipment can put a gun out of action temporarily, as these can be repaired. However, they will not be able to be utilized against us at the critical time. We have already seen the relative effect of fragmentation. Thus we can arrive at the conclusion that damage of materiel resulting from fragments, favors the heavier shell. This however, is not considering the most important item, that of accuracy, which will be discussed later. Due to weight of projectile and explosive, a direct hit upon an artillery piece will cause the greater degree of damage if the hit is made with the 155mm shell.

(2) Log and/or Earth Fortifications:

Despite the fact that our concept of warfare is primarily one of offensive action, we still have a definite place for a defensive doctrine in our tactics. The same can well apply to any possible enemy. We know



that such fortifications constructed by the Japanese in the Pacific were not successful in their mission of holding back our forces. Still they took their toll of American lives. In any future war, we can well expect to again encounter similar or superior constructions, especially in jungle warfare.

For the purposes of this discussion we shall consider the fortifications constructed by the Japanese, which were encountered in our jungle campaigns. These were usually built quite low and constructed of a log roof, logs or earth filled oil drums for the walls and the whole was covered with earth. In order to attain the desired effect, it was necessary for the projectile to perforate the walls or roof and detonate inside the bunker. Let us make a few comparisons of the penetrating abilities of the two weapons concerned, firing low angle. This data has been computed from graphs prepared by the Ordnance Department. <sup>1</sup>

(a). Low Angle Fires:

1. A bunker is constructed of two layers of earth filled oil drums with one foot of

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1. Terminal Ballistic Data, Volume III, Bombs, Artillery and Mortar Fire and Rockets, Office of the Chief of Ordnance, September 1945, pp. 168 and 172.

earth between the layers and the embankment of earth is six feet thick:

The maximum range at which this wall would be perforated with the 105mm howitzer, using charge seven, is 1000 yards; for the 155mm howitzer, charge seven, the maximum range is 8500 yards.

2. Assume a bunker to be constructed of two layers of mahogany logs, each one foot in diameter. A layer of earth one foot thick is in between the layers of logs and the embankment is six feet of earth.

The 105mm howitzer can penetrate this wall at a maximum range of 2000 yards. The 155mm howitzer can accomplish this from a maximum range of 10,000 yards.

3. The following table shows the comparative ability of the pieces to penetrate medium earth at given ranges:

Range (yards)	Penetration (feet)	
	105mm Howitzer	155mm Howitzer
1000	12.1	18.8
2000	11.0	17.6
3000	10.2	16.5
4000	9.5	15.5
6000	8.4	13.7

(b). High Angle Fires: The following quotation definitely points out that the light artillery howitzer, in high angle fire, has only slight penetrating ability against roofs of bunkers:

"It is clear that as high-angle fire is practiced, relatively light weapons like the 75mm and 105mm howitzers, the 155mm mortar, and the 81mm mortar are of borderline usefulness in attacking heavier type roofs of log fortifications. It would seem from the graphs that a well-made bunker or pillbox with three layers of logs and say 5 or 6 feet of earth would stand up against any of the light weapons used in high-angle fire. Such targets would be vulnerable to high-angle fire from the 4.5 inch Gun M1, the 155mm Gun M1, the 155mm Howitzer M1 or the 8 inch Howitzer M1. Questions of probable errors would, however, come to the fore." 1

(3). Concrete: In addition to the log and earth fortifications erected by the enemy in the Pacific, we also encountered concrete pillboxes which held off numerous assaults by infantry troops and withstood volumes of artillery fire. There is a definite need for a heavier caliber artillery piece, which will be readily available to the infantry commander, for the reduction of such obstacles.

The following data will show the relative abilities of the two concerned weapons as regards concrete

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1. Terminal Ballistic Data, Volume III, Bombs, Artillery and Mortar Fire and Rockets, Office of the Chief of Ordnance, September 1945, p. 166.

destruction. This data was calculated by estimating, at a given range, the number of consecutive hits in one small crater necessary to perforate and, from the range probable errors, the number of rounds it is required to fire in order to obtain this number of hits in this crater. <sup>1</sup>

(a). Approximate total number of rounds which must be fired at various ranges to have 90% probability of at least one perforation, using concrete piercing fuze.

1. Concrete pillbox wall 3 feet thick, 4.5 feet high, and 7.5 feet wide:

Range in yards:	1000	2000	3000	4000	5000
105mm Howitzer:	8	35	120	350	710
155mm Howitzer:	2	4	9	23	52

2. For a concrete pillbox 7 feet thick, 10 feet high and 15 feet wide:

Range in yards:	1000	2000	3000	4000
105mm Howitzer:	30	130	480	1400
155mm Howitzer:	5	15	30	70

(b). Approximate total number of  
~~hits~~ <sup>Rounds</sup> at various ranges for 90% probability of enough

1. T.M. 9-1907, Ballistic Data, Performance of Ammunition, War Department, 23 September 1944, pp. 206-209.

hits to make a breach 4 yards wide.

1. A wall 6 feet thick and  
10 feet high:

Range in yards:	1000	2000	3000
105mm Howitzer:	120	220	540
155mm Howitzer:	36	54	100

To further illustrate this, I would like to quote an actual example of action against rocky formations.

"In the Tenth Army attack on the Shuri position on Okinawa, the 96th and 7th Divisions of the XXIV Corps were involved in attacking heavily organized limestone escarpments. One particular resistance point was a rocky crag on the boundary between divisions, which was in fact a three story pillbox, shaped like a ship, dominating a thousand yards or more of open approach. Volume of fire, accurate fire, was tried for two days but the crag resisted and continued to take its toll of our infantry. Since volume of fire was not effective, could not reach into the caves and tunnels to eliminate the defenders, the only solution appeared to be to remove the obstacle. A 155mm howitzer with concrete-piercing fuzes was posted for direct fire at eight hundred yards to saw off the crag at its base and drop it down upon itself. In spite of hostile fire from the crag, the artillery crew accomplished its mission with some 50 rounds. The crag fell, literally, and the infantry moved forward. The fire of one howitzer, fifty rounds, was effective. The right weapon and the right method had been used for the job at hand." <sup>1</sup>

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<sup>1</sup>. Major General Archibald V. Arnold, USA, "Artillery With the Team", The Field Artillery Journal, (January-February, 1948), p. 29.

e. Accuracy:

Regardless of the ability to destroy or neutralize, a weapon cannot be considered effective unless it is capable of delivering the necessary fires upon the target with accuracy. This capability is of foremost importance in artillery support. We have seen, in the combat example, that the proximity of opposing forces often necessitated fires very close in to our own troops. We also saw, in paragraph d above, the number of rounds required, from the concerned weapons, for a 90% probability of perforation of concrete. In preparing the data for this, the Ordnance Department considered the range probable errors of the weapons. This brings out the fact that accuracy has a definite bearing on the number of rounds required for a given mission. We must have accuracy if we are to pin the enemy down or destroy him and his fortifications, installations and artillery materiel.

The following comparative figures were prepared by the Ordnance Department. <sup>1</sup>

Probability of hitting a target one yard square in any one round, firing with concrete piercing fuze:

1. T.M. 9-1907, Ballistic Data, Performance of Ammunition, War Department, 23 September 1944, pp. 238 and 242.

Range in Yards:	3000	5000
105mm Howitzer	0.065	0.012
155mm Howitzer	0.190	0.044

Computing the above data into number of rounds required to hit a target of that size at given ranges, we arrive at the following:

Range in Yards:	3000	5000
105mm Howitzer	15.4	83.3
155mm Howitzer	5.3	22.7

Approximately three times as many rounds are required for the light howitzer.

f. Range:

In order for artillery to properly fulfill its mission, it must be able to provide adequate range which will give sufficient coverage where and when required. Upon many occasions, during the past war, the need for a weapon of longer range in support of ground action was critical. In jungle operations, these occasions arose with the necessity for long range patrols. At other times, forward positions were inaccessible to artillery pieces and long range direct support was the only solution to the problem. Such problems were difficult to solve with only one medium artillery battalion readily available to the

Division Commander.

From the Firing Tables of the respective weapons, we find that the maximum range of the 105mm howitzer is 12,205 yards with a range probable error of thirty-nine yards; for the 155mm howitzer, the maximum range is 16,355, with a range probable error of forty-one yards. This probable error is too great for effective fires and safety. In determining the maximum effective range, for the purposes of this discussion, we will use a range probable error of thirty yards. Now by checking with the Firing Tables we find that the range for the 105mm howitzer is 9,100 yards; for the 155mm howitzer it is 13,200 yards. The difference here is 4,100 yards in favor of the medium howitzer.

2. MOBILITY: This factor will be essential in any future war due to the increased mechanization of modern armies. Jungle terrain, however, is not considered best suitable to the employment of mobile units in their most effective role, due to the natural obstacles presented. We can surmise from this, that mobility, as far as rapid movement over ground is concerned, will not become the prime consideration in the jungle. If the supported troops cannot be expected to make long speedy moves, neither will it



be necessary for its artillery to do so. The essential factor here is for the supporting element to be able to render timely and adequate support when and where it is required. This is mostly a matter of planning. A good artillery commander, through continuous position reconnaissance and by keeping abreast of the situation, will be able to displace his units, prior to any decisive action, in order to accomplish his mission. Then too, if the situation should happen to get away from him, the longer range of the medium howitzer will facilitate continuous support at crucial moments. This range will also give coverage while a portion of a battalion is displacing.

The roads in such areas, especially in the early stages, are practically impassable to wheeled vehicles and also to the standard artillery tractors. It has been found that the best prime mover for artillery was the old TD type of tractor. With this vehicle, the mobility and trafficability is approximately equal for either of the weapons under consideration.

The 221st Field Artillery Battalion conducted an experiment on the ability of the TD 14 tractor to tow the 155mm howitzer over soft muddy terrain. This took place on the island of Bougainville in the Pacific

theater. The vehicle and gun first attempted to negotiate a piece of terrain which was extremely soft and would offer the maximum resistance to any type vehicle. In this case, they mired down after traveling approximately twenty-five yards. Prior to the second attempt, an issue skid pan was attached to the undercarriage of the howitzer. With this attachment only slight difficulty was encountered in that the forward movement was very slow, but the terrain was successfully traversed.

Considering mobility, the light howitzer holds a slight advantage in that a crew can prepare for action and displacement in a little less time than is required for the medium howitzer. In an overall comparison, this advantage can be considered to be negligible.

The prime purpose behind the development of self-propelled artillery weapons is the factor of mobility. If this type weapon should become standard equipment for artillery units, it will be able to perform satisfactorily in jungle terrain but at a reduced speed and its primary advantage will not have been exploited. As regards trafficability of the 155mm howitzer, self-propelled, against that of the 105mm howitzer, self-propelled, it was found in action that they are approximately equal. No appreciable difference in time of

preparing for action or displacement was noted.

3. LOGISTICS: In any conflict of armed forces, supply must receive considerable attention. We cannot say that any one factor in war outweighs the other. Logistics will have a decisive effect upon the success of forces in the field, when it is capable of delivering to such forces the essentials required to wage war, chiefly the items for superior fire power.

Ammunition is one of the essentials which it is mandatory to keep in supply. Without an abundance of ammunition we lose our fire power potential, a prerequisite to winning a war. During World War II, oftentimes we lacked this item due to a tie-up in shipping. It has been my experience, in island warfare, that our ground supply agencies, coupled with combat troops, handled their end of the problem in a superior manner. The fault of ammunition shortage does not lie in this direction. If it reached the island, it was forwarded to the troops with a minimum of delay. Our difficulty was in ocean transportation. So, we shall approach the logistical problem with that in mind.

There is no question as to which type ammunition, of the two under consideration, is more economical of trans-ocean shipping. A comparison of total shipping

weights computed for 5,000 complete rounds of each type ammunition is as follows:

105mm Howitzer	150 tons
155mm Howitzer	286 tons

From this we see that the initial 5,000 rounds for the light howitzer is approximately one-half the weight of that for the medium howitzer. However, looking at it from a long range point of view, what will be the comparative expenditures? This may change the aspect of supply. It will take more logistical support to keep up the supply of light artillery ammunition due to the fact that it is necessary, for this weapon, to expend more rounds to gain the required effect. A comparison of the number of rounds required for neutralization in paragraph 1c, above, shows that approximately 23% more rounds will be fired from the lighter howitzer to accomplish a mission of this nature.

The table below gives the approximate total weight of complete rounds (lbs.) <sup>1</sup> which must be fired at various ranges to have a 90% probability of at least one perforation, of a concrete pillbox wall which is

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1. Weight of unpacked rounds - in the case of separate loading guns this is the weight of the projectile and charge.

3 feet thick, 4.5 feet high, 7.5 feet wide. <sup>1</sup>

Range in yards:	1000	2000	3000	4000	5000
105mm Howitzer	340	1400	5200	15,000	30,000
155mm Howitzer	220	440	1000	2,500	5,700

It is quite obvious, from this, that we cannot very well afford to destroy many pillboxes with the light howitzer, especially from a logistical standpoint. As was previously mentioned, we will encounter such constructions and undoubtedly some which will be much more durable. These will have to be destroyed, if our troops are to advance. A task of this nature must be dealt with at the earliest possible moment if we are going to conserve our manpower. Thus the infantry commander will demand a means which is available to him with the least possible delay.

The overall difference in shipping weight is more than compensated for when we make a comparison of the total weight required for a long period of time. Then too, we should be willing to sacrifice a few more ships, and a bit more of our time and effort in order that we may not needlessly lose good American lives on the fields of battle.

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1. T.M. 9-1907, Ballistic Data, Performance of Ammunition, War Department, 23 September 1944, PP. 208-209.

4. MORALE: The importance of this factor can be brought out very vividly by the following quotation:

"Likewise with the equation, said by Napoleon and repeated by Foch: 'In war the morale is to materiel as three is to one.' This is a truth only as it is related to the state and possibilities of fire. Among fighting men, morale endures only so long as the chance remains that ultimately their weapons will deal greater death or fear of death to the enemy. When that chance dies, morale dies and defeat occurs." <sup>1</sup>

This is applicable to our own as well as enemy forces. There is nothing more demoralizing to an infantryman than the lack of fire power in the assault, especially when he has made several unsuccessful onslaughts to breach the enemy defenses. This is also true when he is being forced to withdraw from an attack due to smothering hostile artillery fire. This same loss of morale will also occur in a defensive phase if our fire fails to stop the enemy advance.

Conversely, if we are able to neutralize the enemy defenses and artillery, and completely stop his attacks, he is very apt to suffer loss of morale and ultimate defeat.

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1. Colonel S. L. A. Marshall, "Battle Command in Future War", The Infantry Journal, (October 1947), p. 17.

## CONCLUSIONS

Our experiences in World War II have brought out the fact that we must have heavier fire support for the assaulting troops. We saw the tremendous effect of violence in a battle for superiority. From this, we can readily surmise that any future struggle will be characterized by even more physical force than has ever been exhibited to date. This makes it imperative that we begin from the front line soldier in building up our military potential. We can give this soldier a much needed increase in fire power if we would place at his disposal the proper direct support artillery. We cannot detract from the marvelous task performed by our light artillery in the past struggle. It did succeed in fulfilling its mission. That was yesterday. Now let us look forward to tomorrow. In doing so, we must take into consideration changes in the trend of warfare and accordingly make changes in materiel to adapt itself to these trends.

In a consideration of various factors pertinent to direct support artillery, we have made a comparison between the 105mm howitzer and the 155mm howitzer. As far as fire power is concerned, we have seen that

the medium howitzer is superior to the light howitzer, in all respects. The medium weapon can more effectively neutralize a larger area, in a given time, with less expenditure of ammunition and cause more casualties to enemy personnel. It has greater destructive power in the reduction of log and concrete pillboxes.

To date, we have not achieved perfection in accuracy of field artillery weapons. The 155mm howitzer, though not the ultimate, is a definite improvement over the present direct support weapon. This factor of accuracy is vitally important in warfare due to the fact that it is necessary to be able to hit a target in order to destroy or neutralize it. The comparison definitely shows that the medium howitzer is superior in this respect. Then too, in close support fires we cannot tolerate our own artillery falling upon its supported elements. As was brought out in the combat example, the medium howitzer has this capability of accuracy to the required degree.

Direct support artillery, as some are inclined to interpret, has not been established for only close-in fires. In the concept of any ground commander, his direct support artillery should be utilized to best accomplish his mission and to aid him in seizing and



holding his objective. He must have this tool. If an infantry battalion, in its attack, is receiving heavy casualties from enemy artillery and finds itself unable to progress, the commander would not increase the tempo of his artillery upon the enemy immediately opposing his troops. To do so would only mean sacrificing human lives. In such event, the primary mission of his artillery is to silence the enemy guns and he must have the means with which to accomplish this. Some say that this is a job for Corps Artillery. It may be, but let us not stand idly by while our troops are suffering. This job is one for any and all artillery.

In comparing these weapons in regards to mobility, we find that the light howitzer has a slight advantage in that it can prepare for action and displacement in less time. This is primarily due to materiel functioning. The deficiency lies in the construction of the firing jack of the medium piece, in that it is manually operated and requires too much time for raising and lowering. A modification recommendation has been submitted by the 221st Field Artillery Battalion on this deficiency. With this correction, the difference in time between the two weapons would be negligible.

As regards the trend toward self propelled artillery weapons, the only great difference between towed and self propelled artillery is mobility. If we turn to self propelled weapons the same advantages will apply between the 155mm howitzer and the 105mm howitzer as were brought out in this discussion. In addition, there will be no difference in mobility between the two.

In the comparison logistically we find that, round for round an advantage is held by the lighter weight piece. As for maintenance of supply, it was brought out that this advantage was considerably reduced. This is due to a consideration of the total rounds required to effectively accomplish any type mission. We know that the medium howitzer will expend less ammunition for the same effect attained by the light weapon. In the overall picture we can safely say that approximately an equal amount of logistical support would be required for either weapon. As was pointed out previously, we cannot overlook the fact that if it does require more support from supply agencies, the 155mm howitzer will pay dividends in lives saved at the front lines.

Success in battle is a prerequisite to morale and this success is highly dependent upon fire superiority. Any infantryman can tell you the degree of elation he

feels when he hears the heavy projectiles passing overhead and then sees the effect as they go crashing into a stubborn pillbox, leaving only destruction and desolation in their wake.

Please remember this, success in battle is paramount to the warding off of any aggressor bent upon the task of depriving us of our way of life. The battlefields of the world have been strewn with our honored dead who, in the past, unselfishly gave their lives in attaining and guarding our freedom. As members of our country's Armed Forces, we are duty bound to preserve it for the future. To do this, we must exploit all means possible to achieve the requisite, success in battle. Fire power, at all echelons, is only one of these means but it is of prime importance and we should direct our every effort to that end. Let us give first consideration to the soldier who is slugging it out on the ground and give him the necessary equipment to do his job and then render him the maximum support in accomplishment of our mission.

#### RECOMMENDATIONS

That the 155mm Howitzer M1 be adopted by the U. S. Army, as its direct support artillery weapon for the Infantry Division.

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