THE
FIELD ARTILLERYMAN
NAAPTB

U. S. ARMY FIELD ARTILLERY SCHOOL

Fort Sill, Oklahoma

INSIDE THIS ISSUE

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Fort Sill, Oklahoma
September 1970

On the cover of this issue of **THE FIELD ARTILLERYMAN** is an artist's conception of enemy gunners preparing to mortar a friendly installation. The standoff attack using a wide assortment of indirect fire weapons is currently the most effective and frequently used method of harassment employed by the insurgents in Southeast Asia. In the feature article of this issue, Brigadier General Lawrence H. Caruthers, Jr., Assistant Commandant of the US Army Field Artillery School and former XXIV Corps Artillery and 1st Infantry Division Artillery Commander, discusses the characteristics and capabilities of the enemy arsenal currently employed against allied forces.

INSTRUCTIONAL AID NUMBER 45

THE FIELD ARTILLERYMAN

THE FIELD ARTILLERYMAN is an instructional aid of the United States Army Field Artillery School published only when sufficient material of an instructional nature can be accumulated. It is designed to keep field artillerymen informed of the latest tactical and technical developments in the field artillery.

In accordance with AR 310-1, distribution of **THE FIELD ARTILLERYMAN** will not be made outside the command jurisdiction of the School except for distribution on a gratuitous basis to Army National Guard and USAR schools, Reserve Component staff training and ROTC programs, and as requested by other service schools, ZI armies, U. S. Army Air Defense Command, active army units, major oversea commands, and military assistance advisory groups and missions. Paid subscriptions to **THE FIELD ARTILLERYMAN** on a personal basis may be obtained by qualified individuals by writing to The Book Store, US Army Field Artillery School, Fort Sill, Oklahoma 73503.

Primarily articles are prepared by individuals assigned to departments of the School or to field artillery units and agencies outside the School. All articles, no matter what the source, are coordinated with appropriate departments in the School and with the US Army Combat Developments Command Field Artillery Agency and the US Army Field Artillery Board collocated with the School at Fort Sill, Oklahoma. This coordination is effected in an effort to arrive at a "Field Artillery Community" position before publishing the information. The Field Artillery Community is Fort Sill's term for the center team concept of Continental Army Command, Army Materiel Command, and the Combat Developments Command. However the publication is prepared and distributed for information only. Nothing contained within it is to be considered directive in nature.

All readers of **THE FIELD ARTILLERYMAN** are encouraged to submit articles for publication, comment on previously published articles, or offer suggestions for the improvement of this instructional aid's content and format. Correspondence should be addressed to: Commandant, US Army Field Artillery School, ATTN: ATSFA-PL-FM, Fort Sill, Oklahoma 73503.

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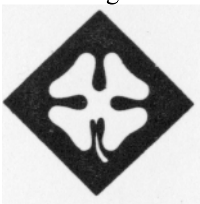

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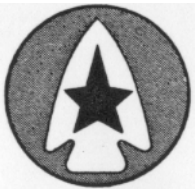

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INSTRUCTIONAL DEPARTMENT NOTES

GUIDED MISSILE DEPARTMENT

AZIMUTH LAYING MODIFICATION FOR PERSHING

A new modification to the Pershing la system, now being applied to equipment in the field, will greatly improve the system's effectiveness and mission flexibility. Pershing is the Army's most powerful surface-to-surface guided missile. The system is employed in quick reaction alert and in general support of the field army or independent corps.

The modification involves changes in the equipment and procedures used to align the inertially stabilized guidance platform to the firing azimuth. These changes include a minor rework of the azimuth laying control box, replacement of several plug-in components, provision of a new countdown computer program, and a revision of operating procedures.

The importance of the modification is that it increases considerably the angle by which the mission firing azimuth may be offset from the azimuth on which the erector-launcher is emplaced and thus greatly reduces the number of factors to be considered during firing position selection, system emplacement, and general support or change-of-target employment.

The new equipment and procedures were tested by the U. S. Army Field Artillery Board at Fort Sill in December 1969 and proved to be very satisfactory. Installation of the modification on Pershing equipment in CONUS and USAREUR began in January 1970. The modification is being applied by the prime contractor for Pershing, under the supervision of the Pershing Project Manager's Office, Redstone Arsenal, Alabama.

TACTICS/COMBINED ARMS DEPARTMENT

ENGINEERS TEACH DEFENSIVE CONCEPTS TO FIELD ARTILLERYMEN

Engineer skills are vital to the construction of perimeter defenses in combat operations. Recognizing this requirement, the Engineer Branch, Associate Arms Division, Tactics/Combined Arms Department, presents instruction which stresses these skills important to battery defense. Several field classes are given to the field artillery noncommissioned officer candidates (FANCOC) and the field artillery officer candidates (FAOCC). These classes include practical exercises which give the student a working knowledge of many techniques specifically applicable in a stability environment. These include techniques for erecting and emplacing barbed wire entanglements, for using explosives to counter enemy mines and boobytraps and to clear landing zones or base camps, for installing and removing protective minefields, and for employing the M18A1 (Claymore) mine. All of these techniques are vital for insuring a successful perimeter defense against enemy sapper attacks and main force assaults.

Classroom instruction includes a presentation on boobytraps and expedient mines. This crucial subject is given to students at all course levels in the Field Artillery School. Counter techniques, such as close observance of the civilian populace, are stressed. Many soldiers have died needlessly in the Republic of Vietnam through failure to employ commonsense countermeasures.

Other classroom instruction ranges from mine warfare doctrine to vehicle and route classification. The most detailed and advanced material is presented to the Field Artillery Officer Advanced Course (FAOAC). Career officers must have an understanding of such concepts as barrier planning as well as the engineer support available in various tactical situations. Both the Field Artillery Officer Vietnam Orientation Course (FAOVOC) and the officer advanced course are introduced to the technical aspects of military geographic documentation. Only basic defensive concepts are presented to officers in the Field Artillery Officer Basic Course (FAOBC), and to officer candidates and NCO candidates.

All of the engineer presentations given to students in the various artillery courses constantly stress practical application to insure that students obtain a working knowledge of important defensive concepts. The critical importance of these concepts in relation to a stability environment is continually being demonstrated.

NONRESIDENT INSTRUCTION DEPARTMENT

CHANGES TO REGULATION INCREASE PROMOTION POINTS

Recent changes to AR 600-200 and to DA Form 3355-R have given the edge on promotion to enlisted men who are enrolled in the Army Correspondence Course Program.

The maximum score possible on a promotion board is 1,000 points—750 administrative points based on the individual's record and 250 points awarded by the promotion board. Military education accrues administrative points, and a maximum of 125 points may be awarded for military education. An enlisted man can earn the entire 125 points by completing subcourses at the rate of one-half point per credit hour. Through resident schooling, such as NCO, ranger, and drill sergeant courses, he can accrue from one to two points per week of instruction. Completion of an NCO academy course (4 weeks or longer) merits an award of 30 points.

US Army field artillerymen can now receive expert and contemporary instruction in the latest techniques and doctrine of their specialty by correspondence. Almost any serviceman who is unable to get an allocation to a resident school can gain promotion points and enhance his career development by correspondence courses.

This service is provided by the Nonresident Instruction Department at the U. S. Army Field Artillery School, Fort Sill, Oklahoma. This department's Extension Courses Division is responsible for providing instruction which parallels that prescribed in the resident courses of instruction at Fort Sill. Requests for a catalog or for more information should be directed to: Commandant, U. S. Army Field Artillery School, Nonresident Instruction Department, ATTN: Student Counseling Branch, Fort Sill, Oklahoma 73503.

GUNNERY DEPARTMENT

GFT CORRECTION

The charge 5 scale of graphical firing scale 155Q4HEM107 shows changes in fuze setting for a 10-meter change in height of burst (FS/10HOB) as .6, .7, .8 and .9. These should be corrected to read **.06, .07, .08 and .09.** The remaining values on this GFT are correct. Units which have this GFT should mark these changes on the charge 5 scale.

GUARDIAN OF THE SOLDIER'S WARRANTY

NOTES FROM THE US ARMY FIELD ARTILLERY BOARD

SERGEANT MISSILE SYSTEM TRAINER

The U. S. Army Field Artillery Board (USAFABD) recently completed the check test of the Sergeant missile trainer M68 at Fort Sill, Oklahoma. The Sergeant missile system trainers were initially placed in operation in 1961 and have been in continuous use since that date. Problems which have plagued the trainer in past years include azimuth orientation unit (AOU) misalinement, platform heater demand voltages, and unstable power supplies. These problems and the age of the trainers have made maintenance of the trainer increasingly difficult.

Confronted with the problems of the tactical units and the U. S. Army Field Artillery School in keeping the trainer operational, the Sergeant project manager decided to modify the trainer guidance electronics and to completely refurbish the trainer warhead, rocket motor, and fins.

The Sergeant trainer device can be used extensively for training because its physical dimensions are the same as those of a tactical round and it may be handled and transported in the same manner as a tactical round. The guidance section can be used to provide operator training in organizational maintenance test station (OMTS) checkout procedures. Interchangeability of assemblies within the trainer guidance section provides realistic maintenance training, and after the trainer has been assembled on the launcher station, it is further used to conduct AOU and firing set training during mock firing operations.

The modification program of the trainer consisted of the redesign of the frequency regulator, the power supply, and the interconnecting box assemblies. All other assemblies received some modification. All plug-in relays are now authorized to be stocked at direct support maintenance level, and this should decrease the problems of maintenance within the unit.

With the application of the modification and refurbishment program, the Sergeant trainer should provide an adequate training device throughout the remainder of the Sergeant system's lifespan.

Career Memo

OFFICER EFFICIENCY REPORT RECLAMAS

Some confusion appears to be resulting from the provision of AR 632-105, which requires that adverse officer efficiency reports be referred to the rated officer for acknowledgement and comments as desired. Many officers are under the impression that their comments attached to an adverse efficiency report constitutes an appeal or a reclama. This is not the case. Though the rated officer's comments become a part of his official record, no further review action will be taken without a written request from the rated officer to The Adjutant General. It is the policy of the Department of the Army to accept an efficiency report as a fair and objective appraisal of the rated officer unless there is evidence to the contrary. AR 623-105 provides that any officer may appeal an efficiency report if he feels that it violates the intent of the regulation. To accomplish this appeal, he must submit a separate reclama. A mere allegation of a personality clash or a significantly lower rating than those he previously received is not enough to invalidate a report. Substantive evidence must be provided to support a claim of injustice or bias. Before making a decision to submit an efficiency report reclama, the officer should visit his career branch at the Office of Personnel Operations to review his record and discuss the advisability of and procedures for submitting the appeal. If he is unable to visit his career branch in person, the officer may designate a deputy, in writing, to review his records and obtain the desired information. Officers assigned to the career branches and to The Adjutant General's Office are prohibited from acting in this capacity. When a properly substantiated reclama is approved by the Department of the Army, the entire efficiency report or the specific portions challenged will be voided and removed from the officer's record. If the reclama fails to support the claim of injustice, the entire correspondence becomes a permanent part of the officer's record. For this reason, the decision to submit a reclama should be carefully weighed, and should be undertaken only when substantive evidence is available to support the claim.

GUIDE FOR RETENTION OF JUNIOR OFFICERS DISTRIBUTED

The Officer Personnel Directorate recently released its comprehensive Commander's Guide to the Retention of Junior Officers, which evolved from a Junior Officer retention booklet developed by the Field Artillery Branch. The new guide is

— Distributed worldwide to commanders in the grade of lieutenant colonel and above.

— Acclaimed by commanders as a significant help in personal counseling sessions with their junior officers.

— Published in looseleaf form and provides a complete summary of current DA policies and procedures for junior officer retention.

— Available to commanders from their respective career branches.

Changes and subsequent issues will be distributed automatically as required.

Commanders who have not received their copies should contact their career branch.

COMMUNICATION: AN AID TO CAREER DEVELOPMENT

Officers are often reluctant to communicate with their respective career branches. This tends to place the entire burden of career planning on branch personnel. It is the individual officer's responsibility to evaluate his own progress periodically and to take or request appropriate action. The vital link in this action is timely communication with your career branch to determine what action is necessary and to indicate your personal desires and report change of qualifications or other data pertinent to your career. The following means of communication are appropriate:

A current preference statement, DA Form 483, should be in each officer's file. Assignment preferences should be logical and in accord with the career pattern of his branch. (AR 614-100.)

Each officer should visit his branch every 3 years or take advantage of branch visits to his station. If an officer is unable to visit his branch he may: deputize a friend to review his file and obtain career guidance from his branch; or call his branch and request information; or correspond with his branch and request information for career guidance purposes.

SHORTAGE OF FIELD ARTILLERY LIEUTENANTS

There continues to be a shortage of field artillery lieutenants. The immediate prospects for additional lieutenants becoming available are not encouraging. Every effort should be made locally to assign field artillery lieutenants to branch material duties, preferably at battery level.

EFFECTS OF RAPID PROMOTION ON CAREER PATTERNS AND CAREER MANAGEMENT

Rapid promotions have reduced the time available for combat arms officers below the grade of colonel to serve in assignments which satisfy criteria for advancement. For example

— A lieutenant now has only 2 years to acquire the knowledge and master the techniques of his branch in qualifying for promotion to captain and the command of a company-size troop unit.

— A captain has about 4 years to attend the advanced course, command a company-size troop unit, serve as a troop unit staff officer, and demonstrate the performance and potential required to qualify him for promotion to major.

— Up to this point there is little time for assignments not directly related to the officer's basic branch. Even so, the officer must be ready to perform in branch immaterial assignments.

— Time spent in the grade of lieutenant colonel is critical. Normally an officer must have commanded a battalion and served on a high-level staff in order to qualify for his next promotion. To the officer this means that there is but a small margin for error in his duty performance and not much time for assignments other than the two mentioned.

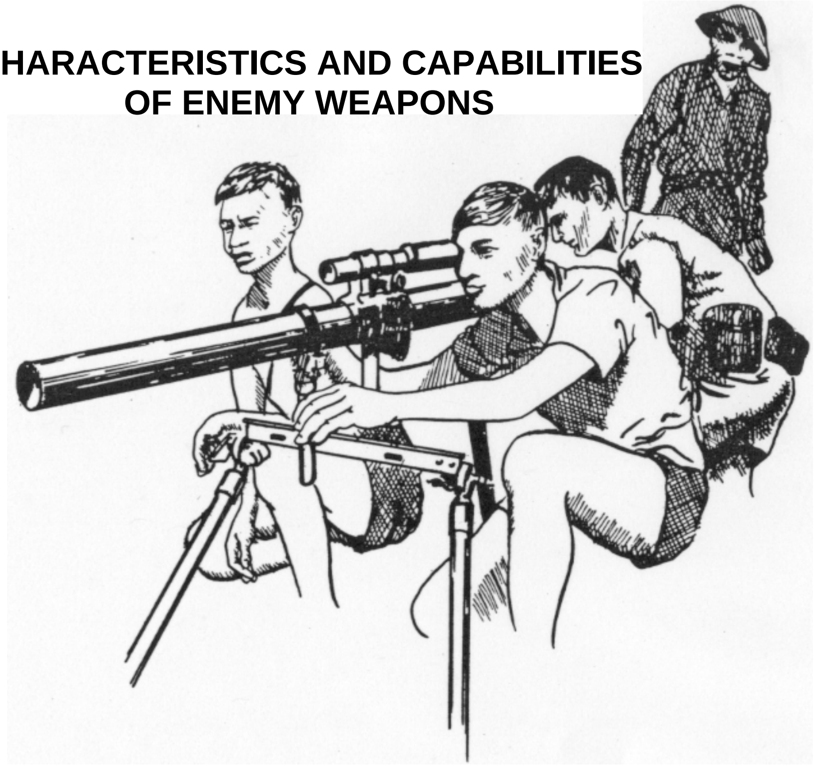
To offset the effect of rapid promotions, the Officer Personnel Directorate continually endeavors to provide the officer with assignments to improve his branch expertise, troop leadership ability, and capability as a staff officer.

LASER ADAPTED FOR IGNITION OF EXPLOSIVES

Picatinny Arsenal has announced the adaption of the laser for remote, wireless initiation of thermal batteries and other devices containing explosives, propellants, and pyrotechnics. The new method of igniting explosives utilizes a thin beam of infrared radiation in place of wires. Wires, which can act as an antenna to the detriment of any device containing them, are removed. In their place is a thin, transparent window which provides an optical path between the laser beam and the reactive material to be initiated. This greatly increases safety in environments which could cause undesired ignition. Also involved is a cost savings in thermal batteries and squibs (explosive switches).

The laser beam, designed to produce a series of pulses as required, is directed through the air on a line-of-sight path or through a maze of fiber optics in any direction determined by the geometry of the equipment used. Striking the explosive material, the pulse excites electronic and vibrational energy levels, causing ignition.

CHARACTERISTICS AND CAPABILITIES OF ENEMY WEAPONS



Brigadier General Lawrence H. Caruthers, Jr.
Assistant Commandant
US Army Field Artillery School

One of the primary offensive actions used by the enemy during stability operations in Southeast Asia is the standoff attack against military installations and outposts, utilizing mortars, recoilless rifles, rockets, and field artillery. In the past 4 years, the enemy's capability to launch such attacks has greatly increased.

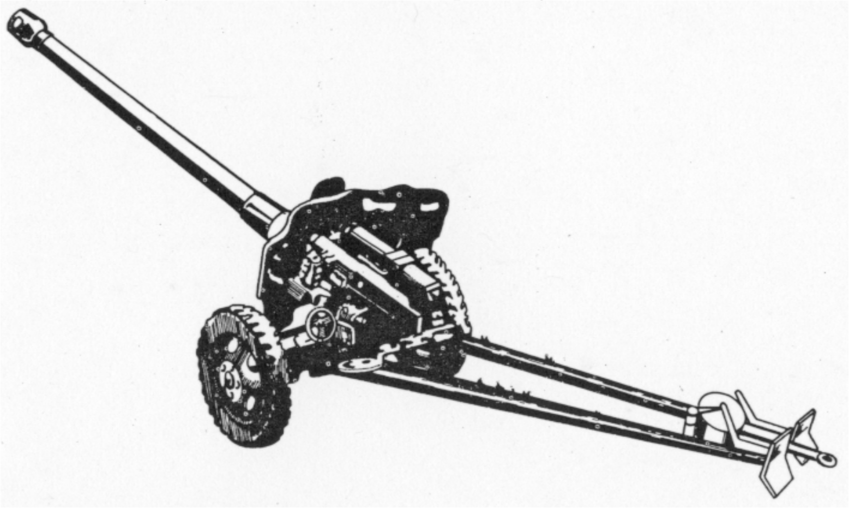
At the outset of hostilities, local guerrilla forces could obtain only a few factory-made weapons and when they could obtain equipment of reasonable quality, it was usually old and worn. Only mortars and recoilless rifles were used in the infrequent standoff attacks. But times have changed. Rockets were introduced into the enemy inventory of weapons in February 1966, and long-range field artillery weapons appeared shortly thereafter. These weapons provided the enemy with added flexibility and greater firepower and range. The threat to friendly installations and outposts increased proportionally with this increase of the enemy capability.

Combat experience indicates that the frequency and effectiveness of enemy standoff attacks are significantly reduced at installations where responsive counterfire programs are actively employed. To effectively develop such a counterfire program, the defender must know how his enemy is equipped.

In this article, current unclassified information about the characteristics and capabilities of weapons used by the enemy is presented. The sources of information are combat after-action reports, intelligence studies, and debriefings.

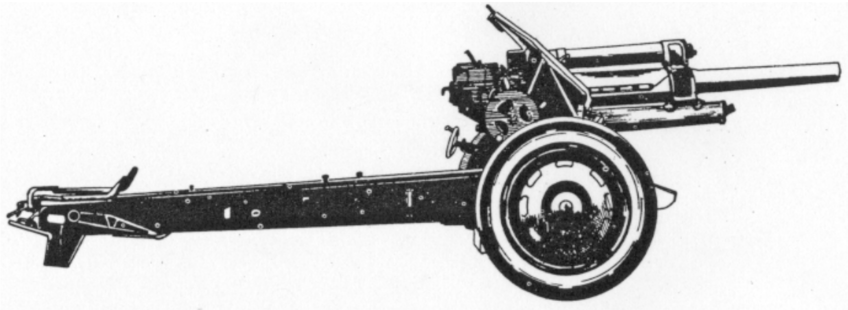
CANNON ARTILLERY

Although they are not the most commonly used weapons, classic cannon artillery weapons are increasingly available to the enemy. Most of the artillery pieces used are Soviet-made weapons ranging in caliber from 85-mm to 152-mm. Virtually every conventional form of ammunition for these weapons is in plentiful supply. Generally, fixed ammunition is used in 100-mm and smaller weapons. Separate-loading amtion is used in 100-mm and smaller weapons. Separate-loading ammunition is used in weapons larger than 100-mm. Semifixed



Caliber	85-mm
Weight, traveling position	3,804 pounds
Length, traveling position	27.3 feet
Height, traveling position	4.7 feet
Elevation	—7° to +35°
Traverse (total)	54°
Standard muzzle velocity	792 meters per second
Maximum horizontal range	15,650 meters
Rate of fire	20 rounds per minute
Armor penetration (at 0°)	5.1 inches
Projectile weight (mean)	21 pounds

Figure 1. D44 divisional gun.



Caliber	122-mm
Weight, traveling position	5,510 pounds
Length, traveling position	20 feet
Height, traveling position	6 feet
Elevation	–3° to +63°
Traverse (total)	49°
Standard muzzle velocity	516 meters per second
Maximum horizontal range	11,800 meters
Rate of fire	6 rounds per minute
Armor penetration (at 0°)	7.87 inches
Projectile weight (mean)	48.59 pounds

Figure 2. Soviet M1938 howitzer.

ammunition, such as that used in the US 105-mm howitzer, is not used in Soviet-made field artillery weapons.

The 85-mm divisional gun (D44) (fig 1) is a medium tank gun adapted for use with a field carriage. The D44 can be identified by its doublebaffle muzzle brake, tubular section split trails, hydraulic buffer recoil system, and hydropneumatic recuperator. It uses a semiautomatic vertical sliding-wedge breechblock and fires ammunition that is interchangeable with that for the 85-mm tank, field, antiaircraft, and assault guns.

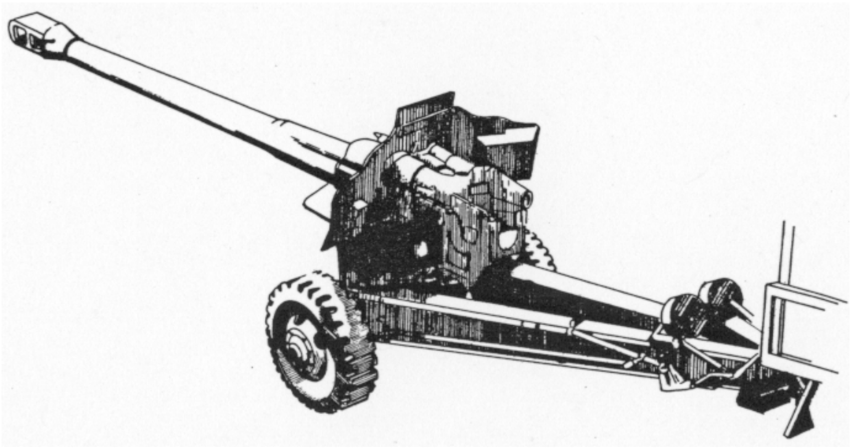
The Soviet 122-mm howitzer (M1938) (fig 2), standard for the divisional artillery of the Soviet Union and its satellites, is often used by main force enemy units in Southeast Asia. It fires case-type, variable-charge separate-loading ammunition. The recoil system is housed in a cradle below the tube and the recuperator is carried above the tube.

The 122-mm Soviet field gun (D74) (fig 3) has seen increasing use on the battlefield because of its light weight, great mobility, and relatively rapid rate of fire. The semiautomatic vertical sliding-wedge breechblock is instrumental in its rate of fire. The D74 has a doublebaffle muzzle brake and a double-cylinder recoil system mounted on top of the tube. It fires ammunition similar to that for the 122-mm howitzer. The weapon is particularly adaptable to this type of environment because of its 6,400-mil capability. A circular firing jack assisted by two caster wheels on the trails permits a rapid shifting of direction.

The largest field artillery piece presently available to the enemy is the Soviet 152-mm gun/howitzer (M1937) (fig 4). This well-designed and sturdily constructed cannon was the principal Soviet weapon used for counterbattery and other long-range destructive and interdictory fires in World War II. Although the Soviets are replacing this weapon with the newer D20, the M1937 is still highly regarded and widely used by Soviet allies. The cannon can be identified by its prominent multi-slotted muzzle brake, large rearward-sloping equilibrators, and screw-type breechblock. It, too, fires separate-loading ammunition.

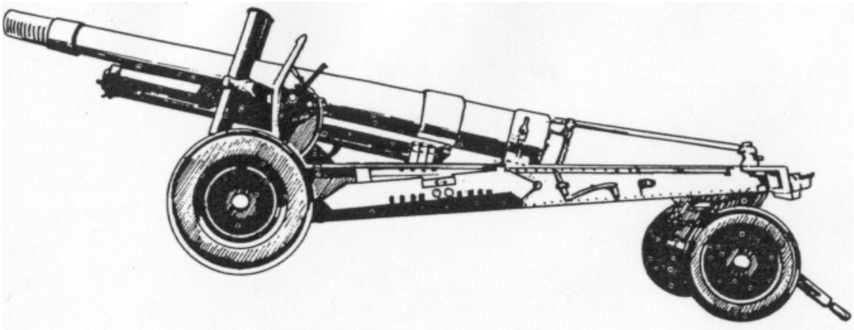
In addition to Soviet field artillery weapons, two captured US howitzers—the 75-mm pack howitzer M116 and the 105-mm howitzer M101A1—are presumably available to the enemy.

Perhaps the most lethal indirect fire weapons frequently used by the enemy are the long-range rockets. Although rockets are less accurate than field artillery and mortars and are more suitable for the attack of larger targets, such as airfields and base camps, the launchers are much lighter than artillery and are therefore adaptable to a mobile-type guerrilla force.



Caliber	122-mm
Weight, traveling position	17,500 pounds
Length, traveling position	30.4 feet
Height, traveling position	7.5 feet
Elevation	–2° to +50°
Traverse (total)	60°
Standard muzzle velocity	900 meters per second
Maximum horizontal range	21,900 meters
Rate of fire	6 rounds per minute
Armor penetration (at 0°)	9.1 inches
Projectile weight (mean)	56.16 pounds

Figure 3. Soviet D14 gun.

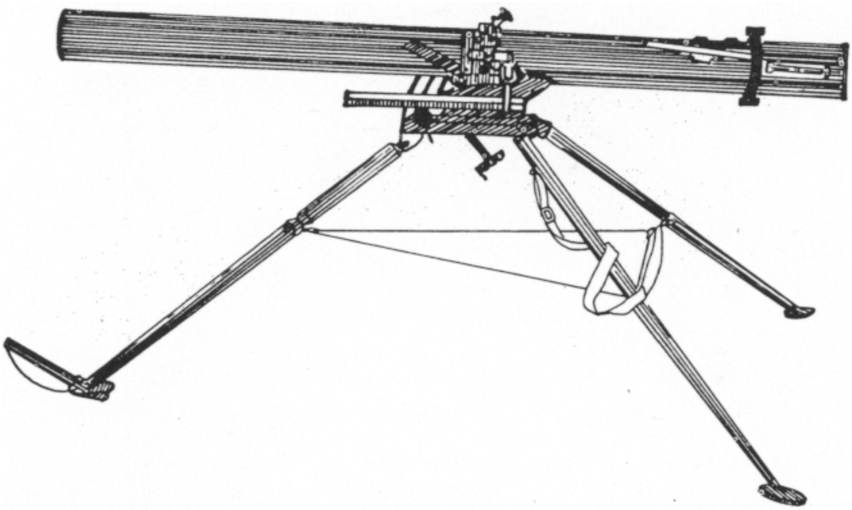


Caliber	152-mm
Weight, traveling position	19,416 pounds
Length, traveling position	23.6 feet
Height traveling position	7.4 feet
Elevation	–2° to +65°
Traverse (total)	58°
Maximum horizontal range	17,300 meters
Rate of fire	4 rounds per minute
Armor penetration (at 0°)	4.9 inches
Projectile weight (mean)	96 pounds

Figure 4. Soviet M1937 gun/howitzer.

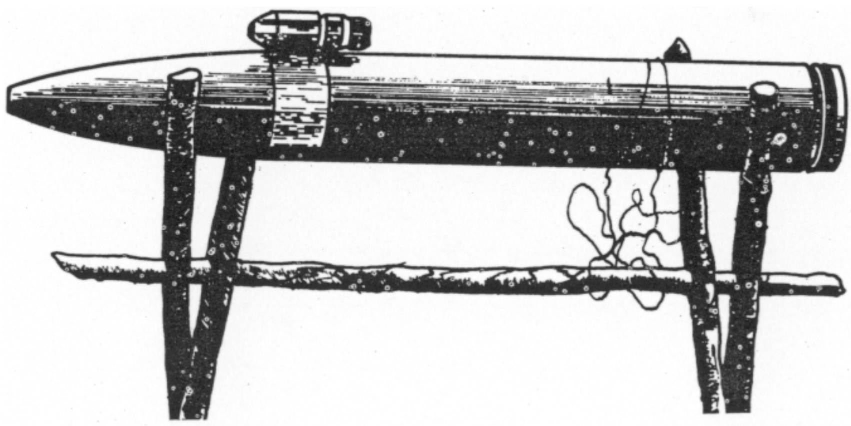
Since its introduction to the war in May 1967, the Chinese Communist-made 122-mm rocket (fig 5) has been effectively employed against almost every type of fortification now in use. Local designation of the rocket is DKZ-B, meaning recoilless cannon-rocket. The warhead and fuzing systems for this rocket are up to date in design, resulting in an effective weapon against both personnel and materiel targets at ranges up to 11,000 meters. The rocket is fin and spin stabilized and can be fuzed with superquick, quick and delay settings. The complete rocket launcher assembly consists of a launcher tube, a cradle assembly, and a tripod assembly with elevating and traversing mechanisms. The legs of the tripod assembly fold into a compact traveling unit for increased mobility. The defender must consider the 122-mm rocket when developing a position defense and a counterfire program.

A barrage-type rocket frequently used for both point and area targets is the Chinese Communist (ChiCom) 107-mm rocket (H12) (fig 6). The 107-mm rocket is basically an improved version of the ChiCom 102-mm rocket with some modifications in design to allow mass production and permit the use of standard components. These major components are a high-explosive, fragmentation warhead; a warhead-to-motor adapter; a rocket motor utilizing a monoperforated, double-base propellant; and a venturi motor plate with six canted nozzles, which produce clockwise spin for stabilization. The fuze has superquick and delay settings and is armed by centrifugal force. The rocket is often launched electrically from



Caliber	122-mm
Weight	101.8 pounds
Length	75.4 inches
Maximum horizontal range	11,000 meters
Tube weight	48 pounds
Tube length	98 inches
Tripod height	39.5 inches
Traverse (total)	14°
Elevation	4.5° to 42°

Figure 5. ChiCom DKZ-B rocket.



Caliber	107-mm
Weight	41.75 pounds
Length	33 inches
Maximum horizontal range	8,300 meters

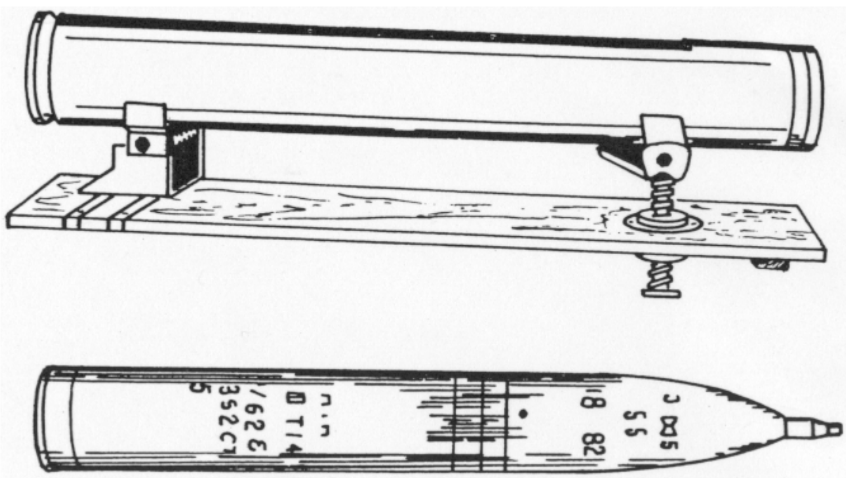
Figure 6. ChiCom H12 rocket.

improvised launchers, such as dirt mounds and crossed sticks, at an approximate maximum rate of fire of one rocket per position at 3-minute intervals.

Although the Soviet 140-mm rocket (DM14) (fig 7) has considerably more power than the two previously discussed rockets, it is not used as often. Its relatively short range, small penetration capability, and crude fire control system make it a less practical weapon in the insurgency situation.

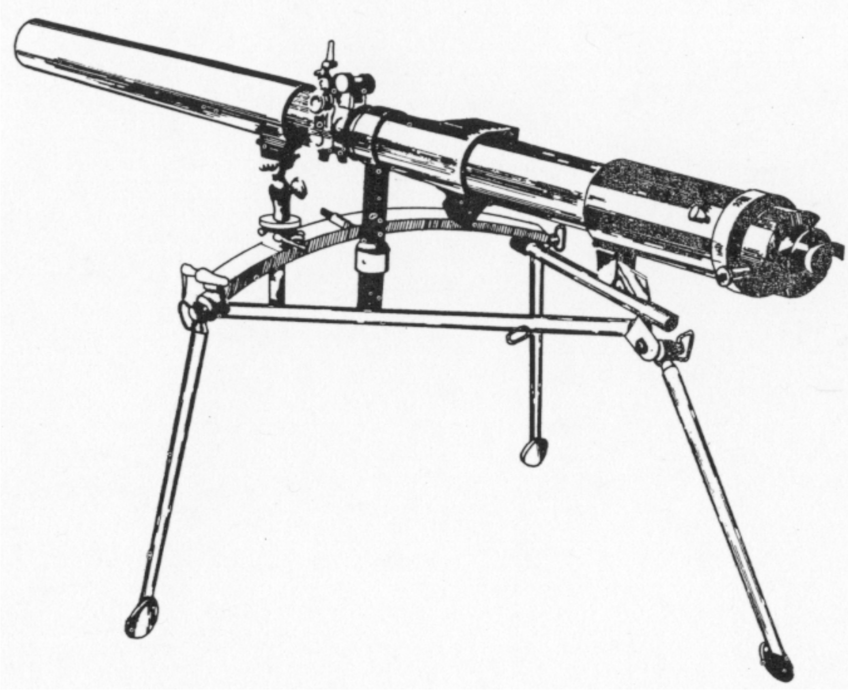
The enemy has also been making limited use of recoilless rifles in standoff attacks against free world bases. Recoilless rifles built by the Chinese Communists or captured from the US allies on other fronts are supplied to the enemy. Although all are intended for direct fire use at relatively short ranges, the insurgents employ the recoilless rifles for long-range indirect fire. Many recoilless rifles modified with mortar sights have been used in this indirect fire role with greater accuracy than rockets and more penetration than mortars.

The enemy is using at least two recoilless rifles—the ChiCom type 36 57-mm (fig 8) and the type 52 75-mm (fig 9) recoilless rifles. Both weapons are essentially identical to US weapons of the same calibers in performance characteristics, methods of operation, and appearance. Both are normaly fired from a monopod or tripod assembly; however, the 57-mm recoilless rifle can be effectively fired from the shoulder.



Caliber 140-mm
Weight .... 88 pounds
Length .... 42.35 inches
Maximum horizontal range .... 10,000 meters

Figure 7. Soviet DM14 rocket.



Caliber	57-mm
Weight, firing position	52 pounds
Length of tube	61.5 inches
Muzzle velocity	341 meters per second
Maximum effective range	3,970 meters
Rate of fire	15 rounds per minute
Armor penetration (at 0°)	2.75 inches
Projectile weight (mean)	5.7 pounds

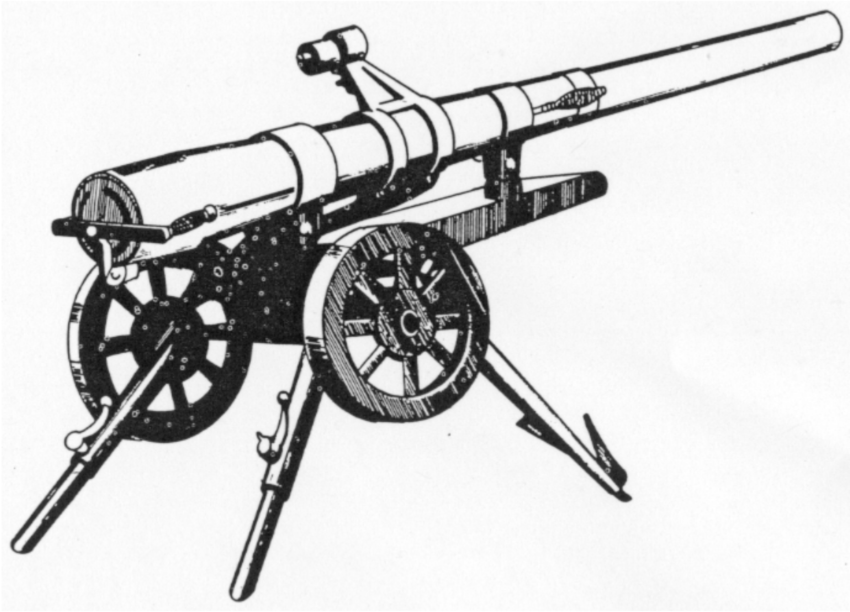
Figure 8. ChiCom type 36 recoilless rifle.

Just as Communist-made mortars were successfully employed against free world forces in previous conflicts, so are they today. Although used mostly in the early stages of the hostilities, World War II vintage mortars are still used in standoff attacks in Southeast Asia. Occasionally, a US-made mortar, such as the M1 81-mm, is found in enemy hands. These are all the conventional smooth-bore, muzzle-loaded mortars utilizing standard teardrop-shaped ammunition.

The most extensively used mortar is the ChiCom 60-mm mortar (type 31) (fig 10). This weapon is virtually identical to the US 60-mm mortar. All major components and ammunition of the two weapons are interchangeable, but different firing tables must be used.

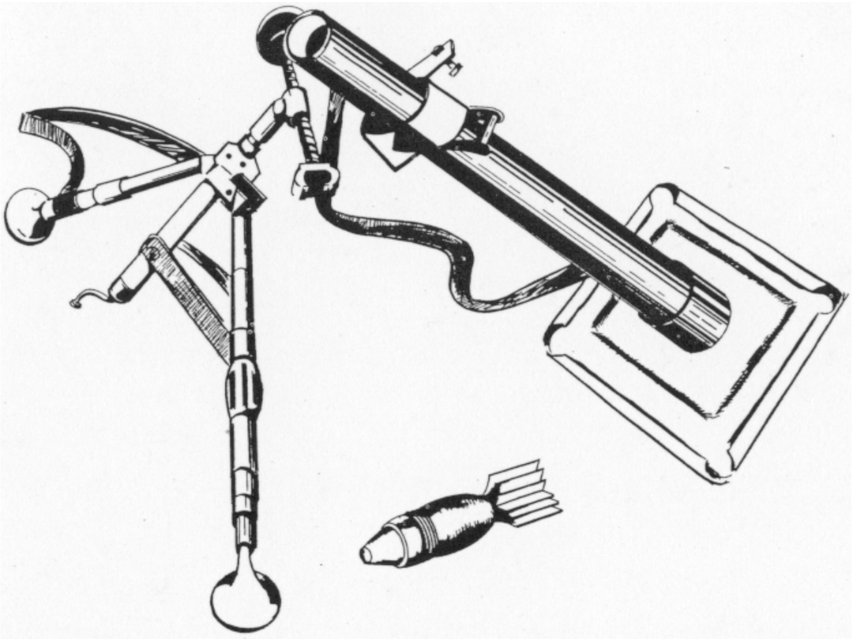
Other widely used mortars are the Soviet 82-mm (M1937) and its twin, the ChiCom type 53 (fig 11). These mortars are very similar to the US 81-mm mortar and use US, German, Japanese, and Italian 81-mm mortar ammunition. The M1937 is no longer in the Soviet Army inventory, but it is used actively by Soviet allies.

The ChiCom 120-mm mortar (type 55) and the identical Soviet M1943 (fig 12) are the most powerful mortars available to the enemy in Southeast Asia. These weapons provide very effective firepower at relatively long ranges. The mortars are usually towed by vehicles and are therefore generally limited to use in areas where the enemy has access to roads. However, the guerrillas have been known to disassemble the mortar into three loads for movement by infantry into apparently inaccessible areas.



Caliber	75-mm
Weight, firing position	132.2 pounds
Length of tube	79 inches
Muzzle velocity	305 meters per second
Maximum effective range	6,675 meters
Rate of fire	16 rounds per minute
Armor penetration (at 0°)	2.95 inches
Projectile weight (mean)	21 pounds

Figure 9. ChiCom type 52 recoilless rifle.

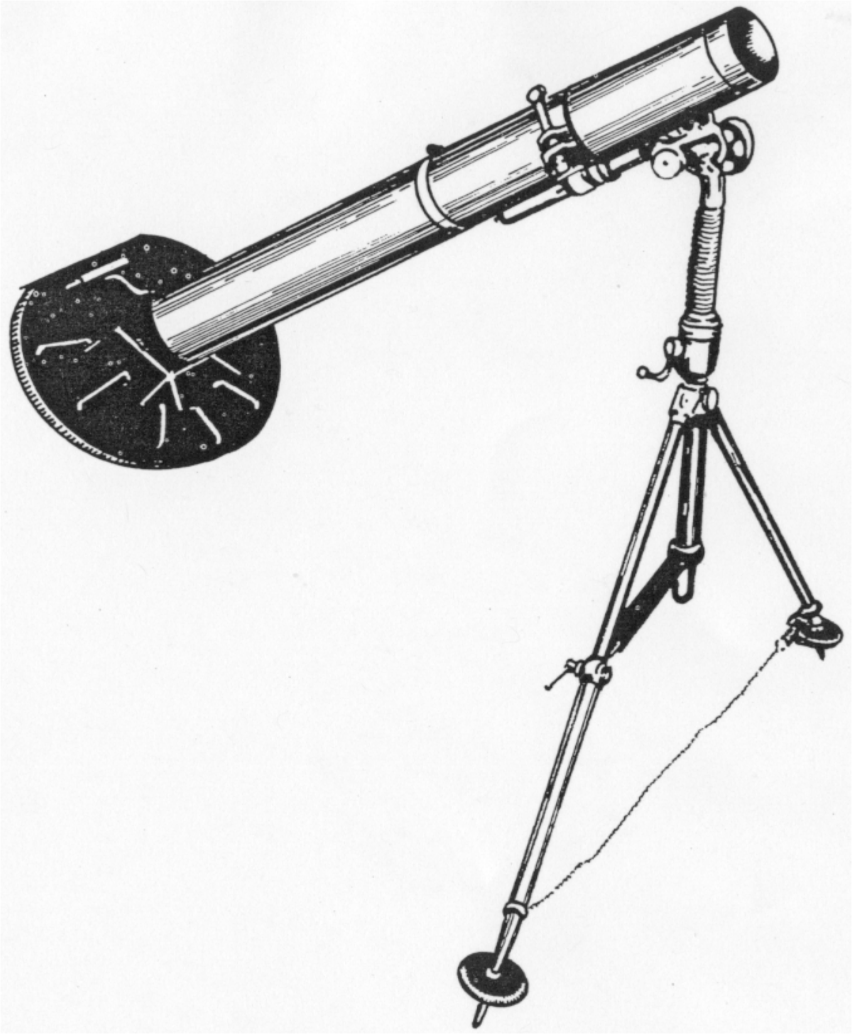


Caliber	60-mm
Weight, firing position	38.8 pounds
Length of tube	26.5 inches
Muzzle velocity	158 meters per second
Maximum effective range	1,530 meters
Rate of fire	30 rounds per minute
Ammunition type	HE, smk, ill
Projectile weight (mean)	3.3 pounds

Figure 10. ChiCom type 31 mortar.

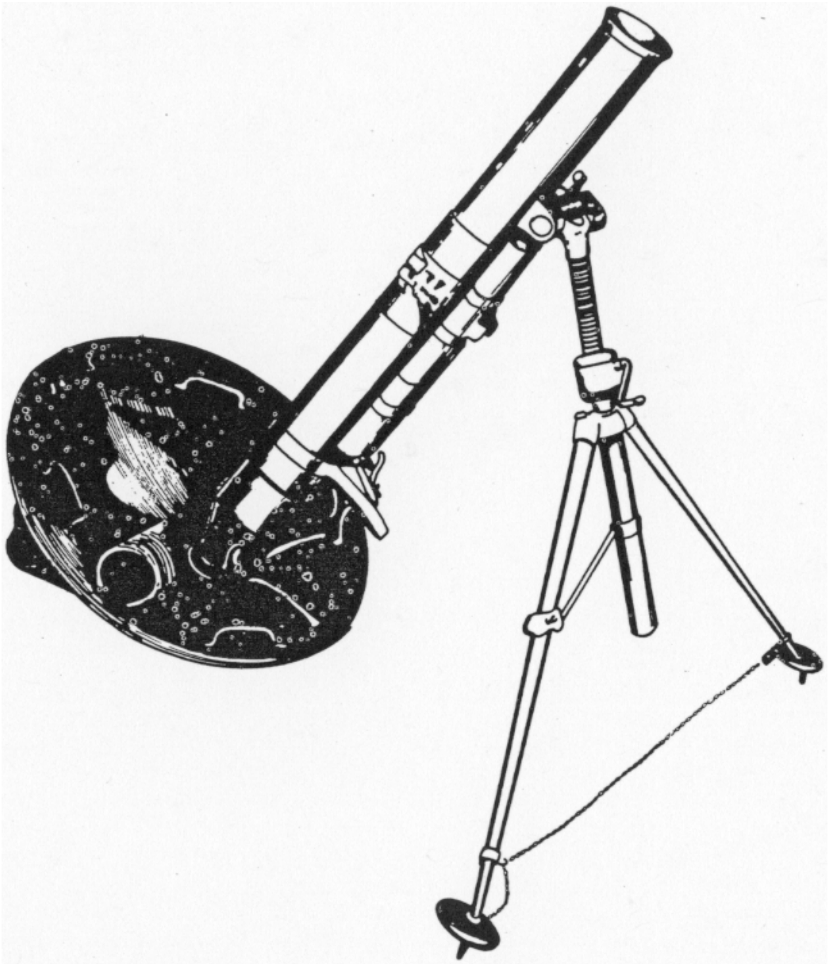
Simple, lightweight weapons, such as rocket-propelled grenade launchers, are particularly useful to the mobile insurgent in his attacks on free world base camps.

The rocket-assisted RPG-7 (fig 13) is a new antitank launcher that replaces the old RPG-2 (fig 14). The normal propellant charge of the RPG-7 launches the projectile, but the rocket motor cuts in several meters beyond the muzzle, increasing the velocity to 300 meters per second. This results in greater projectile range, a flatter trajectory, and increased accuracy. Other improvements are better fuzing and optical sighting. Although the RPG-7 is intended as a direct fire weapon with a maximum



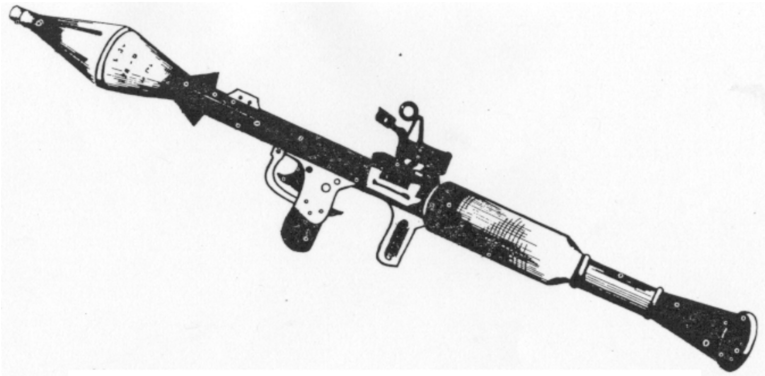
Caliber	82-mm
Weight, firing position	123 pounds
Length of tube	4 feet
Muzzle velocity	210 meters per second
Maximum effective range	3,040 meters
Rate of fire	25 rounds per minute
Ammunition type	HE, smk
Projectile weight (mean)	8.6 pounds

Figure 11. ChiCom type 53/Soviet M1937 mortar.



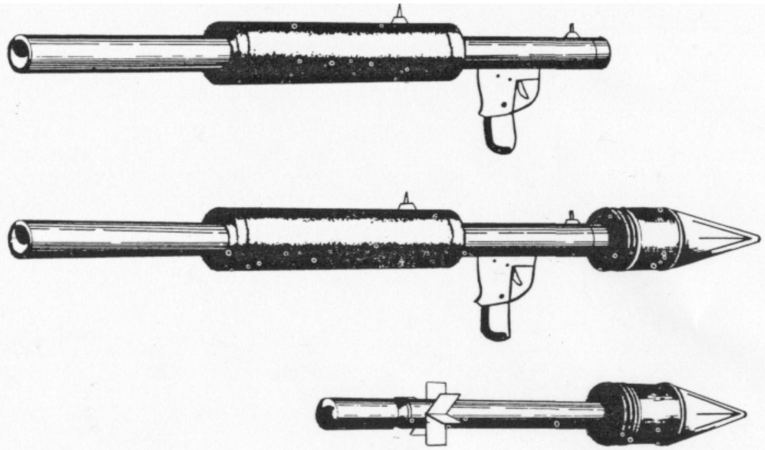
Caliber	120-mm
Weight, firing position	606 pounds
Length of tube	5.4 feet
Muzzle velocity	272 meters per second
Maximum effective range	5,700 meters
Rate of fire	15 rounds per minute
Ammunition type	HE, smk, inc
Projectile weight (mean)	36.3 pounds

Figure 12. ChiCom type 55/Soviet M1943 mortar.



Caliber	40-mm/85-mm
Weight, firing position	14.5 pounds
Length of tube	37.5 inches
Muzzle velocity	120 meters per second
Maximum effective range	500 meters
Rate of fire	6 rounds per minute
Ammunition type	HEAT
Armor penetration (at 0°)	12 inches
Projectile weight (mean)	5.5 pounds

Figure 13. RPG-7 rocket-assisted grenade launcher.



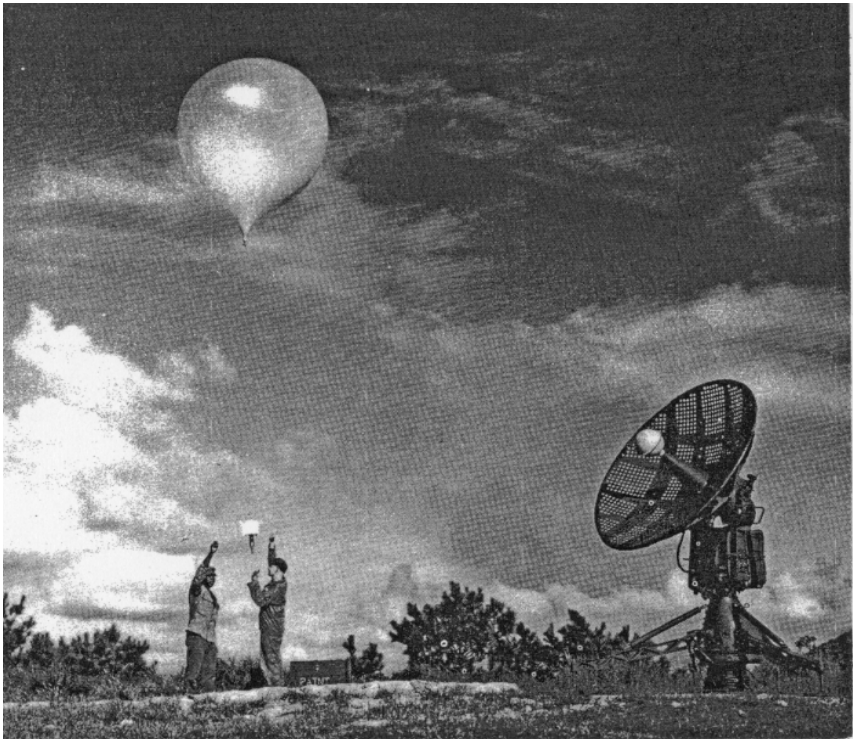
Caliber	40-mm/80-mm
Weight, firing position	6.7 pounds
Length of tube	3.2 feet
Muzzle velocity	84 meters per second
Maximum effective range	150 meters
Rate of fire	6 rounds per minute
Ammunition type	HEAT
Armor penetration (at 0°)	7 inches
Projectile weight (mean)	3.57 pounds

Figure 14. RPG-2 rocket-assisted grenade launcher.

horizontal effective range of 500 meters, insurgents have recently used it in an indirect fire role. Utilizing the self destruction feature, the enemy has achieved ranges of 900 meters on large area targets. The 4.5 second pyrotechnic delay is armed upon initial set back resulting in occasional airbursts. The RPG-2 does not have this capability.

In summary, the weapon systems discussed, plus new weapons entering the enemy's inventory, provide a multitple capability for conducting standoff attacks against our military installations. If the field artilleryman hopes to effectively reduce the threat of the enemy's indirect fire, he must be completely familiar with these weapons and their capabilities.

Army Meteorology



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The increased mobility of air and ground military forces and the expanding area over which they may operate have greatly increased the importance of weather "know-how." This is especially true today, since the aspects of nuclear warfare must be considered in the tactical environment. The effects of weather are so numerous and diverse that they can be properly evaluated only when they are considered in relation to all other factors contributing to the method of conducting a specific operation. Therefore, since all operations are influenced by weather, it is most important that the application of meteorological data be emphasized. The relationship of climate to weather and the uses of current weather reports and forecasts will be discussed in this article.

RELATION OF CLIMATE TO MILITARY OPERATIONS

The climate of the territory involved is of critical importance in planning any military operation. Climatological scrutiny is vital so that suitable clothing, food, shelter, and combat equipment are properly distributed, utilized, and maintained. The monumental struggle against the climate of Korea illustrated how an army can be victimized by inadequately reckoning with meteorology. Post-Korean climatological research by the Army has proven that the efficiency of men and machines is drastically reduced by weather extremes.

So it can be readily seen that climate demands the attention of tacticians and strategists.

With specific regard to air support operations, it is essential that airfields be located in strategic areas that are relatively free from fog, haze, dust, low ceilings, or other obstructions to vision, so that flight operations may be achieved for a maximum number of days of the year.

The intensity and amount of rainfall and its effect on drainage must be considered. The amount of rise in rivers caused by heavy rains and the possibility of floods must be considered when planning the construction of camps, highways, railroads, and bridges. Climatological records, even though they may not be complete, are obtainable for almost all areas of the world.

Climate should be given the high priority it is too often denied, in the preparatory stage as well as in the operational stage of a military mission.

USES OF CURRENT WEATHER REPORTS

In time of war, detailed knowledge of the weather conditions existing over a theater of operations is imperative. These data are significant, for they allow the officers directing or planning a particular campaign to utilize this information to their advantage. Usually, future weather conditions are the most important; however, for certain types of operations, present weather data may be more valuable.

Current weather data are required to compensate for the effects of wind direction and speed on a projectile or on an aircraft and even on the speed and direction of sound. An officer may anticipate a possible chemical, biological, radiological attack when meteorological conditions are optimal for such an attack. The effects of gas and other chemical agents are influenced by the condition of the atmosphere; therefore, before employing such agents, due consideration should be given to the existing and the prospective weather outlook.

Although meteorological information is a necessity, it does not in itself enhance our full utilization of these data unless we are thoroughly indoctrinated in their tactical applications.

USES OF WEATHER FORECASTS

A knowledge of present weather conditions would be of little value if forecasts of changes that might materially affect an operation were not available. Hence, an efficient forecasting service is extremely important to all wartime military operations. As history has so often proved, an army which disregards weather during an operation invites disaster.

In the case of military operations which involve the movement of men, equipment, or supplies, the weather forecast should always be available and should be consulted periodically for possible amendments. Examples of the types of information often asked the meteorologist are: When will a freeze occur that will make it possible to move heavy vehicles over ground which is now a mass of mud? When will a thaw occur? When will fog begin, or end? What will be the height of the base of the lowest layers of clouds, and when will it change? The answers to these and many other questions become extremely important to army commanders in field operations.

The Army may not always be interested in fair weather when planning an operation. For example, an attack during unfavorable weather may be contemplated in order to surprise the enemy.

From the military point of view our meteorological know-how is limited, although we have increased our knowledge due to advances in sophisticated electronic measuring equipment. This is true in part, since we are dealing with a complex heat engine which is in constant motion and ever changing.

ARMY RESEARCH

Since the Army operates primarily in the lower portions of the troposphere, it is only natural that it is most interested in the field of micrometeorology. Consequently, the bulk of micrometeorological research is being conducted by the Army or is contracted by the Army to various academic institutions. These studies are designed to help us better understand the energy transfer between the earth and the atmosphere and to increase our tactical effectiveness.

For example, we are all aware of the important atmospheric circulation patterns in relation to the use of biological and radiological agents. Many meteorologists believe the most obscure area in micrometeorology is in the field of turbulence; therefore, a great deal of effort has been directed toward the analysis of the normally turbulent portion of the atmosphere adjacent to the surface of the earth. To date, a most significant result in this area has been the derivation of a new theoretical formula for determining the size of eddy disturbances under neutral conditions. This is an important advancement, for it represents the first time that the lower levels of the atmosphere have been characterized by independent variables. Although this theory is only designed for neutral atmospheric conditions, it may provide an important tool with hemispheric applications for large-scale numerical forecasting.

Another area of interest is the study of energy balances. In this study the emphasis has been placed on the exchange of energy between the earth's surface and the atmosphere. In this area a notable finding was derived from a theoretical study of the photosynthesis process. This study has been directed at the role of photosynthesis in the energy balance and has resulted in the realization that this process is of much greater importance than was previously believed. It appears, in theory, that a considerable amount of energy is utilized in the photochemical fixation of atmospheric carbon dioxide. If this theory is correct, another important step toward a more complete understanding of the earth-atmosphere system will be realized. This is a must before we can ever hope to understand the idiosyncrasies of the weather.

Studies of how solar radiation affect men and equipment are also being made. These are being conducted in the Arctic, Polar, Temperate, and Tropical Zones. These data will not only aid the Army in operating more effectively and efficiently, but the results of this information can also be passed on for civilian use. For example, different types of materials are being sprayed with various types of chemical compounds to determine which give the best results under a variety of climatic conditions. This undoubtedly will result in new discoveries in the efficient and economical storage of equipment and use of clothing. These will benefit the civilian as well as the fighting man.

ARTILLERY BALLISTIC METEOROLOGY

Exterior ballistics is a science which deals with how certain atmospheric variables affect the motion of a free projectile moving through the atmosphere. These variables are measured by the artillery ballistic meteorology crewman, who sends aloft a sounding balloon and associated electronic equipment. Variables of interest are wind speed, wind direction, and air density. Accuracy is most critical. For example, if we are firing a 155-howitzer, charge 7, range 11,000 meters, a 20-knot tailwind would cause the projectile to overshoot the target by 218 meters. A 20-mph crosswind would cause a 123-meter deviation to the left or right, depending on wind direction. Similar errors can be caused by temperature and density inaccuracies.

Another important aspect of the "ballistic met men's" duties is the acquisition of upper air data used in sound ranging and in predicting radiological fallout. In addition, they have the responsibility of providing the air weather service with upper air data which is most necessary for accurate forecasting.

It can be seen that the role of Army meteorology is an extremely vital one. In the past 10 years significant information has been obtained; additional information will be developed in the near future. This knowledge is necessary to increase our military capabilities.

Training of personnel to give this highly specialized support is conducted at the U. S. Army Field Artillery School, Fort Sill, Oklahoma.

Improved Lifting Sling

CPT David J. LaBoissiere
US Marine Corps

EDITOR'S NOTE: *We remind you that the publication of an article in* **THE FIELD ARTILLERYMAN** *does not necessarily indicate that it is the official policy of the field artillery community. Although every effort is made to arrive at a community position, this instructional aid is published only to enhance professional thought in the field artillery and is not to be considered directive in nature. This article presents techniques for airmobile lifting which are being taught at the US Army Field Artillery School and evaluated at the Rock Island Arsenal as one way to handle the air movement of battery equipment. However, some portions of the article (particularly the discussion of procurement of the chain and grab link devices) are not in strict conformance with current technical manuals. To bring doctrine into conformance with realism, USAFAS has submitted an equipment improvement recommendation for the equipment and procedures. Additional data on the subject will be published in* **THE FIELD ARTILLERYMAN** *as it becomes available. A related article appeared in the November 1969 issue.*

Great advances have been made in airmobile lifting techniques in the past few years, mainly because of the impetus of the Vietnam war. We have witnessed a greater emphasis on airmobile training—the adoption of standard rigging techniques, the reevaluation of sling rigging strength and service life, the 100-percent rule, and a general attitude of "safety first" in all air movement by helicopter external load. In this regard, the airmobile field artilleryman is primarily concerned with the techniques and procedures for sling loading his howitzers, ammunition, and associated battery equipment.

In accomplishing his rigging tasks, the cannoneer will normally use the standard air delivery sling (FSN 1670-753-3630), discussed in detail in TM 55-450-11. The standard sling is made of type X nylon, 1¾ inches wide, and is available in 3-, 8-, 9-, 11-, 12-, 16-, and 20-foot lengths. The major problem with the standard sling, using current rigging doctrine, is the requirement for heavy padding around the slings, the equipment, or both, to prevent sling damage and dropped loads.

Experience gained from operations in Vietnam, however, has shown that the padding procedures are very time consuming and sometimes inadequate. The status of unit training has a strong bearing on the efficiency of any padding procedures used, and some units have incorrectly used standard padding procedures or dispensed with its use altogether. These faults, coupled with a fast moving enemy situation, lack of time, lack of padding materials, or the condition of equipment (greasy, wet, or dusty) may preclude the proper utilization of the padding procedures. When padding is not available or time does not permit padding, units must still conduct lifts as ordered and the result is sling damage or dropped loads. It is evident that a better procedure or technique that is relatively simple to use must be made available to the artilleryman in the combat zone.

CHAIN LEG SLING SET

One step in the right direction is the use of the 15,000-pound capacity, multileg, nylon and chain device (FSN 1670-902-3080 PN 3900061), referred to as the chain leg sling set. This rig has a 1-foot nylon web ring at the apex of four 15-foot nylon sling legs attached to a grab link and a 6-foot length of chain. The overall length of the chain leg sling set is approximately 23 feet. The chain device and grab link facilitates rigging, since the chain portion can be wrapped around the metal surfaces of the load without protective padding. TM 55-450-12 covers the current doctrine on this multilegged sling in detail; however, optimum use of this sling is achieved when the chain segments are used to better advantage. This is accomplished when the chain, not the nylon, is in contact with the load. Unlike the nylon sling segments, the chains are not subject to damage and they are easy to use in rigging and derigging. Although it is a great improvement over the standard air delivery sling, this sling also has some drawbacks.

Designed primarily to lift loads that require lifting legs of approximately equal length, the chain leg sling set is difficult to use because the chain devices cannot be adjusted enough in length to easily rig howitzers. The length of the chain leg sling set is also a handicap when it allows the helicopter to hover out of partial ground effect. When this happens, even though the load is well within the lift capability of the helicopter, the load cannot be lifted off the ground. Also, it is difficult to remove the fixed lifting ring on this sling to add sling segments to the rig. Padding procedures specified for this sling in TM 55-450-12 are a hindrance for use in combat rigging. One example is the rigging for the M101A1 using two chain leg sling sets. The chain leg sling set lifting the howitzer utilizes the chain device adequately, but the ammunition sling is poorly used. The TM outlines a technique for suspending the ammunition from the howitzer that does not utilize the chain devices to any advantage. The legs of this sling are wrapped around a padded portion of the howitzer trails and then laced through the nylon lift ring. This procedure definitely invites nylon damage to this expensive sling set and is not a cost effective use of the sling. Also, airmobile artillery units have always had the desire for a lightweight easy-to-store sling that would not be easily damaged and would facilitate rapid rigging and derigging. Such a rig has been assembled and tested over the past 10 months at the US Army Field Artillery School. It is called the light artillery rig, and it works equally well on both the M101A1 and M102 light howitzers.

LIGHT ARTILLERY RIG

The components of the light artillery rig are pieces of equipment that are already in the Army supply inventory. The standard air delivery sling is one component; the chain and grab link device from the chain leg set is the other. The chain and grab link devices can be salvaged from unserviceable multileg slings (the chain is virtually indestructible) and affixed to the ends of three-loop (10,000-lb) standard air delivery slings. The standard sling is very versatile because it is readily available in any desired sling length from 3 to 20 feet. The flexibility of this combination is apparent, since it permits us to assemble slings and chains to meet the requirements of any conceivable load, without waiting for the development of new costly sling segments for the chain leg sling set. This concept has universal application to all items lifted by helicopter in the external load; however, we will use the rigging of the light artillery pieces (M101A1 and M102) in our example.

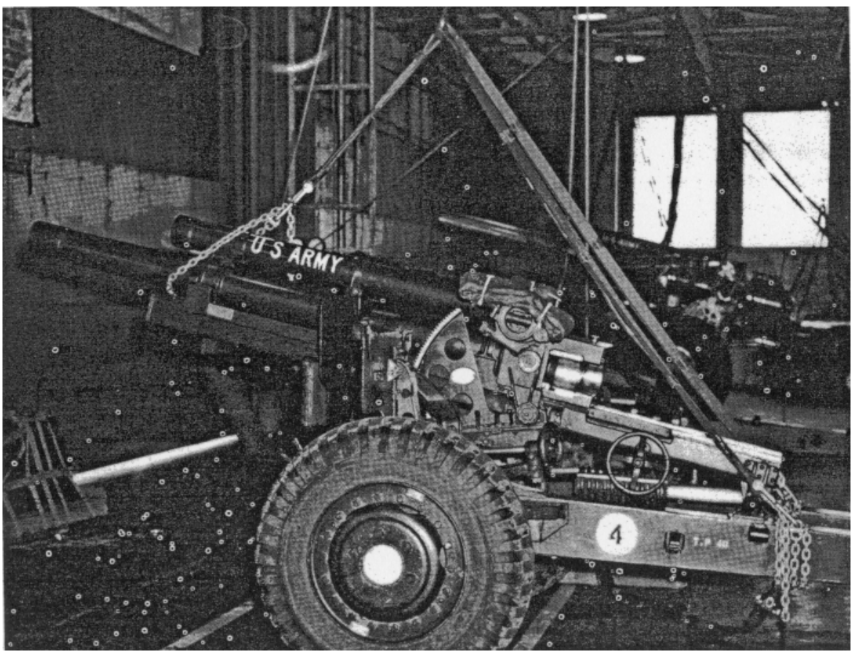

Figure 1. Light artillery rig on M101A1.

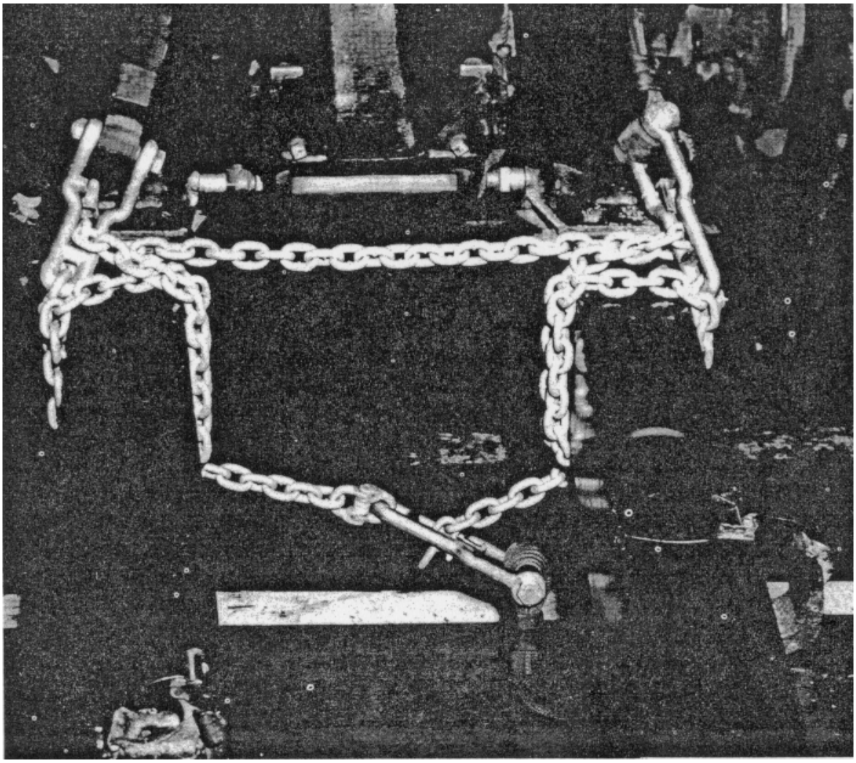

Figure 2. M101A1 with ammunition sling chain device around trails.

The light artillery rig requires five chain devices, two medium clevis assemblies, one large clevis assembly, one link assembly, and two 3-foot and five 8-foot standard air delivery slings. A grab link and chain device is attached to one end of four 8-foot slings and one to the end of a 3-foot sling. On the M101A1, the 3-foot sling and chain will be rigged around the tube and two of the 8-foot slings and chains will lift from the trails to the rear of the traveling lock shaft. The loop ends of these three slings will be secured in a large clevis which also holds another 8-foot sling with a 3-foot lift ring attached to its loop end. The ammunition is carried by the two remaining 8-foot slings and chains, which are wrapped around the trails forward of the traveling lock shaft. Two interlocked medium clevis assemblies, suspended from these slings, will carry the two ammunition bags (A-22). Two alternate solutions are available for the suspension of the ammunition bags, and they eliminate the need for the fifth chain device and 8-foot sling. The first alternate solution is to suspend the ammunition from an 8-foot sling with the chain device secured around the undercarriage of the howitzer near the axle.

The second alternate solution is to suspend the ammunition on an 8-foot sling with the chain device wrapped around both trails, between the lifting slings and the traveling lock shaft (fig 1 and 2).

Figure 1 shows the light artillery rig on the M101A1 howitzer. No padding materials are used, and the resultant paint damage from the chains has been minimal and is considered by all commanders who have witnessed this rig to be offset by the advantages this system affords. Excellent stability of the chains around the trails was achieved by placing the grab links on the outside and above the edge of the trails and then wrapping the chains under and around the trails twice before hooking them through the grab links (fig 3). The tube sling adjustment yielded a good center of gravity when the large clevis, at the apex of the three lifting slings, centered above the rear portion of the recuperator (fig 1). Approximately 30 lifts have been conducted at Fort Sill with the original light artillery rig and no wear has been noted on the slings and only slight paint scarring has been noted on the howitzer.

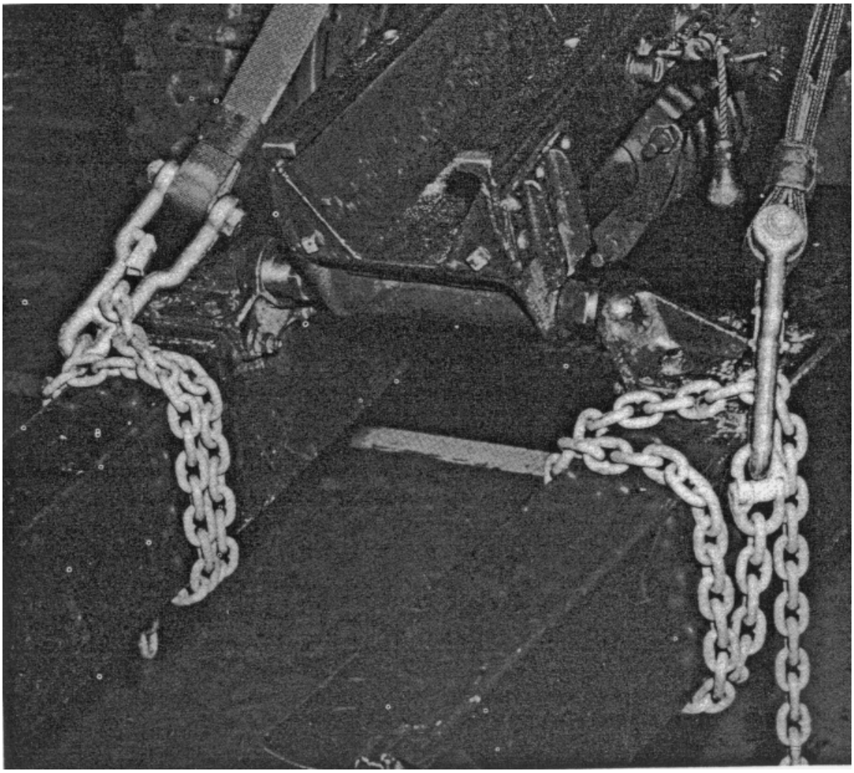

Figure 3. Grab link positioned on outside and above the trail edge of a M101A1.

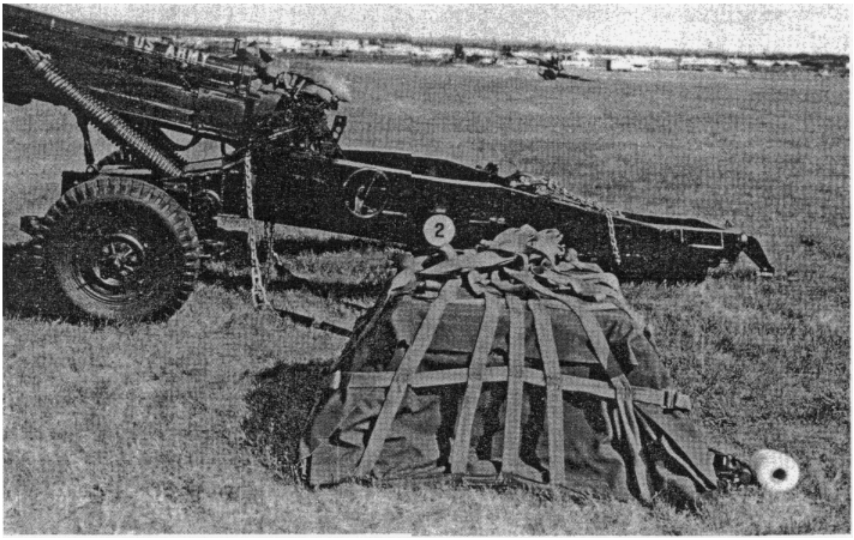

Figure 4. M102 howitzer with ammunition suspended by slings and chains from the trails forward of the breech.

The advantages of this rigging system are many, and they run from simplicity to economy. Having a light, and even a medium, artillery rig preassembled and issued to all units engaged in airmobile operations (both Army and Marine Corps) would eliminate much of the time that units must spend in airlift training. The problems encountered during joint airmobile lifts and the confusion resulting when a person is transferred to a unit that uses a different procedure would be virtually eliminated. Even a howitzer section that is not familiar with slings and rigging operations would have no difficulty rigging its howitzer if it used the light artillery rig. A few minutes of verbal instruction is all that is necessary with this simple system of attaching the chains to the piece, since complicated procedures and padding are not required. Since only the chain device touches the metal surface of the load, even an inexperienced crew could rig the howitzer and prevent nylon damage. The chain and sling combination in this improved rig is relatively lightweight and not excessively bulky so that it may be easily stored in a small box or section equipment chest.

Another advantage of the light artillery rig is that it requires only 3- and 8-foot, three-loop, air delivery slings. Therefore, commonality of slings is achieved for all 105-mm howitzer units. Commonality of slings also has an added advantage for the artillery battery commander. It allows him to switch like-type slings for emergency replacement of damaged segments when the situation requires him to make an immediate lift and replacement slings are not available. Artillery commanders will also appreciate the fact that this light artillery rig permits the weapon to be fired as soon as it is landed, with all slings in the rigged position except the tube sling, which is slid off the tube and placed to the rear under the cradle. It follows naturally that the howitzer can be lifted out in an emergency with the same degree of speed. As far as cost is concerned, the price of the light artillery rig is about half that of the $319 chain leg sling set. With the requirement to replace slings every 6 months (sling life), use of the light artillery rig will add up to a substantial savings for replacement slings. Another obvious advantage of the standard sling and chain combination is that it can be assembled to meet the sling length requirements of any type load. Some examples can be seen in figures 4 through 7.

The light artillery rig and other rigs utilizing the chain and standard sling have now been introduced in words and pictures. Although there are written procedures for the standard air delivery sling and the chain leg sling set, both have limitations. The lack of adjustment on the one sling set and the time consuming padding procedures used with both types of slings make the combination of chain device and standard sling appear to be a readily acceptable solution.

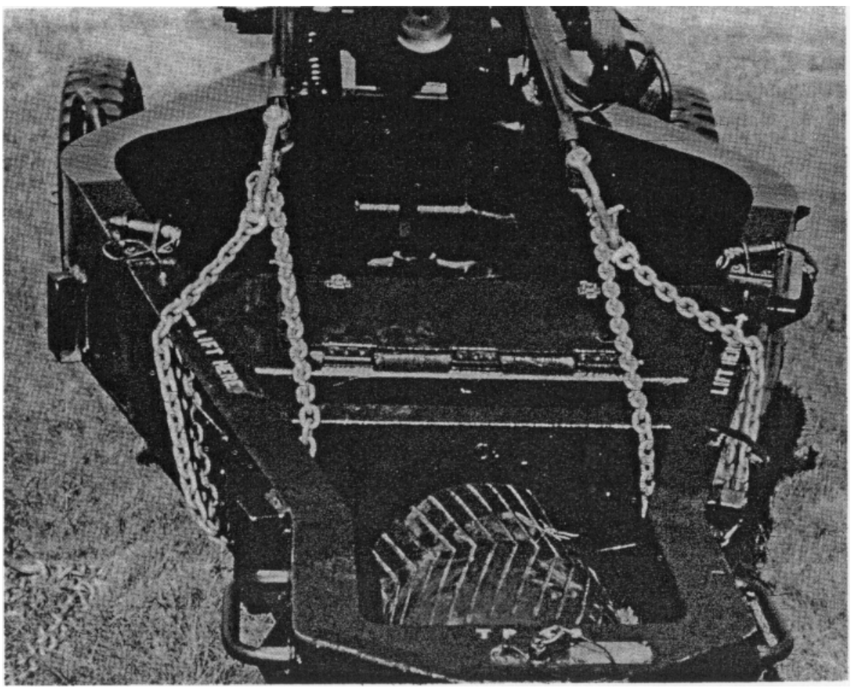

Figure 5. Light artillery rig on the M102 with chains secured around trails.

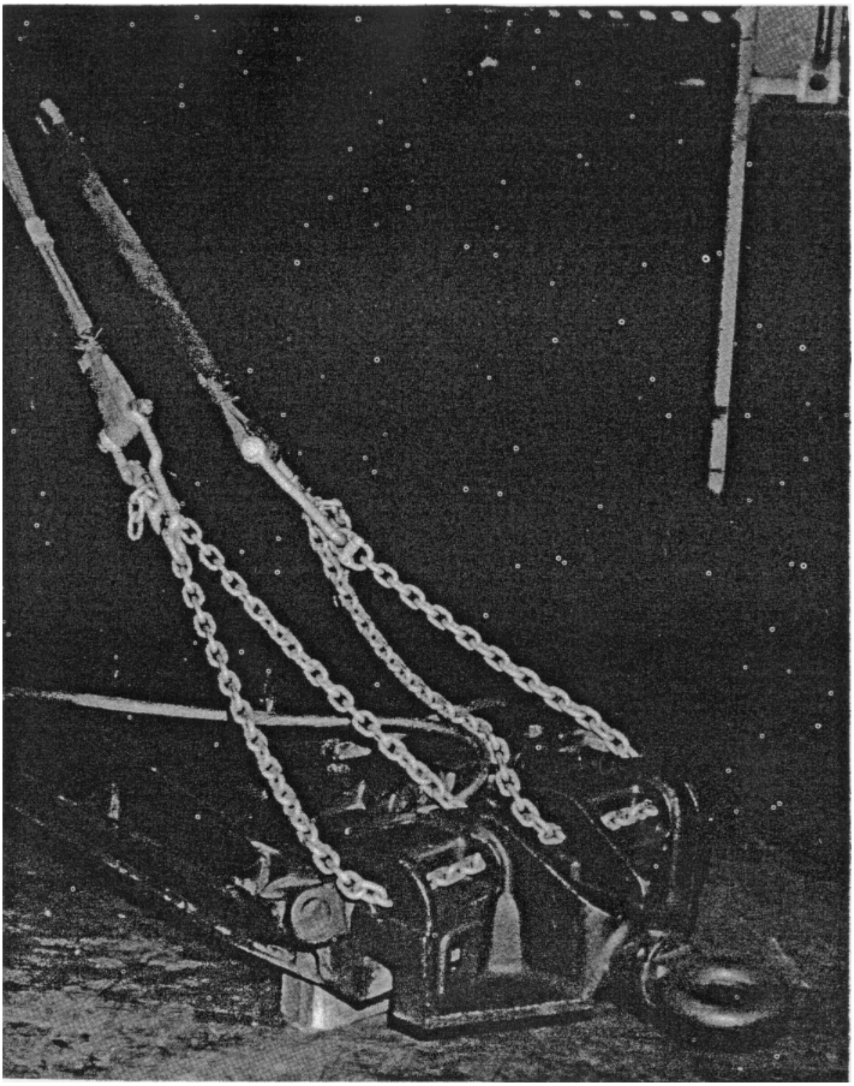

Figure 6. 155-mm howitzer (M114) with slings and chains rigged to each trail.

The optimum airmobile rigging sling will not be available for several years, until a vast amount of money is expended in its development. The need for an improved interim rig exists now, and the sling and chain proposal is flexible, adaptable, and available.

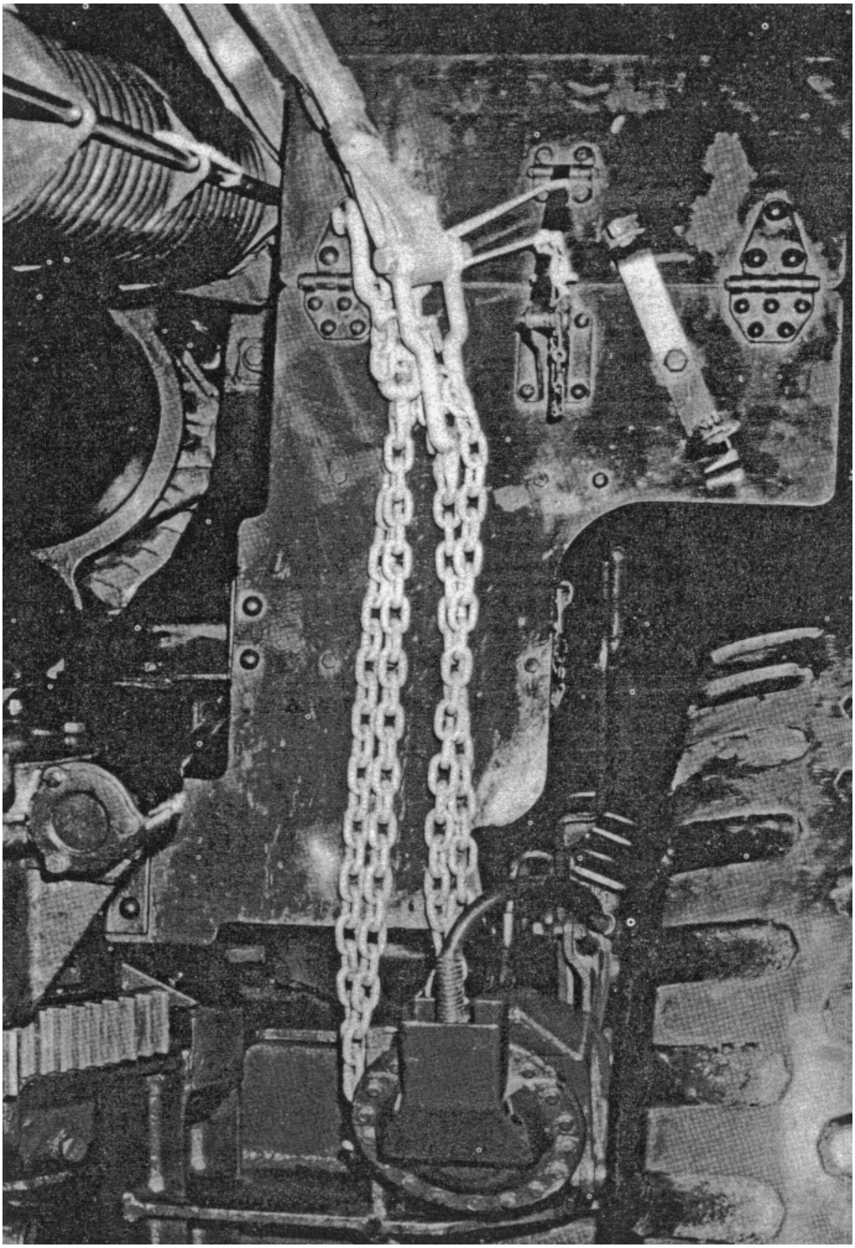

Figure 7. 155-mm howitzer with slings and chains rigged to the lifting bracket.

In Fire Support Coordination

No Fire Line

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When fire support means are to be employed on the battlefield, the fire support coordinator, a field artilleryman, must insure that the necessary coordination is effected for the safe delivery of these fires. The fire support coordinator must know when, with whom, and how to effect this required coordination. Where can he find this information? The obvious answer is "in the appropriate field manuals"; however, the information found in field manuals is general in nature and often does not contain sufficient details for the application of the appropriate fire coordination techniques. A complete understanding of fire coordination techniques is mandatory for proficiency in fire support coordination. The purpose of this article is to explain one fire coordination technique—the establishment and use of the no-fire line (NFL).

Manuever commanders employ boundaries to delimit tactical areas of responsibility, including both maneuver and fires. The description of a boundary states specifically to which unit or formation an area or a point is inclusive or exclusive. Field artillerymen use the boundary as the basic fire coordination measure to control and coordinate fire support. Before fires can be delivered across a boundary, whether lateral, rearward, or forward, these fires must be coordinated. Coordination requires time and time may be critical. In order to reduce the time spent on coordination and thereby expedite the fires of field artillery and naval ships, field artillerymen use an effective measure call the no-fire line.

The no-fire line is defined as a line short of which field artillery or ships may not fire except on request or approval of the supported commander but beyond which they may fire at any time without danger to friendly troops. The no-fire line designates an area which is located between the lateral boundaries of the supported maneuver force, and which extends from the no-fire line to the forward extension of these lateral boundaries (hashed area, fig 1). Forward of the no-fire line, the fire coordination requirement inherent in the boundary is eliminated for artillery and naval gunfire. In effect, the support commander is saying that all targets beyond the NFL are hostile and that the required coordination to engage these targets was accomplished when the line was established. Naturally targets of a political nature or otherwise precluded from attack, would not be engaged without coordination and proper authority. The no-fire line is established by the direct support field artillery unit commander, who is the brigade fire support coordinator, in coordination with the brigade commander. It is depicted on maps and firing charts by a dashed line labeled "NFL". It is colored red and includes the effective date-time group. As can be surmised, the NFL is most applicable to a stationary front or a defensive type action.

It is essential that the current location of the NFL be known to all artillery units and naval ships supporting the maneuver force. To this end, the NFL must be rapidly disseminated to subordinate, adjacent, and

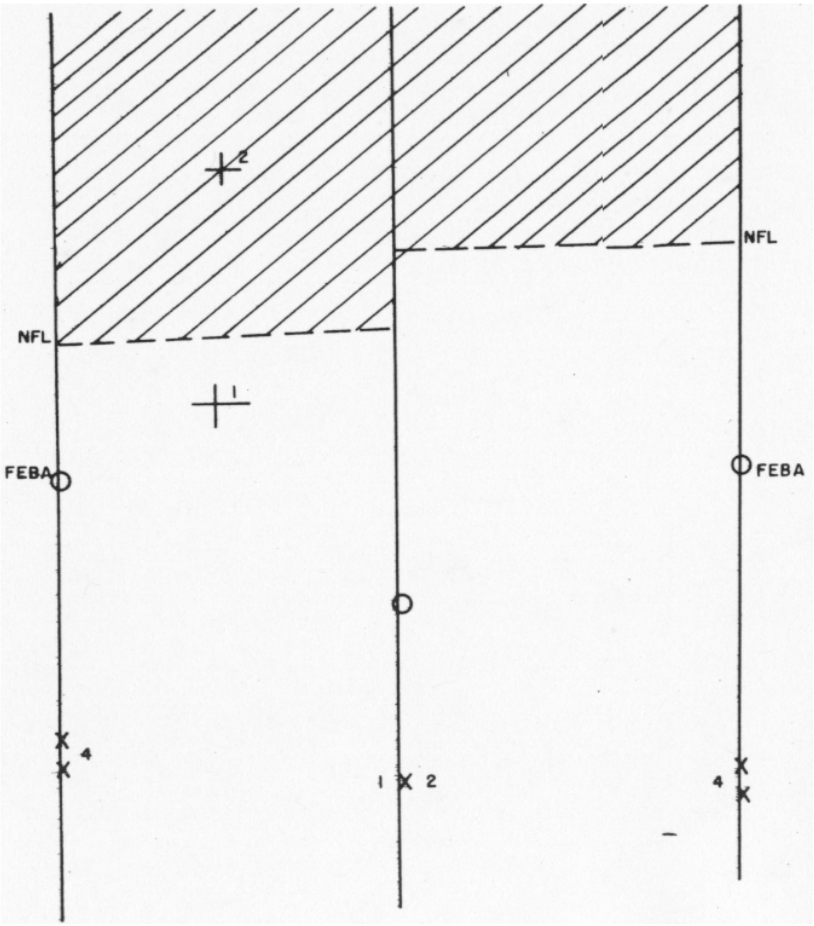

Figure 1. Sample no-fire line problem.

higher headquarters. Only in this way can we insure safe and rapid fires on fleeting targets which may threaten the security of the force.

What do we as field artillerymen accomplish by establishing a no-fire line? Prior to its selection and dissemination, we coordinate closely with the brigade commander to insure that he will have an area forward of the forward edge of the battle area (FEBA) in which he can maneuver his forces with safety. If troop safety were the sole reason, there would be no need for an NFL, for simply by not establishing an NFL, we require all field artillery and naval gunfire support ships to coordinate with the brigade prior to firing forward of the FEBA. By establishing an area into which field artillery and naval gunfire support ships can fire without danger to friendly troops, we eliminate time-consuming coordination and permit rapid response by field artillery and ships not in direct support of the brigade. These destructive fires will greatly assist the brigade in the acomplishment of the mission. We accomplish the expediting of fires across boundaries.

Let's see how this works. Before any field artillery units or naval gunfire support ships which are not in direct support of the 1st Brigade can attack target 1, they must obtain clearance from the 1st Brigade. This clearance is normally obtained from the field artillery battalion that is in direct support of the brigade. The establishment of the NFL does not change the coordination and clearance requirements for targets that are short of the no-fire line. The coordination requirements inherent in the boundary remain in effect.

Assume that target 2 has been spotted by an aerial observer from the division artillery which is in general support of the division. It is now possible for any field artillery unit or naval gunfire support ship to engage this target without coordination with or clearance from the 1st Brigade. The field artillery in general support of the division to include, if necessary, the artillery in direct support of the 2d Brigade, can fire across brigade boundaries without time-consuming coordination.

MILITARY MUSEUM DEDICATED

General of the Army Omar N. Bradley museum was recently dedicated at Carlisle Barracks, Pennsylvania. The museum will be incorporated with the U. S. Army Military History Research Collection and part of the facilities there will be used to house General Bradley's papers and memorabilia. The Military History Research Collection was organized in June 1967 in an effort to consolidate historically significant United States Army materials in one place, preserve them and insure their availability to civilian and military scholars.

Future Developments In Cannon Artillery

1LT William M. Cochrane
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USAFAS

In order to provide superior firepower for the battlefield of the future, field artillery cannon weapon systems undergo a continuing program of research and development. Some of the developments now under consideration include several new 105-mm towed howitzers, a new 155-mm towed howitzer, and improved versions of the 155-mm M109 and the 8-inch M110 self-propelled (SP) howitzers.

The Active Army is now equipped with three models of 105-mm howitzers—the M101A1 and M102 towed howitzers and the M108 SP howitzer.

The M101A1 was developed during World War II and is the authorized direct support weapon for infantry units other than airborne and airmobile units. Although the M101A1 is the basic direct support weapon for a large portion of the US field artillery, no new weapons of this model have been produced since 1953. A replacement weapon for the M101A1 will soon be necessary simply because of the age of the weapons in the inventory. The limited range and traverse capabilities of the M101A1 and its excessive weight (4,980 pounds) for air movement led to the establishment of a requirement for a lightweight towed 105-mm howitzer. The M102 was developed to fulfill that requirement and is now the primary weapon for field artillery units in direct support of airborne and airmobile operations. Even though the M102 provides an increased range (500 meters over that of the M101A1), a traverse capability of 6,400 mils, and a weight of only 3,300 pounds, its suitability as a replacement for the older weapon is questionable due to problems in stability that have been encountered when the weapon is fired in certain types of soil.

The M108 is a self-propelled weapon developed to provide support for mechanized and armored forces. This weapon is being replaced by the M109 (155-mm SP) and is scheduled to be phased out of the inventory by the end of fiscal year 1972. Currently there are no plans to produce another 105-mm self-propelled howitzer.

LIGHT HOWITZER CONCEPTS

Three new 105-mm howitzer concepts are being considered to meet the requirement for a single general-purpose 105-mm weapon to be used in support of infantry, airborne, and airmobile forces, since none of the

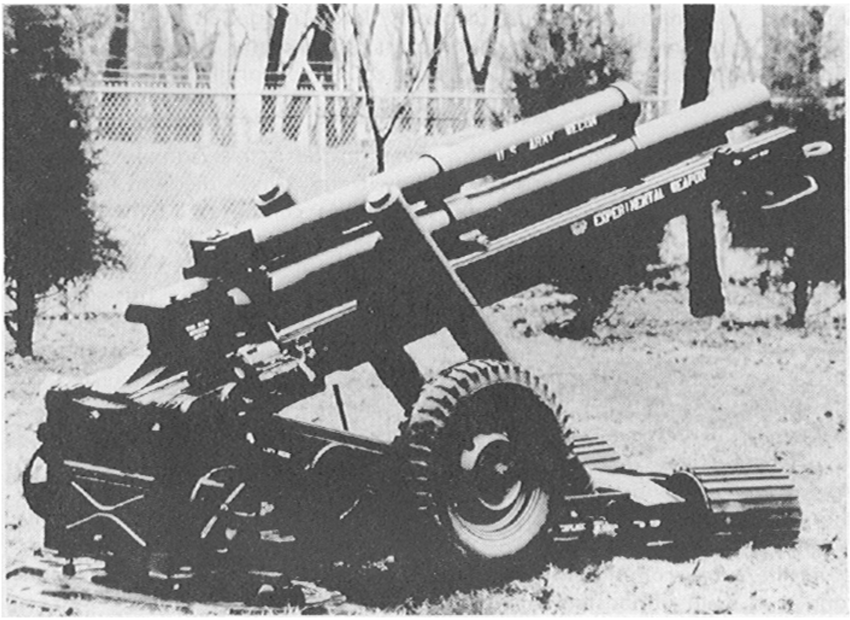

Figure 1. XM204 soft recoil towed howitzer.

present weapons meet this criterion. The weapons being considered are the XM164*, a Marine Corps-developed weapon which combines the tube and fire control elements of the M102 with the carriage design of the M101A1 and uses lightweight metal parts wherever possible; the XM204*, a soft recoil towed howitzer on which military potential testing is expected to begin this summer at Fort Sill (fig 1); and a third weapon concept, as yet undefined, which is intended to produce significant range and reliability improvements.

Current indications are that the XM164, which was recently tested by the U. S. Army Field Artillery Board, would not represent a significant enough improvement over the M101A1 and M102 to warrant its procurement by the Army. Therefore, at this time the soft recoil concept should be considered a prime candidate for future 105-mm weapon systems.

Although the soft recoil concept is theoretically applicable to weapons of larger calibers as well as to 105-mm weapons, improvements will have to be made in propellants before this concept can be applied to cannon using separate-loading ammunition. For the soft recoil concept to function, the ignition delay between the time the primer functions and the time the weapon fires must be reproducible with only a small variance. Standard 155-mm propellant charges, for example, have an unpredictable ignition delay ranging from about 40 milliseconds to more than 80 milliseconds. Designing the weapon to allow for this large variance will introduce an unacceptably large range error. Ammunition research to solve this problem is progressing, and the soft recoil concept may someday be applied to all calibers of cannon artillery.

MEDIUM HOWITZERS

There are now two 155-mm howitzers in the Active Army inventory—the M114A1 towed and the M109 SP howitzers. These medium howitzers have a maximum range of 14,600 meters, as compared to the 17,300-meter range of the Soviet 152-mm gun howitzer. An increase in range for the US medium howitzers would provide more effective counterbattery fire, as well as extending the lateral coverage of the unit. This increase in lateral coverage would improve the unit's capability to mass fires with adjacent units. In addition, with the increased Soviet emphasis on hostile artillery location, the probability of US field artillery being detected by the enemy is increasing; therefore, an increased range capability for US cannon artillery is imperative.

To meet this requirement for increased range in 155-mm weapons, new cannon and ammunition systems have been developed. These are the XM185 cannon assembly and the XM549 rocket-assisted projectile (RAP) used with the XM119E5 propelling charge. The new charge/projectile/tube combination is expected to yield increased maximum ranges in both unboosted and rocket-assisted modes.

A modified M109 howitzer mounting the XM185 cannon recently completed service testing at Fort Sill. Designated the M109E1 (fig 2), the new weapon has a tube about 8 feet longer than the standard M109. It will accomodate all standard ammunition components as well as the new zone 8 propelling charge XM119E5, which achieves ranges to 18,200 meters with the standard HE projectile M107. In addition, the M109E1 has a breech-mounted rammer* which allows loading at a wide range of elevations. This entire concept is still in the developmental stage; however, it may provide a low-cost, low-risk method of achieving greater ranges in the immediate future.

Figure 2. M109E1 extended tube 155-mm SP howitzer.

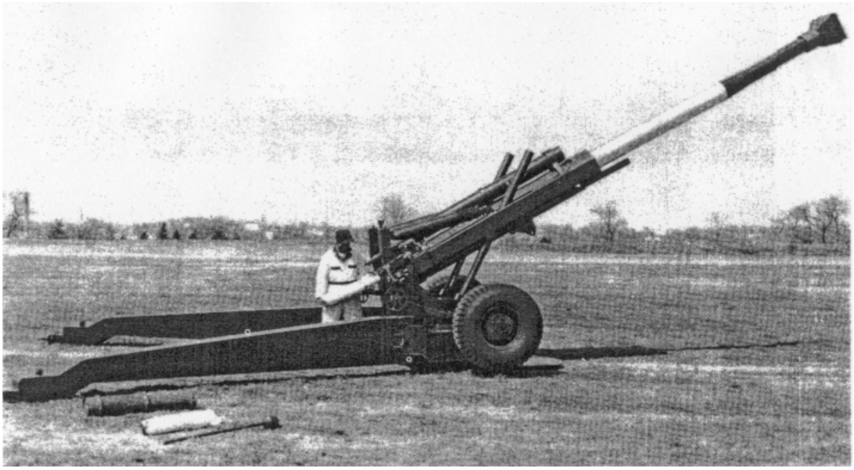

Figure 3. XM198 towed 155-mm howitzer.

The towed medium howitzer currently under development is the XM198 (fig 3 and 4). a possible replacement for the M114A1 which has been in the inventory since 1942. Designed primarily as an airmobile 155-mm howitzer with a capability of being airlifted by the CH47-C Chinook helicopter, the XM198 incorporates a cannon ballistically similar to the XM185 cannon used on the M109E1. The XM198 will fire both RAP and standard ammunition to ranges comparable to those achieved with the M109E1. Designed as a general support weapon, the XM198 can be moved by helicopter and has a range capability for providing coverage of a division zone of operation.

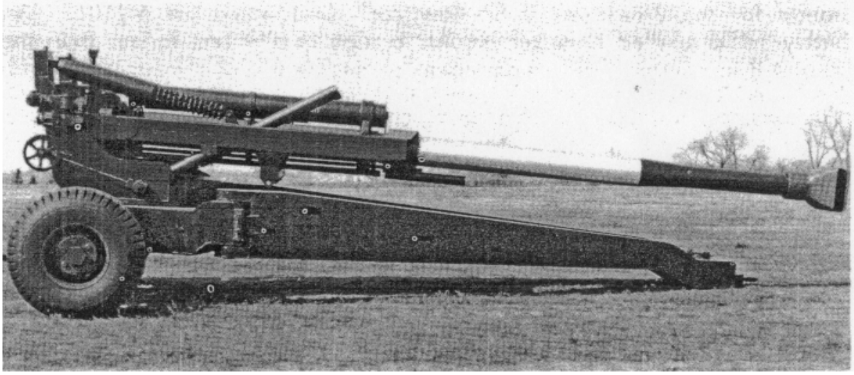

Figure 4. XM198 in stowage position.

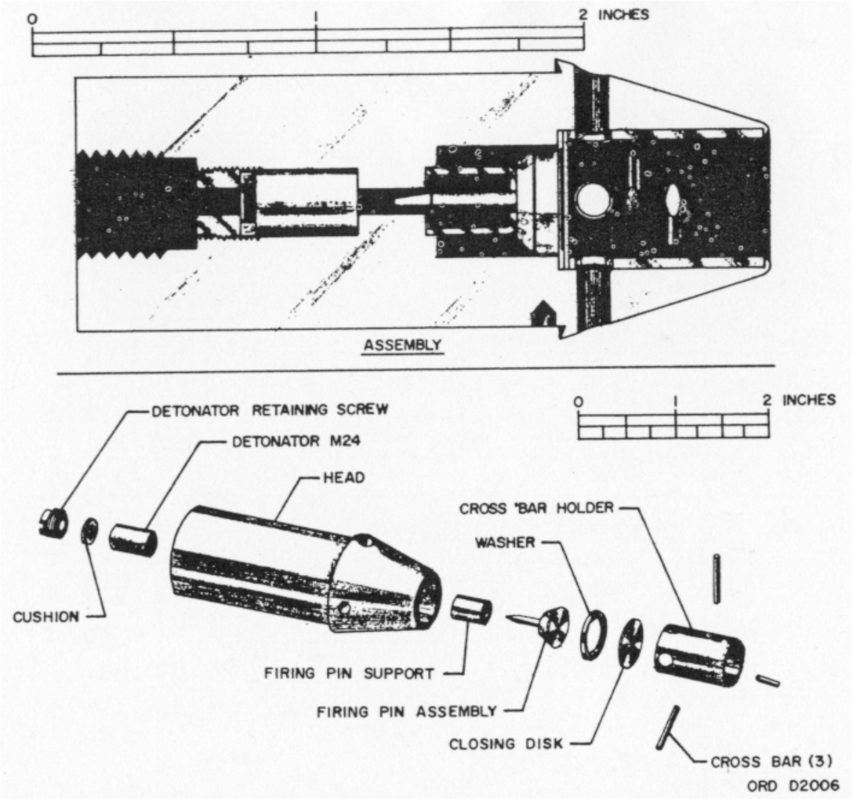

Figure 5. M557E1 rain-insensitive PD fuze.

A concept similar to the XM185 cannon for the M109 is under evaluation for the 8-inch M110 SP howitzer. Designated the M110E2, this heavy self-propelled howitzer mounts a tube over 9 feet longer than the current 8-inch tube. The combination of this new cannon with the developmental XM188 propelling charge and XM650 RAP will produce a greatly increased range capability for the 8-inch howitzer.

AMMUNITION

In addition to the RAP concept under development for the 105-mm, 155-mm and 8-inch weapon systems, several other new ammunition items are being considered. These include the XM396, a flechette round for 155-mm weapons; the XM583, a new proximity fuze; and the XM577* and XM587, developmental time fuzes.

A product-improved version of the M557 point-detonating (PD) fuze, the M557E1 (fig 5), has been developed to provide a rain-insensitive PD fuze. The head of the M557 has been modified to incorporate a recess, one-half inch in diameter and three-fourths of an inch deep, in front of the firing pin head. The recess is baffled by three crossbars at different depths and orientations in the recess. There are four 1/8-inch-diameter drain holes in the bottom of the firing pin recess. In addition, the ogive has been strengthened by increasing its thickness. Test firing of the M557E1 in Southeast Asia indicates that the fuze provides an added bonus in the form of better canopy penetration.

A new family of ammunition with similar ballistic characteristics is being developed. The result anticipated is that all firing data for one caliber of weapon, regardless of the projectile, fuze, or charge selected, eventually can be derived from a single set of firing tables. Only minor correction factors, similar to those now used for nonstandard conditions, will be necessary for changing from one type of ammunition to another.

The weapons and ammunition items described above, coupled with such developments as the laser rangefinder and TACFIRE, will provide the Army of the future with the highly responsive fire support necessary to defeat a sophisticated enemy force.

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*Editor's Note: Readers desiring more information on weapon developments are referred to the following issues of **THE FIELD ARTILLERYMAN (ARTILLERY TRENDS):** XM164, April 1970; XM 204, April 1969; breech-mounted rammer, December 1968; and the XM577 fuze, elsewhere in this issue.

TACFIRE TRAINING COURSE

The first in a series of TACFIRE (tactical fire direction system) training courses was recently held at the Data Systems Division of Litton Industries. The course was attended by 80 senior military and civilian personnel responsible for preparing Army plans for the testing and field deployment of the TACFIRE system.

The instruction included a general orientation to the TACFIRE system, a description of design and development techniques for hardware and software, communications interface, planned personnel utilization, training aids and devices, maintenance and logistic support plans, and the integrated test program.

Attendees represented the Office of the Secretary of Defense and Headquarters Department of the Army as well as major commands including Combat Developments Command, Army Materiel Command, Computer Systems Command, and Continental Army Command.

New GFT's for . . .

High Angle Limits

LTC (Ret) Matthew J. Ringer
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USAFAS

New high-angle GFT's are being manufactured and will soon be available for issue. The first GFT's to be completed, for the 155-mm howitzer M109, are due for distribution during the fourth quarter of FY 70. Other GFT's will be distributed during the first and second quarters of FY 71.

Unlike the scales on some present GFT's, the new high-angle scales will have an upper limit on quadrant elevations that may be less than the maximum elevation capability of the weapon. Several factors were considered in reaching the decision to impose an upper limit on quadrant elevations.

The first factor concerns the function of the spin imparted to a projectile by the rifling of the tube. The amount of spin that a projectile should have is determined during the development phase of a cannon system. Spin serves to orient the projectile and control its attitude during flight. If there is insufficient spin, the projectile will lose its stability and tumble. If there is too much spin, the projectile will be so stable that it will not nose over on the descending leg of the trajectory and will impact on its side or base. A very delicate balance between an under stabilized and an over stabilized projectile throughout flight is assured by the proper amount of spin.

The second factor concerns the computational techniques used in determining data for firing tables. The Firing Table Branch of the U. S. Army Aberdeen Research and Development Center (ARDC) is responsible for publishing tabular firing tables and providing data for graphical firing tables. Until fairly recently, dozens of ARDC mathematicians had to integrate the equations of motion of hundreds of trajectories in order to produce firing table data. Computations were based on the point-mass theory (three degrees of freedom), in which the projectile was assumed to have no dimensions and all characteristics were described by the projectile's center of gravity. Any effect that yaw or spin might have on the projectile's flight was approximated periodically rather than computed throughout the trajectory. With the advent of electronic computers, the time-consuming integrations of the equations of motion were no longer required and computation time was reduced from weeks to hours. Because the computations continued to be based on the point-mass theory, they could be made for any desired quadrant elevation without regard to the attitude of the projectile with respect to the trajectory. As a result, computations were usually made to the maximum elevation capability

Table I, Maximum Practical QE in Mils

Howitzer	Projectile	Charge	Maximum Practical QE
105-mm M101A1	M1	1	1275
		2	1290
		3	1300
		4	1310
		5	1325
		6	1325
		7	1315
105-mm, M108/M102	M1	1	1270
		2	1280
		3	1290
		4	1305
		5	1315
		6	1310
		7	1295
155-mm, M114A1	M107	1G	1275
		2G	1290
		3G	1300
		3W	1305
		4G	1315
		4W	1315
		5G	1320
		5W	1320
		6	1310
		7	1295
155-mm, M109	M107	1G	1255
		2G	1270
		3G	1285
		3W	1285
		4G	1295
		4W	1295
		5G	1295
		5W	1295
		6	1285
		7	1270
175-mm, M107	M437	1,2,3	1156
8-inch, M110/M115	M106	1	1295
		2	1305
		3	1310
		4	1320
		5G	1315
		5W	1315
		6	1305
		7	1295

of each weapon. The early electronic computer at ARDC was replaced by a high-speed computer that is capable of rapidly computing the equations of motion in six degrees of freedom rather than in three degrees of freedom. Computations based on three degrees of freedom consider only the location of the center of gravity (point-mass) of the projectile with respect to range, height, and direction. Computations based on six degrees of freedom consider the shape and attitude of the projectile, as well as the range, height, and direction. In the latter computations, not only is the location of the projectile known at any point on the trajectory but also the attitude; i.e., the amount of yaw, pitch, and spin.

In a recent study conducted by Barbara J. Jordan and Donald H. McCoy of the Firing Table Branch, ARDC, projectile flight based on six degrees of freedom was simulated in a computer program. It was found that projectile flight is not predictable beyond a certain quadrant elevation because the stabilizing effect of spin will not let the projectile orient itself in a nose-down attitude on the descending leg of the trajectory. Failure of the projectile to assume a nose-down attitude causes it to impact base first or on its side which often results in a dud, and changes the ballistic characteristics of the projectile, which often results in a large range and/or deflection error. The Jordan-McCoy study showed that, at quadrant elevations above 1,300 mils, deflection errors approached 800 meters and that deflection probable errors were sometimes as large as 200 meters. The U. S. Army Field Artillery Board at Fort Sill, during test firings of the M109E1, found that predicted ranges were often exceeded by more than 1,000 meters. The Board hypothesized that the projectiles "floated" through the air much as a skier floats after taking off from a ski jump.

The maximum practical quadrant elevations that were determined by the Jordan-McCoy study and that will determine values for high-angle GFT's are listed in table I. It is recommended that units not exceed these quadrant elevations. It may be necessary to change to a different charge or to select a more suitably located firing unit to fire the mission.

HAZARD SIMULATOR FOR MUNITIONS

Through the use of an electromagnetic hazard simulation chamber the Army can now more accurately test the susceptibility of munitions to unplanned explosions caused by high-powered electromagnetic fields. Being utilized at Picatinny Arsenal in New Jersey, this new equipment allows researchers to determine propellant susceptibility to such phenomena as lightning, a static charge, nuclear bursts, or communications and radar systems.

For Forward Fire Base

Radar Survey

Sensory Equipment Division
Target Acquisition Department
USAFAS

The field artillery must be able to deliver accurate and timely fires in remote areas often without survey or time to complete an observed firing chart. The AN/MPQ-4A countermortar radar section, organic to each divisional direct support battalion, can provide usable survey control between the radar and firing units by combining the procedures employed in weapons location with those employed during a radar-observed registration.

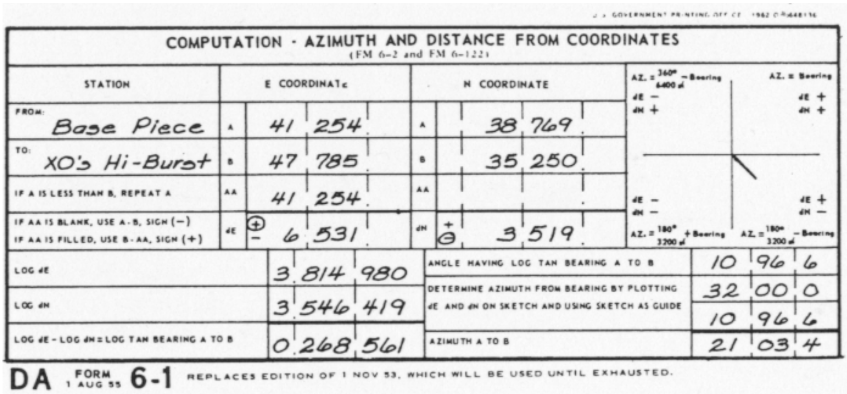
To accomplish a survey mission, the radar must be emplaced within its rated range of the field artillery unit to be located. Current range of the AN/MPQ-4A countermortar set is 10,000 meters. The range capability is expected to be increased to 15,000 meters in the near future. The radar site should meet the normal positioning requirements for weapons location and radar gunnery applications. If the radar location is known, the grid coordinates and altitude are placed in the radar set computer. If the radar location has not been determined, assumed data are placed in the radar set computer.

LOCATING THE BATTERY

The radar section, using standard weapons location techniques, determines the grid coordinates of each base piece relative to the radar. The radar beam is positioned over the battery being located. The base piece fires one round of high angle at the maximum safe elevation (to get the projectile as nearly directly above the battery as possible), using the lowest possible charge (to allow the slowest trajectory possible, thus permitting the radar computer to perform a curvilinear extrapolation) and minimum safe time (to minimize detection by the enemy). The radar section, using standard weapons location techniques, determines the location of the base piece based on this one round.

DETERMINATION OF DIRECTION

Direction for the firing battery may be determined with the M2 aiming circle however, local magnetic irregularities often cause errors that exceed 20 mils. The battalion survey section is capable of determining direction to an accuracy of less than 1 mil by use of the gyro azimuth surveying instrument or by astronomic observation or simultaneous observation. The procedures for conducting a simultaneous observation appear in FM 6-2. If the forward fire base is occupied during periods of poor visibility or if time is not available to complete a gyro or simultaneous observation, direction and altitude can be established rapidly by firing a radar-observed executive officer's high burst. Coordinates of the base piece and the high burst, as determined by the radar computer, are entered on DA Form 6-1 (Computation—Azimuth and Distance from Coordinates) (fig 1). Logarithms are used to solve for the bearing angle. Once the bearing angle is known, the azimuth can be readily determined by using DA Form 6-1.



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COMPUTATION - AZIMUTH AND DISTANCE FROM COORDINATES
(FM 6-2 and FM 6-122)

STATION		E COORDINATE		N COORDINATE
FROM: Base Piece	A	41 254	A	38 769
TO: XO's Hi-Burst	B	47 785	B	35 250
IF A IS LESS THAN B, REPEAT A	AA	41 254	AA	
IF AA IS BLANK, USE A-B, SIGN (−) IF AA IS FILLED, USE B-AA, SIGN (+)	dE	+ 6 531	dN	− 3 519

AZ. = 6400 mils (360°) − Bearing; dE −; dN +
AZ. = Bearing; dE +; dN +
dE −; dN −; AZ. = 3200 mils (180°) + Bearing
dE +; dN −; AZ. = 3200 mils (180°) − Bearing

LOG dE	3.814 980	ANGLE HAVING LOG TAN BEARING A TO B	10 96 6
LOG dN	3.546 419	DETERMINE AZIMUTH FROM BEARING BY PLOTTING dE AND dN ON SKETCH AND USING SKETCH AS GUIDE	32 00 0
			10 96 6
LOG dE − LOG dN = LOG TAN BEARING A TO B	0.268 561	AZIMUTH A TO B	21 03 4

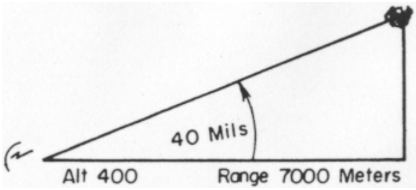
DA FORM 6-1, 1 AUG 55. REPLACES EDITION OF 1 NOV 53, WHICH WILL BE USED UNTIL EXHAUSTED.

Figure 1. DA Form 6-1.

The azimuth determined on DA Form 6-1 is the direction achieved for the executive officer's high burst. Adjustments for current met corrections and drift should be applied to refine direction. Accuracies obtained by this method should be within 10 mils.

DETERMINATION OF ALTITUDE

The radar set can also be used to determine the relative altitude of the firing battery. The executive officer's high burst is observed by the radar and by the battery executive officer, who uses an aiming circle. The radar determines the range, azimuth, and angle of elevation to the burst. The executive officer measures the angle of elevation to the burst from his position. Since the altitude of the radar is known or assumed, the relative altitude of the burst may be determined by using the mil relation (fig 2).



RADAR DETEMINES:
AZIMUTH TO BURST
RANGE TO BURST
ANGLE OF ELEVATION

Figure 2. Mil relation.

Example:

- Compute the vertical interval (VI) between the radar and the burst. Add the VI to the altitude of the radar to determine the altitude of the burst.

Altitude of the radar	400 meters
Vertical interval to burst (40 × 7.0)	280 meters
(Angle of site in mils multiplied by range to burst in thousands of meters)	________
Altitude of burst	680 meters

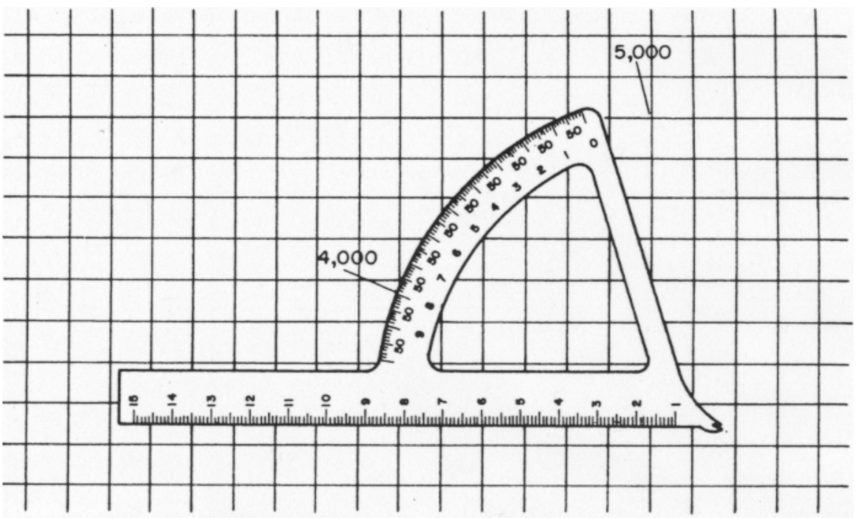


Figure 3. Location of the high burst.

- Plot the location of the high burst, as determined by the radar, on a battle map or grid sheet and measure the distance from the battery location to the burst. Using this range and the angle of elevation read by the executive officer, compute the vertical interval of the burst above the battery (fig 3 and 4).

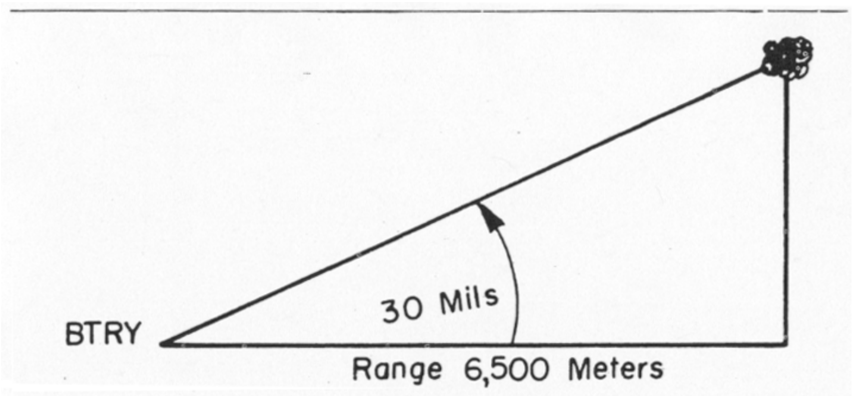


Figure 4. Vertical interval.

Angle of site measured by executive officer	30 mils
Range from battery to burst	6,500 meters
Vertical interval of burst above battery (30 × 6.5)	195 meters

- The altitude of the battery is determined by subtracting the vertical interval of the burst above the battery, as determined in step 2, from the altitude of the burst, as determined in step 1.

Altitude of burst	680 meters
Vertical interval of burst above battery	195 meters
Altitude of battery	485 meters

ALTERNATE METHODS OF RADAR SURVEY

A helicopter can be used in determining the location of a firing battery. The helicopter hovers over the battery just high enough to be seen by the radar. The radar determines the range and the azimuth to the helicopter and converts the data (in the radar computer) to the grid coordinates of the battery. The altitude of the battery can then be determined by firing an executive officer's high burst, as previously discussed, or by using the altimeter in the helicopter. (If the survey section altimeter is used, as many readings as desired can be made. For example, the altitude of each firing battery and of the radar may be determined by moving the altimeter from position to position.) The helicopter lands at each position, and the altitude is read on the altimeter in the helicopter. If desired, the helicopter may be used in the same manner as the executive officer's high burst. In this case, the helicopter is flown at a sufficient distance and altitude from both the radar and the firing battery to permit the radar to measure the range, azimuth, and elevation to the helicopter. The battery executive officer measures one angle of elevation. The altitude of the battery is then computed by using the same procedures as when the executive officer's high burst is used*

Another method that may be used to determine the location of a firing battery is to tether a balloon, attached to a reflector, over the battery center at a height at which the reflector can be detected in the lower beam of the radar. The radar is then used to determine the grid coordinates and the altitude of the reflector. The grid coordinates of the battery center are assumed to be the same as the coordinates of the reflector. The altitude of the battery center is determined by subtracting the vertical distance the reflector is suspended above this point (which may be measured from the tether line) from the altitude of the reflector.

LOCATING THE RADAR

If the coordinates of the radar position have not been determined, control may be extended from a friendly artillery unit that has survey data. The procedure is as follows:

- The radar observes one round (high angle, lowest possible charge) fired from the known location.
- The radar set computer determines the range and azimuth from the radar to the weapon.
- The known location of the weapon is plotted on a battle map or grid sheet.
- The radar position is determined by plotting along the back-azimuth at the range determined by the computer.

LIGHTWEIGHT COMMERCIAL BLASTER

Army engineers at Picatinny Arsenal have redesigned a commercial 11-ounce blasting device to replace the standard and much heavier 4½-pound military blaster used since World War II. The new blasting machine, XM32, is a hand-held unit that can fire 10 blasting caps in a 500-foot field wire hookup. It is expected to find extensive application in most types of warfare.

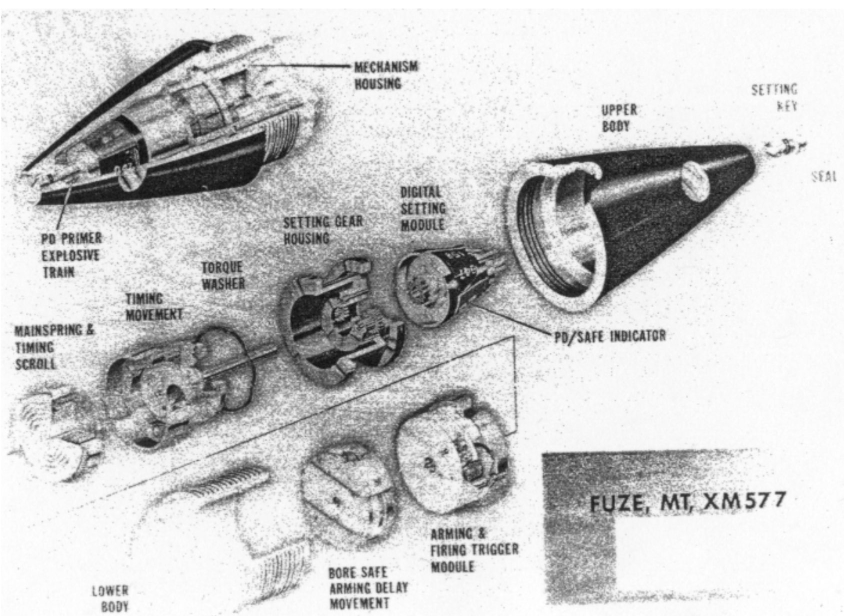
This method of locating a battery can be used in locating sensors. This is discussed in "Locating Sensors with Q4 Radar" in the April 1970 issue of* **THE FIELD ARTILLERYMAN. *Another related article titled "Instant Survey" appeared in the October 1964 issue of* **ARTILLERY TRENDS.**

Recent Developments In XM577 Time Fuze

All mechanical time (MT) fuzes used in the United States Field Artillery are based on a design conceived by the Germans prior to World War I. In spite of all refinements and improvements, mechanical time fuzes have inherent limitations and, since World War II, have not met military fuzing requirements.

A recent breakthrough in mechanical fuze development by the United States demonstrates that military fuzing requirements can be met and, in some areas, exceeded. The newly developed fuze is designated the XM577. Universality of the design allows its application in all existing and anticipated artillery systems in which a time fuze is required.

The mechanism and explosive train of the XM577 fuze are housed in a two-piece body. The upper part (fuze ogive) has a window through which the fuze setting can be read. The lower part is threaded into the upper part and has an additional threaded portion for fuze-to-shell and booster-to-fuze mounting. The mechanism consists of four modules as follows:



A setting module consisting of a flag indicator for the SAFE and PD positions, a digital counter for time setting, and a setting gear assembly in its own housing.

A timing module consisting of a timing movement (escapement), a gear train and a mainspring and a scroll on the output end. The mainspring and scroll control the function of the trigger mechanism.

An arming and firing trigger module consisting of a double D-shaft firing arm and two safety levers, which control the release of the arming rotor and firing pin.

A bore safe module consisting of a rotor that carries the detonator, an arming delay mechanism, and two safety detents. The explosive train consists of three major components as follows:

A detonator housed in the rotor of the bore safe.

A multipurpose lead capable of initiating HE, propellant, and black powder charges.

A set of PD elements consisting of ring primer in the nose of the fuze and two mild detonating fuze (MDF) paths leading from the primer to the detonator "armed" location. The fuze setting key at the nose of of the fuze acts as the PD firing pin.

The XM577 mechanized time, superquick (MTSQ) fuze has completed engineer design. A pilot production line has been established, with the automated production and inspection equipment currently undergoing final test. Future actions include completing the engineer service tests which will be followed by type classification.

Revision of Career Groups

Department of the Army has recently approved a major revision of MOS career groups 13 (field cannon and rocket artillery) and 15 (field artillery missiles) to be effective 1 July 1970. This revision removes the rocket crewman positions from career group 13 and places them in career group 15. The title of career group 13 will then be "Field Artillery Cannon," and the title of career group 15 will be "Field Artillery Missiles/Rockets." In accordance with this revision, Honest John crewmen positions will be converted from MOS 13A and 13D to MOS 15F; rocket operations, intelligence, and liaison positions will be converted from MOS 13E (field artillery operations and intelligence assistant) to MOS 15J, which will be converted to Lance/Honest John operations/fire direction assistant.

The operations, intelligence, and liaison positions in Sergeant and Pershing missile organizations will be converted from MOS 15J to MOS 15B (sergeant missile crewman) or 15E (pershing missile crewman), as appropriate.

In addition, the revision—

- Establishes MOS 15D for Lance missile crewmen.

- Establishes MOS code 15E30 for duty positions of azimuth laying specialist.

- Establishes additional skill identifiers for Nuclear Operations (M5 - 8" how; M6 - 155-mm how; M7 - sgt missile; M8 - Lance; N1 - Pershing; Q8 - Honest John) to identify personnel who have received additional training in maintenance and/or operation of nuclear weapons systems or subsystems. Use of special qualifications identifier "N" for this purpose will be discontinued.

- Establishes special requirements in AR 611-201 to comply with security regulations for nuclear training and for duty positions in MOS 13A, 13B, 15B, 15D, 15E, 15F, and 15J.

- Changes special requirements presented in AR 611-201 to reflect selection, assignment, and retention criteria for personnel in MOS 13E and 15J serving in command and control duty positions.

Additional information is presented in DA Circular 611-63 (Implementation of Change 15, AR 611-201), dated 17 February 1970.

NEW BALLOON FOR VIETNAM

Meteorological balloon ML-635 has been developed to satisfy ENSURE requirement number 319, which was requested by USARV. The ML-635 balloon is a low altitude fast rising balloon which will be used by field artillery meteorological sections for acquiring meteorological data when fallout predictions or AWS data are not required. In Southeast Asia, the majority of the met requirements do not exceed 16 line computer or 11 line NATO met messages. This balloon has a rate of rise in excess of 400 meters per minute, uses only 3 each ML-305 charges, has an average bursting altitude above 10,000 meters, and costs about $1.75 each.

The balloon has passed military potential tests, and a basic load plus a 1 year's operating supply for each met section in Vietnam is on order.

COMMUNICATIONS SECURITY

Would you give your enemy a loaded gun to use against you? Would you tell him where to locate his forces to effectively ambush your own forces? Certainly not. At least not deliberately. But when you violate communications procedures and use "homemade" and unauthorized codes, you assist the enemy and jeopardize your own forces.

The most frequently observed violations are the use of the "shackle codes" system, made up of 10-letter words, and the "point of origin" system to identify grid coordinates. These systems not only are worthless but deceive some people into thinking that information they send or receive over their radio or telephone is secure. Nothing could be further from the truth. These systems are easily compromised, usually in less time than was needed to transmit or receive the information. Once you transmit a message over a radio, it becomes public information that is available to anyone who can monitor your frequency. The assumption that telephone and wire communications are secure still prevails. This assumption is erroneous and can have serious results, especially in actual combat operations. Wire communications frequently require long lines which are not under our constant surveillance; therefore, they represent another opportunity for the enemy to intercept valuable intelligence and use it to our detriment.

The use of unauthorized procedures and codes exposes your transmission to exploitation and gives the enemy intelligence to use against you. Electronic warfare is engaged in by all armies. We must not over-look the threat posed by the signal intelligence capabilities of foreign governments. This threat can be minimized if we adhere to the communications procedures we have been taught. The US Army is the best equipped army in the world and has the most sophisticated communications equipment. Our government has spent millions of dollars perfecting the equipment to give us the capability to communicate securely and at an unprecedented rate. We are given extensive schooling on how to effectively operate this equipment. Only if we retain and practice what we have learned will we have the most effective communications system in the world. Unfortunately, some of us tend to forget what we learned in communications training. We forget that communications security is an individual responsibility and that a radio or telephone operator has the ability to influence the success or failure of a military operation. Our adversaries, both real and potential, can be expected to employ sophisticated equipment and analytical techniques to exploit our communications for information of intelligence value.

Security equipment and authorized codes, prepared by experts, are issued down to the lowest level needed and are used extensively in areas where our combat forces are located. Our opponents are often called unsophisticated and stupid, but our forces and convoys continue to be ambushed and practically all areas of operations are hampered and harassed by the enemy. Where does he get his intelligence information accurate enough to aid him in the accomplishment of his mission? Much of it is derived from our communications, both radio and telephone. We must protect our communications and deny the enemy the opportunity to exploit them. The best defense is the use of authorized security equipment, codes, and communications procedures. Remember, the enemy is listening. Don't give him the gun or the plans to use against you.

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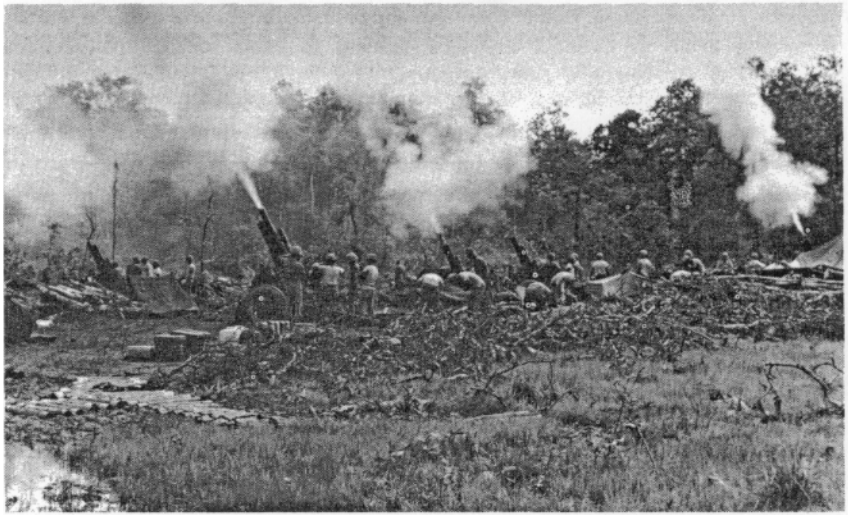
NEW TRACTION LINK IMPROVES MOBILITY

A new rotating linkage device will greatly improve the mobility of wheeled vehicles in South Vietnam, according to recent tests conducted at the US Army Research and Development Center at Aberdeen Proving Ground. Results of a 1,500-mile endurance test indicate that the device extends the service life of tire chains 3½ times, reduces maintenance, and increases reliability.

The linkage consists of swivel hooks as end connectors for tire cross-chains. No tools are needed to maintain the chain in field tactical conditions, and the assembly can be rebuilt by hand without special tools.

An advantage of the new chain is that the swivel hook permits the cross-chain to rotate. This exposes more of the hardened chain-link surfaces to wear and considerably increases the life of the cross-chain.

Southeast Asia



LESSONS LEARNED

The following material is extracted from correspondence from US field artillery units in Southeast Asia and from after action reports distributed by the Department of the Army. However many of the items are field expedients adaptable only to stability operations, and therefore do not always represent official US Army Field Artillery School doctrine.

6,400-MIL CORRECTIONS TO FIRING DATA

FDC personnel should be fully aware of the necessity of correcting for nonstandard conditions throughout the entire 6,400-mil zone of fire. There are several ways to determine these corrections; some require long tedious computations and multiple GFT settings, whereas others are simplified by using FADAC. In the event the FADAC is nonoperational, a rapid technique has been developed in which wind cards are used to facilitate the determination of accurate corrections in a minimum amount of time. Total corrections are determined in the normal manner by registration. The concurrent met less the corrections for cross and range winds is then solved. The met corrections are subtracted from total corrections to determine constants which will subsequently be used. By assuming that rotation corrections are constant for light artillery, wind cards are used to determine the corrections to range and deflection every 800 mils. These values are recorded on a chart for each charge. Finally, the corrections for wind (in the direction of the registration point) are subtracted from the total corrections derived from the registration, and a GFT setting is constructed on the stick by using the subtotal range correction. The subtotal deflection correction is placed in the appropriate drift block. The total corrections depicted on the stick compensate for all nonstandard conditions except wind. When a mission is to be fired, the recorded wind corrections (for the appropriate direction) are simply added to the chart data and the GFT setting is used to determine firing data. When a subsequent met is solved to update the firing corrections, the same procedure in which wind corrections are not computed on the met data correction form is followed. The constants determined from the registration with concurrent met are added to the new met to determine a new GFT setting and deflection correction scale. Once again wind cards are used to determine the wind corrections which are recorded in chart form. The advantage of this technique is speed. The entire computational sequence will take less than 30 minutes for 5 charges once the sequence has been mastered.

REOCCUPATION OF AN ABANDONED FIRE BASE

A captured enemy document showed a detailed sketch, to scale, of an abandoned fire base/landing zone (FB/LZ). The sketch showed exact locations of all bunkers, positions, and wire. The sketch also designated directions of attack on the FB/LZ by arrows. Writing on the sketch indicated that, although he knew the FB/LZ was vacant, the enemy was continuing to observe the area in the event of US or ARVN reoccupation. Reoccupation of a fire base, therefore, should include relocation of weapon positions, bunkers, and other defense positions.

PERIMETER DEFENSES

Claymore Mines. The legs of permanently positioned mines should be embedded in concrete which should in turn, be buried in the ground to prevent the enemy from tampering with these mines. An alternate, hasty means to secure claymore mines is to secure the mines to metal pickets driven in the ground with the mine legs inserted in the picket holes and then bent around the picket. When claymores are located close to friendly positions, sandbags or similar shock-absorbing material should be placed behind each mine to protect personnel from the backblast. When there is sufficient distance between the mines and perimeter positions to eliminate any backblast problems, the back of each mine should be painted white to assist friendly personnel in detecting, removing, or reversing the mines. Claymores which are not permanently emplaced should be removed each morning and repositioned in the evening.

Maintaining Adequate Observation of Perimeter. All vegetation in and about the perimeter area which hinders clear observation and restricts fields of fire must be removed to deny the enemy possible concealment that would facilitate his movement through the perimeter. Towers and bunkers must be situated to provide maximum observation and fields of fire of the entire perimeter. Sappers are trained to function effectively in darkness. Once a sapper has penetrated the perimeter barriers, he relies on confusion among the defenders and their inability to distinguish friend from foe due to poor visibility. An effective lighting system providing full illumination of the perimeter should be considered in order that the enemy can be detected and eliminated before he can penetrate the perimeter barrier. However, the various illumination techniques should be coordinated with the maneuver commander prior to employment.

EYE PROTECTION FOR HOOKUP MEN

When hooking external loads to a CH-47, artillerymen should wear goggles to prevent injuries caused by foreign objects flying into their eyes. When goggles are not available, hookup men may wear protective masks in lieu of goggles. These masks will allow hookup men to breathe dust-free air. Gas masks are as effective as goggles for preventing eye injuries during the hookup operation of an airmobile move.

Sensor Systems Studied In Project MASSTER

A new field test and experimentation organization, Project MASSTER (Mobile Army Sensor System, Test, Evaluation and Review), was activated at Fort Hood, Texas, last fall.

Project MASSTER, operating under the STANO Systems Manager, with test support from US Army Material Command and the US Army Security Agency and test direction from US Army Combat Developments Command, provides for the integrated field test and evaluation of surveillance, target acquisition, and night observation (STANO) systems/items. LTG Beverly E. Powell, CG of Fort Hood, has been designated project director. HQ, Project MASSTER, is comprised of approximately 200 military and civilian personnel tactically and technically qualified to supervise the conduct of

- — Materiel adaptation and evaluations,
- — Functional and organizational experimentation,
- — And field experiment testing.

Troop units participating in the testing come primarily from units assigned to III Corps. Additional troop units may be assigned to Fort Hood as required for the conduct of various tests and evaluations.

The concept of Project MASSTER is a departure from current test and evaluation procedures. Project MASSTER provides for the continuous testing and evaluation of doctrine, concepts, and materiel for Army battlefield surveillance, target acquisition and collection of information. In addition to evaluating the integration of men and materiel in the performance of specific tasks, Project MASSTER provides the capability to rapidly assess the most recent STANO items developed by industry. The information and findings resulting from this experimentation, testing, and evaluation will be rapidly disseminated to all interested agencies and commands by a tailored reporting process.

The activation of Project MASSTER at Fort Hood is one of several reorganizations approved by the Secretary of the Army in order to provide a dedicated STANO management structure. The reorganizations follow several months of study into developmental activities in the area of Army battlefield surveillance, target acquisition and information collection. The reorganization of STANO activities, which has been accomplished within existing resources, provides a management structure which will insure that the best techniques and equipment are available to field commanders at all levels and which will insure direction of effort. The STANO management structure consists of a STANO steering group; a STANO systems manager; and STANO offices within the Department of the Army staff agencies and US Army Material Command, USA Combat Developments Command, US Army Security Agency, and US Continental Army Command.

The STANO steering group consists of senior officers representing the Department of the Army staff and major commands. It provides overview guidance to the STANO effort.

The STANO systems manager, who reports directly to the Army Chief of Staff, is responsible for the coordination of all Army STANO development activities. This coordination includes the interchange of information in the areas of doctrine, concepts, materiel, training, and personnel activities. The activities of the STANO systems manager are coordinated with the other services, as well as with other agencies of the Department of Defense.

The concept for the future battlefield, the integrated battlefield area control system, visualizes the relationship of STANO activities to developments in firepower; mobility; command, control, and communications; and, to a lesser degree, the support services. Project MASSTER will serve the Army as the integrating mechanism for continuing improvement of its STANO capabilities.

STATUS OF TRAINING LITERATURE

The following training literature either has been prepared or currently is under preparation by the US Army Field Artillery School for fiscal years 1971 and 1972. The completion date listed is that time at which the publications were submitted or are scheduled to be submitted to the Office of the Adjutant General. The publications may be under revision (R), or change (C), or may be new (N). Publications include Field Manuals (FM), Technical Manuals (TM), Artillery Training Programs (ATP), Army Subject Schedules (ASubjScd) and Army Training Tests (ATT).

PUBLICATION		DESCRIPTION	ESTIMATED DATE FY	QTR
C	FM 6-10	Field Artillery Communications	71	3
C	FM 6-15	Field Artillery Meteorology	71	2
C	FM 6-16	Table for Artillery Meteorology	71	2
C	FM 6-40	Field Artillery Cannon Gunnery	71	1
R	FM 6-40-1	Field Artillery Honest John/Little John Rocket Gunnery	71	1
C	FM 6-40-2	Field Artillery Gunnery	71	2
C	FM 6-161	Radar Set AN/MPQ-4A	71	3
R	TM 6-300-71	The Army Ephemeris	71	1
N	FM 6-1-1	Forward Observer, TACFIRE	72	4
N	FM 6-1-2	Field Artillery Missile Bn, TACFIRE	72	4
N	FM 6-1-3	Firing Battery, TACFIRE	72	4
N	FM 6-1-4	Field Artillery Battalion, TACFIRE	72	4
N	FM 6-1-5	Division Artillery, TACFIRE	72	4
N	FM 6-1-6	Fire Support Element, TACFIRE	72	4
C	FM 6-2	Field Artillery Survey to Incorporate Form 10A and Polaris Techniques	72	1
R	FM 6-75	105-mm Howitzer, M101 Series, Towed	72	2
R	FM 6-81	155-mm Howitzer, M114 Series, Towed	72	3
R	FM 6-88	155-mm Howitzer, M109, Self-Propelled	72	4
R	FM 6-122	Sound and Flash	72	2
N	FM 6-( )	RATAC	72	1
N	FM 6-( )	Field Artillery Battery, Lance	72	2
R	TM 6-300-72	The Army Ephemeris	72	1
N	ATP 6-195	Field Artillery Battalion, Lance	71	3
C	ATP 6-555	Field Artillery Missile Battalion, Sergeant	71	2
C	ATP 6-558	Field Artillery Searchlight Battery	71	3
C	ATP 6-615	Field Artillery Battalion, Pershing	71	4
N	ATT 6-195	Field Artillery Battalion, Lance	71	4
R	ATT 6-358	Field Artillery Gun/Howitzer Battery, Heavy, Towed/Self-Propelled	71	1

C	ATT 6-558	Field Artillery Searchlight Battery	71	3
C	ATT 6-615	Field Artillery Battalion Pershing	71	2
N	ASubjScd 6-15D10	MOS Technical and Refresher Training of Field Artillery Lance Crewman	71	4
C	ASubjScd 6-15F10	MOS Technical and Refresher Training of Field Artillery Rocket Crewman	71	3
N	ASubjScd 6-15J20	MOS Technical and Refresher Training of Lance/Honest John Operations/Fire Direction Assistant	71	3
R	ASubjScd 6-1	Care and Handling of Ammunition	71	4
R	ASubjScd 6-4	Field Artillery Combat Intelligence	71	2
R	ASubjScd 6-12	Field Exercises	71	3
R	ASubjScd 6-17	Liaison	71	1
C	ASubjScd 6-13E20	MOS Technical and Refresher Training of Field Artillery Operations and Intelligence Specialist	71	2
C	ASubjScd 6-15E10	Pershing Crewman (Pla)	71	2
N	ATP 6-195	Field Artillery Battaltion	72	3
C	ATP 6-175	Field Artillery Rocket Units, Honest John	72	1
C	ATP 6-575	Field Artillery Target Acquisition Battalion	72	4
R	ATT 6-175	Field Artillery Rocket Battalion (Btry), Honest John	72	2
C	ATP 6-415	Field Artillery Battalion Gun/Howitzer—Heavy	72	1
C	ATT 6-576	Headquarters and Headquarters Field Artillery Target Acquisition Battalion	72	4
C	ATT 6-577	Field Artillery Target Acquisition Batteries	72	4
R	ASubjScd 6-6	Communications Exercises for Artillery Units	72	1
R	ASubjScd 6-21	Operation of Meteorological Section	72	2
R	ASubjScd 6-24	Organization and Duties of Operations Section FATAB	72	3
C	ASubjScd 6-13A10	MOS Technical and Refresher Training of Field Artillery Crewman	72	2
R	ASubjScd 6-17A10	MOS Technical and Refresher Training of Field Artillery Combat Surveillance and Target Acquisition Crewman	72	4
C	ASubjScd 6-82C10	MOS Technical and Refresher Training of Field Artillery Surveyor	72	1

US ARMY FIELD ARTILLERY SCHOOL

RESIDENT COURSES

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
1.	**2-6-C8**	1-71	5 Jul 70	6 Jul 70	17 Jul 70	35
	FA Field Grade	2-71	26 Jul 70	27 Jul 70	7 Aug 70	35
	Officer Refresher	3-71	20 Sep 70	21 Sep 70	2 Oct 70	51
	(2 Weeks)	4-71	7 Feb 71	8 Feb 71	19 Feb 71	51
	(Max Cap: 62)	5-71	4 Apr 71	5 Apr 71	16 Apr 71	52
						224
2.	**2-6-C20**	1-71	12 Jul 70	17 Jul 70	9 Oct 70	119
	FA Officer	2-71	26 Jul 70	31 Jul 70	23 Oct 70	119
	Basic	3-71	9 Aug 70	14 Aug 70	6 Nov 70	119
	(12 Weeks)	4-71	23 Aug 70	28 Aug 70	20 Nov 70	119
	(Max Cap: 120)	5-71	6 Sep 70	11 Sep 70	4 Dec 70	119
		6-71	20 Sep 70	25 Sep 70	18 Dec 70	119
		7-71	4 Oct 70	9 Oct 70	15 Jan 71	119
		8-71	2 Nov 70	6 Nov 70	15 Feb 71	119
		9-71	15 Nov 70	20 Nov 70	26 Feb 71	119
		10-71	29 Nov 70	4 Dec 70	12 Mar 71	119
		11-71	3 Jan 71	8 Jan 71	2 Apr 71	120
		12-71	17 Jan 71	22 Jan 71	16 Apr 71	120
		13-71	31 Jan 71	5 Feb 71	30 Apr 71	120
		14-71	14 Feb 71	19 Feb 71	14 May 71	120
		15-71	28 Feb 71	3 Mar 71	28 May 71	120
		16-71	14 Mar 71	19 Mar 71	11 Jun 71	120
		17-71	11 Apr 71	16 Apr 71	9 Jul 71	120
		18-71	9 May 71	14 May 71	6 Aug 71	120
		19-71	23 May 71	28 May 71	20 Aug 71	120
		20-71	20 Jun 71	25 Jun 71	17 Sep 71	120
						2390
3.	**2-6-C22**	1-71	6 Jul 70	10 Jul 70	27 Apr 71	145
	FA Officer	2-71	8 Sep 70	11 Sep 70	29 Jun 71	145
	Advanced	3-71	2 Nov 70	6 Nov 70	25 Aug 71	145
	(39 Wks, 3 Days)	4-71	11 Jan 71	15 Jan 71	19 Oct 71	136
	(Max Cap: 145)	5-71	8 Mar 71	12 Mar 71	14 Dec 71	135
		6-71	17 May 71	71 May 71	7 Mar 72	135
						841

(NOTE: Approx 14 allies in each of the above classes)

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
4.	**2E-F13**	1-71	19 Jul 70	20 Jul 70	21 Aug 70	8
	Nuclear &	2-71	20 Sep 70	21 Sep 70	23 Oct 70	8
	Chemical Target	3-71	15 Nov 70	16 Nov 70	18 Dec 70	8
	Analysis	4-71	24 Jan 71	25 Jan 71	26 Feb 71	8
	(4 Weeks, 3½ Days)	5-71	21 Mar 71	22 Mar 71	23 Apr 71	8
	(Max Cap: 10)	6-71	30 May 71	1 Jun 71	2 Jul 71	8
						48

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
5.	**2E-F14**	1-71	23 Aug 70	24 Aug 70	5 Sep 70	17
	Nuclear &	2-71	2 May 71	3 May 71	15 May 71	16
	Chemical Target					
	Analysis (Res Comp)					
	(2 Weeks) (Max Cap: 35)					
						33
6.	**2E-F25**	1-71	9 Aug 70	10 Aug 70	15 Aug 70	54
	Artillery Staff	2-71	15 Nov 70	16 Nov 70	21 Nov 70	54
	Officer Refresher,	3-71	28 Mar 71	29 Mar 71	3 Apr 71	54
	Corps Arty, Div Arty,	4-71	6 Jun 71	7 Jun 71	12 Jun 71	54
	FA Group					
	(1 Week) (Max Cap: 60)					
						216
7.	**2E-F30**	1-71	12 Jul 70	13 Jul 70	19 Aug 70	113
	FA Officer	2-71	4 Oct 70	5 Oct 70	10 Nov 70	113
	Vietnam	3-71	3 Jan 71	4 Jan 71	10 Feb 71	113
	Orientation	4-71	28 Mar 71	29 Mar 71	5 May 71	113
	(5 Weeks)	5-71	20 Jun 71	21 Jun 71	29 Jul 71	113
	(Max Cap: 100)					
						565
8.	**2E-1154**	1-71	24 Jul 70	27 Jul 70	6 Oct 70	22
	Artillery Target	2-71	8 Jan 71	11 Jan 71	23 Mar 71	22
	Acquisition Officer					
	(10 Wks, 1 Day)					44
	Max Cap: 20)					
9.	**2F-1190**	1-71	6 Jul 70	7 Jul 70	3 Sep 70	29
	FA Ballistic	2-71	7 Sep 70	8 Sep 70	5 Nov 70	29
	Missile Officer	3-71	12 Oct 70	13 Oct 70	14 Dec 70	29
	(8 Wks, 3 Days)	4-71	25 Jan 71	26 Jan 71	26 Mar 71	29
	(Max Cap: 32)	5-71	8 Mar 71	9 Mar 71	6 May 71	29
		6-71	26 Apr 71	27 Apr 71	25 Jun 71	29
		7-71	24 May 71	25 May 71	26 Jul 71	30
						204
10.	**2G-1183**	1-71	14 Sep 70	14 Sep 70	3 Nov 70	20
	Artillery Survey	2-71	3 May 71	4 May 71	23 Jun 71	19
	Officer					
	(7 Wks, 1 Day)					39
	(Max Cap: 48)					
11.	**4C-0205**	1-71	2 Jul 70	6 Jul 70	21 Sep 70	42
	Communications	2-71	16 Jul 70	17 Jul 70	2 Oct 70	42
	and Electronics	3-71	20 Aug 70	21 Aug 70	6 Nov 70	42
	Staff Officer	4-71	3 Sep 70	4 Sep 70	23 Nov 70	42
	(10 Wks, 5 Days)	5-71	22 Oct 70	23 Oct 70	25 Jan 71	42
	(Max Cap: 44)	6-71	12 Nov 70	13 Nov 70	12 Feb 71	42
		7-71	3 Dec 70	4 Dec 70	5 Mar 71	42
		8-71	3 Jan 71	4 Jan 71	22 Mar 71	42
		9-71	28 Jan 71	29 Jan 71	16 Apr 71	42
		10-71	18 Feb 71	19 Feb 71	7 May 71	43
		11-71	18 Mar 71	19 Mar 71	4 Jun 71	43
		12-71	22 Apr 71	23 Apr 71	12 Jul 71	43
		13-71	20 May 71	21 May 71	9 Aug 71	43
		14-71	3 Jun 71	4 Jun 71	20 Aug 71	43
						593

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
12.	**WO-F1**	1-71	12 Jul 70	13 Jul 70	24 Jul 70	106
	Warrant Officer	2-71	27 Sep 70	28 Sep 70	9 Oct 70	106
	Orientation	3-71	29 Nov 70	30 Nov 70	11 Dec 70	106
	(2 Weeks)	4-71	28 Feb 71	1 Mar 71	12 Mar 71	106
	(Max Cap: 100)	5-71	9 May 71	10 May 71	21 May 71	107
						531
13.	**2-6-F1**	1-71	16 Aug 70	19 Aug 70	5 Feb 71	124
	FA Officer	2-71	11 Oct 70	14 Oct 70	2 Apr 71	126
	Candidate	3-71	6 Dec 70	9 Dec 70	28 May 71	127
	(23 Weeks)	4-71	14 Feb 71	17 Feb 71	23 Jul 71	127
	(Max Cap: 126)	5-71	11 Apr 71	14 Apr 71	17 Sep 71	127
		6-71	6 Jun 71	9 Jun 71	12 Nov 71	127
						758
14.	**2-6-F2**	1-71	4 Jun 71	9 Jun 71	21 Aug 71	71
	FA Officer					
	Candidate (Res Comp)					
	(11 Weeks)					
	(Max Cap; 120)					
						71

			(Report)	**(Start)**	**(Close)**		
			PHASE I		**PHASE III**	**PHASE II**	
15.	**2F-F1/121-F1**						
	FADAC Operator						
	(Ph I: 1½ Da)	1-71	16 Aug 70	17 Aug 70	22 Aug 70	25 Aug 70	21
	(Ph II: 1 Week)	2-71	18 Oct 70	19 Oct 70	24 Oct 70	27 Oct 70	21
	(Ph III: 4 Days)	3-71	17 Jan 71	18 Jan 71	23 Jan 71	26 Jan 71	21
	(Max Cap: 20)	4-71	11 Apr 71	12 Apr 71	17 Apr 71	20 Apr 71	20
							83

Phase I: Common to all students.
Phase II: Applies to Gunnery Application (GD).
Phase III: Applies to Survey Application (TAD).

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
16.	**4C-211A/104-F8**	1-71	27 Jul 70	28 Jul 70	22 Sep 70	12
	FA Radar	2-71	28 Sep 70	29 Sep 70	24 Nov 70	12
	Technician	3-71	18 Jan 71	19 Jan 71	16 Mar 71	12
	(8 Weeks)	4-71	15 Mar 71	16 Mar 71	10 May 71	12
	(Max Cap: 20)	5-71	24 May 71	25 May 71	21 Jul 71	12
						60
17.	**250-F1**	1-71	6 Jul 70	7 Jul 70	13 Oct 70	27
	FA Operations and	2-71	2 Nov 70	3 Nov 70	25 Feb 71	27
	Intelligence NCO	3-71	8 Mar 71	9 Mar 71	15 Jun 71	28
	(14 Weeks)					
	(Max Cap: 35)					82
18.	**412-F1**	1-71	2 Nov 70	3 Nov 70	2 Dec 70	32
	Artillery Survey NCO					
	(4 Weeks) (Max Cap: 80)					32
19.	**610/611-F1**	1-70	5 Jul 70	7 Jul 70	4 Sep 70	20
	Master	2-70	30 Aug 70	1 Sep 70	30 Oct 70	20
	Mechanic	3-70	18 Oct 70	20 Oct 70	18 Dec 70	20
	(9 Weeks)	4-70	10 Jan 71	12 Jan 71	12 Mar 71	20
	(Max Cap: 20)	5-70	7 Mar 71	9 Mar 71	7 May 71	20
		6-70	2 May 71	4 May 71	2 Jul 71	19
						119

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
20.	**101-F4**	1-71	21 Jan 71	22 Jan 71	6 Apr 71	31
	Communications Chief	2-71	15 Apr 71	16 Apr 71	29 Jun 71	32
	(10 Wks, 2 Days)					63
	(Max Cap: 44)					
21.	**4F-F5/041-13A1N**	1-71	10 Jul 70	13 Jul 70	17 Jul 70	8
	8-Inch Atomic	2-71	24 Jul 70	27 Jul 70	31 Jul 70	8
	Projectile	3-71	31 Jul 70	3 Aug 70	7 Aug 70	8
	Assembly	4-71	14 Aug 70	17 Aug 70	21 Aug 70	8
	(1 Week)	5-71	21 Aug 70	24 Aug 70	28 Aug 70	8
	(Max Cap: 30)	6-71	11 Sep 70	14 Sep 70	18 Sep 70	13
		7-71	18 Sep 70	21 Sep 70	25 Sep 70	13
		8-71	25 Sep 70	28 Sep 70	2 Oct 70	13
		9-71	2 Oct 70	5 Oct 70	9 Oct 70	13
		10-71	9 Oct 70	12 Oct 70	16 Oct 70	13
		11-71	23 Oct 70	26 Oct 70	30 Oct 70	13
		12-71	30 Oct 70	2 Nov 70	6 Nov 70	13
		13-71	13 Nov 70	16 Nov 70	20 Nov 70	13
		14-71	27 Nov 70	30 Nov 70	4 Dec 70	13
		15-71	4 Dec 70	7 Dec 70	11 Dec 70	13
		16-71	11 Dec 70	14 Dec 70	18 Dec 70	13
		17-71	3 Jan 71	4 Jan 71	8 Jan 71	13
		18-71	8 Jan 71	11 Jan 71	15 Jan 71	13
		19-71	15 Jan 71	18 Jan 71	22 Jan 71	13
		20-71	25 Jan 71	1 Feb 71	5 Feb 71	13
		21-71	5 Feb 71	8 Feb 71	12 Feb 71	13
		22-71	12 Feb 71	15 Feb 71	19 Feb 71	13
		23-71	26 Feb 71	1 Mar 71	5 Mar 71	13
		24-71	5 Mar 71	8 Mar 71	12 Mar 71	13
		25-71	19 Mar 71	22 Mar 71	26 Mar 71	13
		26-71	26 Mar 71	29 Mar 71	2 Apr 71	13
		27-71	9 Apr 71	12 Apr 71	16 Apr 71	13
		28-71	16 Apr 71	19 Apr 71	23 Apr 71	13
		29-71	30 Apr 71	3 May 71	7 May 71	14
		30-71	7 May 71	10 May 71	14 May 71	14
		31-71	14 May 71	17 May 71	21 May 71	14
		32-71	4 Jun 71	7 Jun 71	11 Jun 71	14
		33-71	11 Jun 71	14 Jun 71	18 Jun 71	14
		34-71	18 Jun 71	21 Jun 71	25 Jun 71	14
		35-71	25 Jun 71	28 Jun 71	2 Jul 71	14
						437
22.	**041-13B30**	1-71	2 Aug 70	3 Aug 70	11 Sep 70	40
	Field Artillery	2-71	13 Sep 70	14 Sep 70	22 Oct 70	40
	Mechanic	3-71	25 Oct 70	26 Oct 70	4 Dec 70	40
	(5 Wks, 4 Days)	4-71	3 Jan 71	4 Jan 71	11 Feb 71	40
	(Max Cap; 40)	5-71	14 Feb 71	15 Feb 71	26 Mar 71	40
		6-71	28 Mar 71	29 Mar 71	6 May 71	40
		7-71	9 May 71	10 May 71	18 Jun 71	40
						280
23.	**4F-214F/121-15B30**	1-71	17 Aug 70	18 Aug 70	22 Sep 70	6
	Sergeant Missile Battery	2-71	7 Dec 70	8 Dec 70	25 Jan 71	7
	(5 Weeks)	3-71	15 Feb 71	16 Feb 71	23 Mar 71	7
	(Max Cap: 32)	4-71	19 Apr 71	20 Apr 71	24 May 71	7
						27

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
24.	**-15E30**	1-71	14 Sep 70	15 Sep 70	28 Sep 70	11
	Pershing Laying Specialist	2-71	19 Oct 70	20 Oct 70	2 Nov 70	11
	(2 Weeks)	3-71	23 Nov 70	24 Nov 70	8 Dec 70	11
	(Max Cap: 35)	4-71	25 Jan 71	26 Jan 71	8 Feb 71	11
		5-71	22 Feb 71	23 Feb 71	8 Mar 71	11
		6-71	22 Mar 71	23 Mar 71	5 Apr 71	11
		7-71	19 Apr 71	20 Apr 71	3 May 71	11
		8-71	17 May 71	18 May 71	1 Jun 71	11
		9-71	7 Jun 71	8 Jun 71	21 Jun 71	11
		10-71	21 Jun 71	22 Jun 71	2 Jul 71	11
						111
25.	**221-17B20**	1-71	6 Jul 70	7 Jul 70	24 Aug 70	69
	Counterbattery/Countermortar	2-71	3 Aug 70	4 Aug 70	21 Sep 70	69
	Radar Crewman	3-71	24 Aug 70	25 Aug 70	12 Oct 70	69
	(6 Wks, 5 Days)	4-71	21 Sep 70	22 Sep 70	9 Nov 70	41
	(Max Cap: 35)	5-71	19 Oct 70	20 Oct 70	8 Dec 70	41
		6-71	23 Nov 70	24 Nov 70	28 Jan 71	41
		7-71	11 Jan 71	12 Jan 71	1 Mar 71	41
		8-71	8 Feb 71	9 Feb 71	29 Mar 71	41
		9-71	15 Mar 71	16 Mar 71	3 May 71	40
		10-71	3 May 71	4 May 71	21 Jun 71	40
						492
26.	**412-17C20**	1-71	6 Jul 70	7 Jul 70	31 Aug 70	28
	Sound Ranging Crewman	2-71	8 Sep 70	9 Sep 70	3 Nov 70	28
	(8 Weeks)	3-71	22 Mar 71	23 Mar 71	17 May 71	21
	(Max Cap: 28)					
						77
27.	**4F-214E/121-21G20**	1-71	3 Jul 70	6 Jul 70	8 Oct 70	16
	Pershing System Maintenance	2-71	7 Aug 70	10 Aug 70	13 Nov 70	16
	(13 Wks, 3 Days)	3-71	11 Sep 70	14 Sep 70	18 Dec 70	19
	(Max Cap: 21)	4-71	23 Oct 70	26 Oct 70	12 Feb 71	19
		5-71	3 Jan 71	4 Jan 71	8 Apr 71	19
		6-71	5 Feb 71	8 Feb 71	13 May 71	19
		7-71	12 Mar 71	15 Mar 71	17 Jun 71	19
		8-71	16 Apr 71	19 Apr 71	23 Jul 71	18
						145
28.	**104-26B20**		**(PH I REPORT)**	**(PH II REPORT)**		
	Weapons Support	1-71	10 Jul 70	1 Oct 70	14 Jan 71	27
	Radar Maintenance	2-71	21 Aug 70	12 Nov 70	26 Feb 71	26
	(PH I: 11 Wks, 4 Da)	3-71	2 Oct 70	12 Jan 71	8 Apr 71	26
	(PH II: 12 Wks, 2 Da)	4-71	13 Nov 70	23 Feb 71	19 May 71	26
	(24 Wks, 1 Day)	5-71	8 Jan 71	1 Apr 71	30 Jun 71	26
	(Max Cap: 24)	6-71	19 Feb 71	13 May 71	12 Aug 71	26
						157
29.	**101-31B20**	1-71	13 Jul 70	14 Jul 70	17 Sep 70	40
	Field Radio Mechanic	2-71	20 Jul 70	21 Jul 70	24 Sep 70	40
	(9 Wks, 2 Days)	3-71	27 Jul 70	28 Jul 70	1 Oct 70	40
	(Max Cap: 40)	4-71	3 Aug 70	4 Aug 70	8 Oct 70	40
		5-71	10 Aug 70	11 Aug 70	15 Oct 70	40
		6-71	17 Aug 70	18 Aug 70	22 Oct 70	40
		7-71	24 Aug 70	25 Aug 70	29 Oct 70	40
		8-71	31 Aug 70	1 Sep 70	5 Nov 70	40
		9-71	7 Sep 70	8 Sep 70	12 Nov 70	38

COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
	10-71	28 Sep 70	29 Sep 70	4 Dec 70	38
	11-71	5 Oct 70	6 Oct 70	11 Dec 70	38
	12-71	12 Oct 70	13 Oct 70	18 Dec 70	38
	13-71	19 Oct 70	20 Oct 70	8 Jan 71	38
	14-71	9 Nov 70	10 Nov 70	29 Jan 71	38
	15-71	16 Nov 70	17 Nov 70	4 Feb 71	38
	16-71	30 Nov 70	1 Dec 70	17 Feb 71	38
	17-71	7 Dec 70	8 Dec 70	25 Feb 71	38
	18-71	11 Jan 71	12 Jan 71	18 Mar 71	38
	19-71	25 Jan 71	26 Jan 71	1 Apr 71	38
	20-71	1 Feb 71	2 Feb 71	8 Apr 71	38
	21-71	8 Feb 71	9 Feb 71	15 Apr 71	38
	22-71	22 Feb 71	23 Feb 71	28 Apr 71	38
	23-71	1 Mar 71	2 Mar 71	5 May 71	38
	24-71	8 Mar 71	9 Mar 71	12 May 71	38
	25-71	15 Mar 71	16 Mar 71	19 May 71	38
	26-71	29 Mar 71	30 Mar 71	3 Jun 71	39
	27-71	5 Apr 71	6 Apr 71	10 Jun 71	39
	28-71	12 Apr 71	13 Apr 71	17 Jun 71	39
	29-71	19 Apr 71	20 Apr 71	24 Jun 71	39
	30-71	10 May 71	11 May 71	16 Jul 71	39
	31-71	17 May 71	18 May 71	23 Jul 71	39
	32-71	24 May 71	25 May 71	30 Jul 71	39
	33-71	31 May 71	1 Jun 71	5 Aug 71	39
	34-71	14 Jun 71	15 Jun 71	19 Aug 71	39
	35-71	21 Jun 71	22 Jun 71	26 Aug 71	39
	36-71	28 Jun 71	29 Jun 71	2 Sep 71	39
					1395
30. 101-31B30	1-71	19 Jul 70	20 Jul 70	3 Aug 70	15
FADAC Mechanics	2-71	2 Aug 70	3 Aug 70	17 Aug 70	15
(2 Wks, 1 Day)	3-71	30 Aug 70	31 Aug 70	15 Sep 70	15
(Max Cap: 24)	4-71	29 Nov 70	30 Nov 70	14 Dec 70	13
	5-71	14 Feb 71	15 Feb 71	2 Mar 71	12
	6-71	18 Apr 71	19 Apr 71	3 May 71	12
					82
31. 101-31D20	1-71	3 Aug 70	4 Aug 70	30 Sep 70	18
Pershing	2-71	19 Oct 70	20 Oct 70	17 Dec 70	15
Communications	3-71	11 Jan 71	12 Jan 71	10 Mar 71	15
Specialist	4-71	15 Mar 71	16 Mar 71	11 May 71	15
(8 Wks, 1 Day)	5-71	17 May 71	18 May 71	15 Jul 71	15
(Max Cap: 18)					78
32. 198-35D20	1-71	2 Jul 70	6 Jul 70	12 Oct 70	18
Meteorological	2-71	11 Sep 70	14 Sep 70	16 Dec 70	17
Equipment Mechanic	3-71	15 Jan 71	18 Jan 71	26 Apr 71	17
(14 Weeks)	4-71	30 Apr 71	3 May 71	10 Aug 71	17
(Max Cap: 14)					69
33. 198-35D30	1-71	11 Sep 70	14 Sep 70	18 Feb 71	22
Meteorological	2-71	15 Jan 71	18 Jan 71	7 Jun 71	22
Equipment Repairman	3-71	30 Apr 71	3 May 71	21 Sep 71	21
(19 Wks, 4 Days)					
(Max Cap: 18)					65

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
34.	**611-63C20**	1-71	5 Jul 70	7 Jul 70	21 Aug 70	47
	Tracked Vehicle	2-71	12 Jul 70	14 Jul 70	28 Aug 70	47
	Mechanic	3-71	19 Jul 70	21 Jul 70	4 Sep 70	47
	(7 Weeks)	4-71	26 Jul 70	28 Jul 70	11 Sep 70	47
	(Max Cap; 47)	5-71	2 Aug 70	4 Aug 70	18 Sep 70	47
		6-71	9 Aug 70	11 Aug 70	25 Sep 70	47
		7-71	16 Aug 70	18 Aug 70	2 Oct 70	47
		8-71	23 Aug 70	25 Aug 70	9 Oct 70	47
		9-71	30 Aug 70	1 Sep 70	16 Oct 70	37
		10-71	13 Sep 70	15 Sep 70	30 Oct 70	37
		11-71	20 Sep 70	22 Sep 70	6 Nov 70	37
		12-71	27 Sep 70	29 Sep 70	13 Nov 70	37
		13-71	4 Oct 70	6 Oct 70	20 Nov 70	37
		14-71	11 Oct 70	13 Oct 70	27 Nov 70	37
		15-71	18 Oct 70	20 Oct 70	4 Dec 70	37
		16-71	25 Oct 70	27 Oct 70	11 Dec 70	37
		17-71	1 Nov 70	3 Nov 70	18 Dec 70	37
		18-71	8 Nov 70	10 Nov 70	8 Jan 71	37
		19-71	15 Nov 70	17 Nov 70	15 Jan 71	37
		20-71	22 Nov 70	24 Nov 70	22 Jan 71	37
		21-71	29 Nov 70	1 Dec 70	29 Jan 71	37
		22-71	6 Dec 70	8 Dec 70	5 Feb 71	37
		23-71	3 Jan 71	5 Jan 70	19 Feb 71	37
		24-71	10 Jan 71	12 Jan 71	26 Feb 71	37
		25-71	17 Jan 71	19 Jan 71	5 Mar 71	37
		26-71	24 Jan 71	26 Jan 71	12 Mar 71	37
		27-71	31 Jan 71	2 Feb 71	19 Mar 71	37
		28-71	7 Feb 71	9 Feb 71	26 Mar 71	37
		29-71	14 Feb 71	16 Feb 71	2 Apr 71	37
		30-71	21 Feb 71	23 Feb 71	9 Apr 71	37
		31-71	28 Feb 71	2 Mar 71	16 Apr 71	37
		32-71	7 Mar 71	9 Mar 71	23 Apr 71	37
		33-71	14 Mar 71	16 Mar 71	30 Apr 71	37
		34-71	21 Mar 71	23 Mar 71	7 May 71	37
		35-71	28 Mar 71	30 Mar 71	14 May 71	37
		36-71	4 Apr 71	6 Apr 71	21 May 71	37
		37-71	11 Apr 71	13 Apr 71	28 May 71	36
		38-71	18 Apr 71	20 Apr 71	4 Jun 71	36
		39-71	25 Apr 71	27 Apr 71	11 Jun 71	36
		40-71	2 May 71	4 May 71	18 Jun 71	36
		41-71	9 May 71	11 May 71	25 Jun 71	36
		42-71	16 May 71	18 May 71	2 Jul 71	36
		43-71	23 May 71	25 May 71	9 Jul 71	36
		44-71	6 Jun 71	8 Jun 71	16 Jul 71	36
		45-71	13 Jun 71	15 Jun 71	23 Jul 71	36
		46-71	20 Jun 71	22 Jun 71	30 Jul 71	36
						1772
35.	**412-82C20**	1-71	3 Aug 70	4 Aug 70	8 Oct 70	73
	Artillery Survey	2-71	10 Aug 70	11 Aug 70	15 Oct 70	73
	Specialist	3-71	17 Aug 70	18 Aug 70	22 Oct 70	73
	(9 Wks, 2 Days)	4-71	24 Aug 70	25 Aug 70	29 Oct 70	73
	(Max Cap: 70)	5-71	5 Oct 70	6 Oct 70	11 Dec 70	73
		6-71	26 Oct 70	27 Oct 70	19 Jan 71	73
		7-71	2 Nov 70	3 Nov 70	26 Jan 71	73
		8-71	9 Nov 70	10 Nov 70	2 Feb 71	73
		9-71	4 Jan 71	5 Jan 71	11 Mar 71	73
		10-71	18 Jan 71	19 Jan 71	25 Mar 71	73
		11-71	25 Jan 71	26 Jan 71	1 Apr 71	73
		12-71	1 Feb 71	2 Feb 71	8 Apr 71	74

COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
	13-71	8 Mar 71	9 Mar 71	12 May 71	74
	14-71	22 Mar 71	23 Mar 71	26 May 71	74
	15-71	29 Mar 71	30 Mar 71	3 Jun 71	74
	16-71	5 Apr 71	6 Apr 71	10 Jun 71	74
	17-71	10 May 71	11 May 71	16 Jul 71	74
	18-71	24 May 71	25 May 71	30 Jul 71	74
	19-71	7 Jun 71	8 Jun 71	12 Aug 71	74
	20-71	14 Jun 71	15 Jun 71	19 Aug 71	74
					1469
36. 420-93E20	1-71	10 Jul 70	13 Jul 70	24 Nov 70	20
Meteorological	2-71	7 Aug 70	10 Aug 70	8 Jan 71	20
Observation	3-71	11 Sep 70	14 Sep 70	11 Feb 71	13
(19 Weeks)	4-71	16 Oct 70	19 Oct 70	19 Mar 71	13
(Max Cap: 20)	5-71	20 Nov 70	23 Nov 70	22 Apr 71	13
	6-71	8 Jan 71	11 Jan 71	24 May 71	12
	7-71	12 Feb 71	16 Feb 71	29 Jun 71	12
	8-71	19 Mar 71	22 Mar 71	3 Aug 71	12
	9-71	23 Apr 71	26 Apr 71	8 Sep 71	12
	10-71	28 May 71	1 Jun 71	13 Oct 71	12
					139
37. 5B-F1/420-93F20	1-71	20 Jul 70	21 Jul 70	28 Sep 70	42
Artillery Ballistic	2-71	17 Aug 70	18 Aug 70	26 Oct 70	42
Meteorology	3-71	14 Sep 70	15 Sep 70	23 Nov 70	28
(9 Wks, 4 Days)	4-71	5 Oct 70	6 Oct 70	15 Dec 70	27
(Max Cap: 40)	5-71	9 Nov 70	10 Nov 70	4 Feb 71	27
	6-71	4 Jan 71	5 Jan 71	15 Mar 71	27
	7-71	1 Mar 71	2 Mar 71	7 May 71	27
	8-71	26 Apr 71	27 Apr 71	2 Jul 71	27
	9-71	21 Jun 71	22 Jun 71	30 Aug 71	27
					274
38. 041-13B40-I*	1-71	6 Jul 70	13 Jul 70	16 Oct 70	50
FA Noncommissioned	2-71	3 Aug 70	10 Aug 70	17 Nov 70	50
Officer Candidate	3-71	31 Aug 70	8 Sep 70	16 Dec 70	50
(15 Weeks)	4-71	28 Sep 70	5 Oct 70	27 Jan 71	50
(Max Cap: 56)	5-71	26 Oct 70	2 Nov 70	26 Feb 71	50
	6-71	23 Nov 70	30 Nov 70	24 Mar 71	50
	7-71	4 Jan 71	11 Jan 71	16 Apr 71	50
	8-71	1 Feb 71	8 Feb 71	14 May 71	50
	9-71	1 Mar 71	8 Mar 71	11 Jun 71	50
	10-71	29 Mar 71	5 Apr 71	16 Jul 71	50
	11-71	26 Apr 71	3 May 71	11 Aug 71	50
	12-71	24 May 71	1 Jun 71	3 Sep 71	50
					600

*Report date specified for administrative reasons only.
Official report and start dates are the same as specified under the start date.

39. 250-13E40-I	1-71	15 Jul 70	20 Jul 70	17 Oct 70	50
FA Operations and	2-71	21 Oct 70	26 Oct 70	6 Feb 71	50
Intelligence Assistant SDB	3-71	10 Feb 71	15 Feb 71	15 May 71	50
(13 Weeks) (Max Cap: 50)	4-71	19 May 71	24 May 71	21 Aug 71	50
					200

	COURSE	CLASS NO	REPORT	START	CLOSE	INPUT
40.	**221-17B40-I**	1-71	16 Sep 70	21 Sep 70	11 Dec 70	10
	Counterbattery/	2-71	24 Feb 71	1 Mar 71	19 May 71	10
	Countermortar					——
	Radar Crewman SDB					20
	(12 Weeks) (Max Cap: 13)					
41.	**030-17E40-I**	1-71	8 Jul 70	13 Jul 70	15 Sep 70	15
	Field Illumination	2-71	16 Sep 70	21 Sep 70	25 Nov 70	17
	Crewman SDB	3-71	2 Dec 70	7 Dec 70	26 Feb 71	16
	(9 Wks, 2 Days)	4-71	24 Feb 71	1 Mar 71	4 May 71	16
	(Max Cap: 20)	5-71	5 May 71	10 May 71	15 Jul 71	16
						——
						80
42.	**420-93F20-I**	1-71	8 Jul 70	13 Jul 70	23 Sep 70	12
	Ballistic Meteorology	2-71	16 Sep 70	21 Sep 70	3 Dec 70	12
	Crewman SDB	3-71	2 Dec 70	7 Dec 70	3 Mar 71	12
	(10 Wks, 4 Days)	4-71	24 Feb 71	1 Mar 71	11 May 71	12
	(Max Cap: 13)	5-71	5 May 71	10 May 71	22 Jul 71	12
						——
						60
43.	**Unnumbered**	1-71	5 Jul 70	6 Jul 70	11 Jul 70	30
	Nuclear & Chemical	2-71	25 Oct 70	26 Oct 70	31 Oct 70	30
	Target Analysis	3-71	10 Jan 71	11 Jan 71	16 Jan 71	30
	Refresher	4-71	28 Feb 71	1 Mar 71	6 Mar 71	30
	(1 Week)	5-71	23 May 71	24 May 71	29 May 71	30
						——
						150