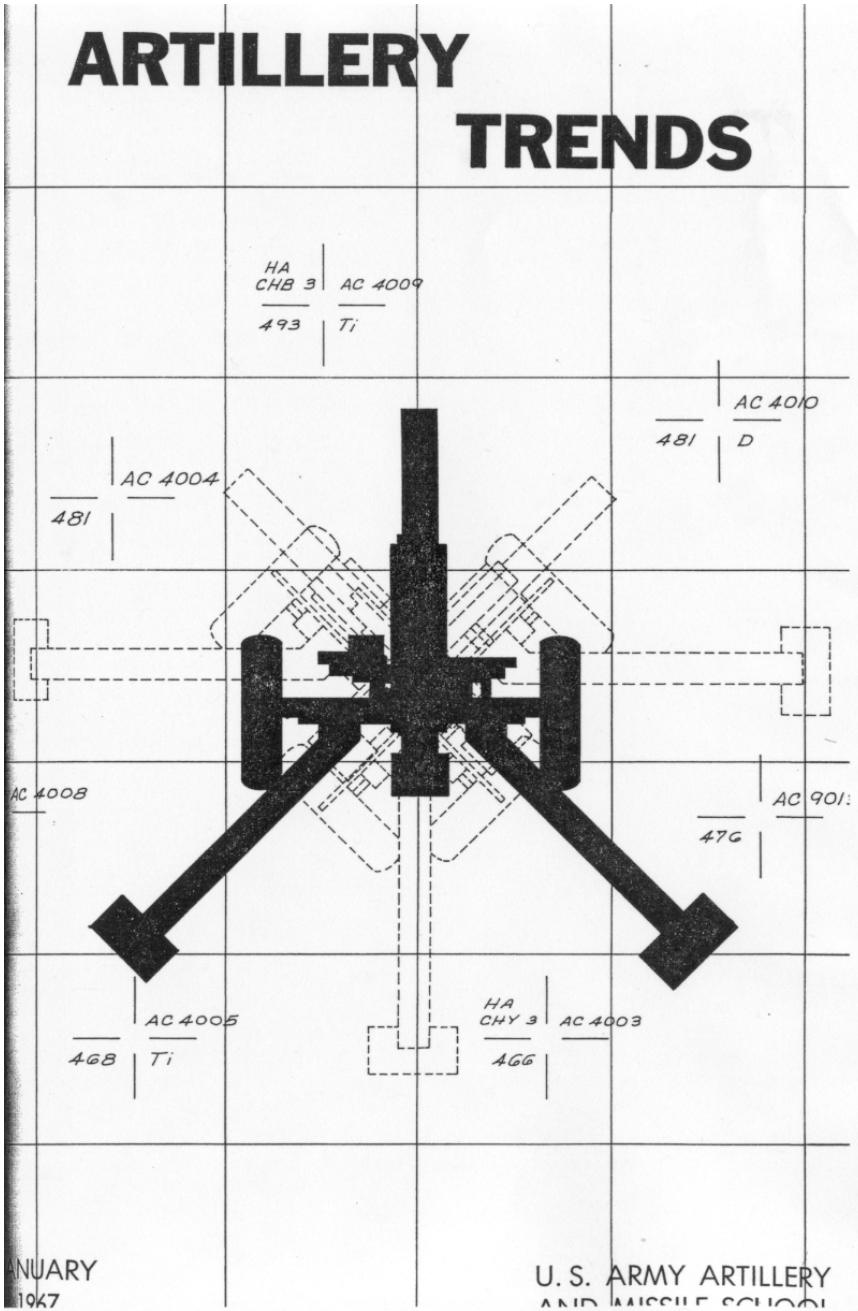
ARTILLERY TRENDS

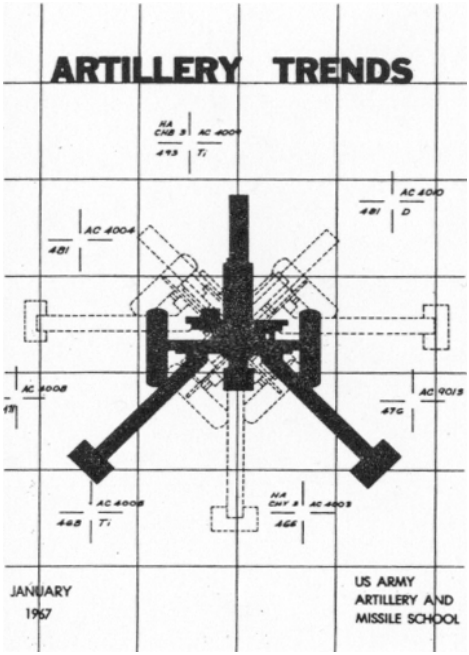


ANUARY
1967

U. S. ARMY ARTILLERY
AND MISSILE SCHOOL

Introduction

• COVER



The situation which exists in Vietnam requires the artillery to provide rapid and accurate supporting fires in any direction and at any time or at the same time. To provide for this 6,400-mil coverage, the artillery has had to adapt their operations to meet this demand. A solution to 6,400-mil chart operations has been drafted by the Gunnery Department of the United States Army Artillery and Missile School at Fort Sill, Oklahoma. Its solution has been adopted by the School as standard procedure.

As field expedience, a unit in Vietnam devised a pedestal for the 155-mm towed howitzer decreasing the time taken to shift trails. With time saved in both the fire direction center and the firing battery, the artillery can now provide supporting fires more rapidly than before.

The solution to 6,400 mil chart operations is contained in an article entitled, "Simple Solution for 6,400 Mil Chart Operations." In "Speed-shifting the 155-mm Howitzer," one discovers how a simply-constructed device can eliminate the back-breaking task of shifting trails on the 155-mm howitzer.

We invite readers to submit for publication their ideas which have proven workable in increasing the effectiveness of the Artillery. Dissemination of such information would be in keeping with the latest trends in the artillery. The material contained in **ARTILLERY TRENDS** represents the best information available at the time of publication. All readers and users of this handbook likewise are encouraged to forward information concerning changes or suggestions for improvement of content and format to:

Commandant
U. S. Army Artillery and Missile School
ATTN: AKPSIAS-PL-AT
Fort Sill, Oklahoma 73503

INSIDE THIS ISSUE

INSTRUCTIONAL AID NUMBER 37

"INSTRUCTIONAL DEPARTMENT NOTES"

ARTILLERY TRANSPORT DEPARTMENT

MASTER MECHANIC COURSE

In the modern, mobile Army of today, the majority of units have both wheeled and tracked vehicles. These units, necessarily, must have maintenance personnel who are skilled in maintaining both types of vehicles.

The Master Mechanic Course, a Hq CONARC Service School Course, taught by the Artillery Transport Department, not only develops the senior mechanic as a proficient wheeled and tracked vehicle maintenance man, but also provides him with the capability of supervising and training maintenance personnel. The training and knowledge acquired by the Master Mechanic course graduate is an invaluable asset to all commanders.

The purpose of the Master Mechanic Course is to qualify enlisted personnel as advanced mechanics and leaders in an organizational maintenance operation for wheeled vehicles, tracked vehicles or both.

The student receives training during his 9 weeks of schooling which will enable him to become well-rounded and knowledgeable in all aspects of wheeled and tracked vehicle maintenance. The scope of instruction includes engines (gasoline, diesel and multifuel) and their accessories such as electrical systems, fuel systems, cooling systems (liquid and air), and ignition systems. The use of test instruments and gauges are taught during the checking and adjusting of these systems.

The course also provides instruction on chassis and power trains with equal emphasis placed on steering systems, brake systems, transmissions (both conventional and semi-automatic), wheeled and tracked vehicle suspension systems, transfer cases, axle assemblies, turret mechanisms and main armament.

Instruction is also conducted in maintenance management, which includes current Army Equipment Record Procedures, the concept of materiel readiness and the Army repair parts-supply system.

Recovery operations also play an important part in the training of a Master Mechanic. An excellent vehicle recovery training area has been established at which students receive 16 hours of practical training in the field. In this area, using the latest in recovery equipment, students actually participate in recovery operations and solve problems for both wheeled and tracked vehicles. Safety is stressed throughout the course and is especially emphasized during recovery and power pack removal operations.

Quotas to the course are available on request through major commands. Maintenance personnel possessing the following prerequisites outlined in DA Pamphlet 350-10, are encouraged to request attendance, thereby increasing their value to the Army and improving their career potential:

- Qualified in MOS 63B20 or 63C20.
- Grade E-4 or above.
- Nine months or more acitve duty remaining after completion of course.
- One year of field experience in feeder MOS.
- Must have current military driver's license.

COMMUNICATION/ELECTRONICS DEPARTMENT

KNOW YOUR AN/PRC-25

Widespread issue and use of the AN/PRC-25 radio set in Vietnam has indicated that this is one of the finest pieces of communications equipment to be issued to the combat arms in many years. The set has far exceeded its rated range of 5-8 kilometers, requires minimum maintenance, and the BA-386/PRC-25 battery is providing power well beyond its rated life. Frequency stability and detent tuning have provided rapid, dependable communications.

The C/E Department has received reports that the H-138/U handset has certain shortcomings. Investigation and research by C/E personnel have verified the following points which should be strongly emphasized to officers and radio operators using the H-138/U handset:

- The handset will not receive after being immersed in water. Troops in Vietnam have learned to wrap and tape the handset inside the plastic bag used to ship the batteries (BA-386/PRC-25) prior to an operation in wet terrain. This will provide a waterproof cover with no loss of efficiency. An important point to remember is that as long as the rubber push-to-talk switch cover isn't torn and is firmly seated in the handset handle, the switch and transmitter element are waterproof. If the handset is dropped in water, it will still transmit even though the receiver element may be waterlogged. The operator cannot receive nor hear a sidetone, but he can transmit, and should know that he has this capability.
- After considerable wear, the push-to-talk switch sometimes becomes erratic in keying the transmitter. In addition the rubber "O" ring in connector U-182/U becomes worn and sometimes sticky, or will fall

out. To insure proper keying, the operator should push the middle portion of the push-to-talk switch. If the rubber "O" ring is missing from connector U-182/U, the operator must use extreme care to insure that a good connection is made.

- Breakage of the handset, and water damage to the receiver have resulted in the development of several parts, which can be requisitioned and replaced at battalion level. SB 11-603, dated 4 April 1966 authorizes the following parts:

FSN	Nomenclature	U/issue
5340-999-2820	Clip, spring tension	EA
5965-857-1034	Barrier, Receiver	EA
5965-857-1036	Barrier, Transmitter	EA

The C/E Department has submitted an EIR recommending improvements to the handset. Until the improvements come, good training will continue to provide excellent communications.

USE OF THE ANTENNA AT-984 A/G

Recent TO&E's authorize one long wire antenna, AT-984 A/G to each direct support artillery battery. Reports from Vietnam indicate that American units are extremely pleased with the increased range provided by the use of the antenna with the AN/PRC-25 radio set. Several units have requested additional antennas to provide one for each forward observer. Until the latest issue of TM 11-5820-398-12 was published, instructions on the use of the antenna were lacking. Paragraph 6-6 of the TM now provides complete instructions. To use this antenna on the AN/PRC-25 remove the long whip antenna, AT-271—A/PRC, from the RT-505/PRC. Remove the antenna support base from the antenna and reinstall on the RT-505. Unscrew the antenna support base far enough to insert "spade" type lug connector on the AT-984 A/G under the base and then screw the base down snug. The antenna support base must be used to deactivate a loading coil in the output circuit of the RT-505/PRC. For best results the AT-984 A/G should be tied to a support approximately four feet from the ground and extended in the direction of the station to be contacted.

GUIDED MISSILE DEPARTMENT

PERSHING INTEGRATED MAINTENANCE PROCEDURES

The Guided Missile Department has completed a review of draft TM 9-1400-382-12, Operator and Organizational Maintenance Procedures for Pershing Firing Position Equipment. The manual introduces a troubleshooting concept for electronic equipment which is new to Field Artillery Missile Systems. It is based on maintenance dependency charts (MDC's)

which use symbols rather than the conventional electronic wiring schematics now in use.

The maintenance dependency chart depicts the operation of electronic equipment in a manner which defines all circuit interdependencies and identifies the specific checkpoints necessary to isolate equipment malfunctions. The chart ties the detailed circuit operation (in symbolic format) to the basic procedures of energizing, and checking out the system. It integrates these into one scheme useable as a troubleshooting tool. This permits the symptoms of faulty equipment to be quickly and easily evaluated. These symptoms take the form of indications on built-in meters, lamps, and other displays. The MDC presentation allows the technician to be aware of the significance of previous checks performed and of the alternatives he has for further checks. Unnecessary or redundant checks are completely eliminated resulting in rapid location of component failure.

The MDC's are complemented by block diagrams which pictorially depict the contents of each chart. The information contained in this format can be used during training to improve knowledge of system theory and operations.

The combination of MDC and block diagram are used to depict all functions that occur during the Pershing firing sequence without referencing schematics or engineer wiring charts. They provide organizational maintenance personnel in the firing battery of the Pershing battalion the information required for isolation of malfunctions that may occur during the firing sequence.

TM 9-1400-382-12 was published in June 1966. Action has been initiated to incorporate the new troubleshooting concept into the Pershing training program at United States Army Artillery and Missile School.

GUNNERY DEPARTMENT

FIELD ARTILLERY OBSERVATION

Training Circular 6-1 entitled "Field Artillery Observation" has reached the field. The purpose of this circular is to provide information on impending changes to the field artillery forward observers call for fire (initial fire request), and the radiotelephone procedure for the conduct of fire as contained in FM 6-40, November 1960, with changes 1, 2 and 3. The effective date of implementation of this training circular was 1 September 1966. The call for fire format and associated terms will be used by the American, British, Canadian and Australian Armies. (See page 69.)

WIND CARDS

Wind Cards and accompanying instruction notes are being written by Ballistic Research Laboratory. WC 155-AH-2 should reach the field by the first quarter of Fiscal Year 1967. WC 105-AS-2, WC 105-H-6, WC 155-Q-3, WC 8-J-3 and WC 8-O-3, should reach the field by the second quarter of Fiscal Year 1967.

REVISED FM 6-40

FM 6-40 is presently being revised and should reach the field during Fiscal Year 1967.

FADAC PROGRAM TAPES

The first tactical cannon ballistic program tape for the Gun Direction Computer M18, (FADAC) was approved for issue on 27 April 1966, by AMC. This program tape, the M109/8 Inch Howitzer combination, was followed by 14 other caliber combination tapes which were expected to be approved by the beginning of the fourth calendar quarter 1966.

FADAC TRAINING FILMS

The Army Pictorial Center completed the shooting of three Gun Direction Computer, M18 (FADAC) training films at Fort Sill in May 1966. These films should be available after January 1967.

The title and synopsis of each film is as follows:

- **The Gun Direction Computer M18.** This film is an introduction to the computer. It shows how to set the computer up, the pre-operation program tests, and how the computer actually flies the trajectory of a projectile (in animation form). It presents the characteristics and capabilities of the computer; and an explanation is given depicting a tactical situation using the computer.

Operation of the Gun Direction Computer M18-Cannon Application.

This film will show how the computer will fit into a cannon battalion FDC. It shows the operator entering common battalion information in the computer and entering appropriate data for each battery. The fulfillment of the five requirements for predicted fire is emphasized throughout the film. First a battalion mass predicted fire mission is carried out. Then part of a will adjust mission is shown and the mission target is replotted and stored. Finally the computer solution of a high burst is depicted.

Operation of the Gun Direction Computer-Rocket Application.

This film will show how the computer will fit into a rocket battalion FDC. The operator is shown entering data for the various firing points and targets. The meteorological data is entered and a fire mission comes into the FDC. The film shows the entire processing of a fire mission for an Honest John rocket to include crest clearance computations and the application of low level wind corrections.

M564 Fuze

The M564 mechanical time and superquick (MTSQ) fuze is intended for use with 105-mm, 155-mm and 8-inch howitzers, HE or WP projectiles where mechanical time or superquick functioning is desired. The fuze will not withstand setback or spin forces developed when fired from the 175-mm gun. This fuze is an improvement over older MTSQ fuzes (such as the M520 series) in that it provides a longer timing mechanism (100 sec. vs 75 sec.) and permits fuze settings to accuracies of 0.1 second as opposed to 0.5 second. Fuze settings to 0.1 second are made possible by means of a vernier scale on the fuze.

The main components of the fuze are the point detonating assembly,

the lower cap, the fuze body, the movement assembly and safety adapter (booster) assembly. The primary difference in design is as stated above, i.e. the rotatable lower cap has a scale graduated from 0 to 100 in increments of 1 fuze setting and numbered every 5 fuze settings. The fuze body is inscribed with a vernier scale and a zero line to indicate the settings.

The fuze is designed to function either at a set time or upon impact, depending upon whichever occurs first after arming. The safety adapter (booster) becomes armed only after the projectile has traveled a minimum of 60 meters from the weapon, depending on the weapon, muzzle velocity, and rate of spin.

- If superquick (impact) action only is desired, no preparation of fuze is necessary; the fuze is used as issued.
- For mechanical time action, the following procedures apply:

(1) For whole second increments, using fuze setter XM34 or M63, turn the lower cap until the desired time graduation, or mark on the scale, is in line with the "O" mark on the fuze body vernier scale.

(2) For fractional second increments (tenths), first proceed as indicated in (1) above; there continue turning the lower cap until a graduation on the lower cap scale is in line with the mark on the vernier scale which represents the desired fractional second. The time set on the fuze, as with the M520 series, is actually fuze increments closely related to the time of flight and based on the velocity and spin of the projectile. An example of a fuze setting as well as additional information on the fuze can be found in TB 9-1300-251, Fuze Mechanical Time and Superquick: M564; Description, Handling and Use.

Gunnery, M564 fuze data are available only in FT 155-AH-2 and FT 105-AS-1. These data are based on a limited number of early engineering developmental firings and are not reliable. Ammunition Information Letter No. 1, on the M564 fuze has been published. It includes detailed FDC procedures to include tables listing corrections to time of flight to obtain M564 fuze setting. Until these tables are received, it is recommended that units conduct a time registration with the M564 fuze and establish a GFT setting. The GFT setting compensates for all non-standard conditions including the differences between the M564 fuze and the M520 fuze scale of the GFT. Data to transfer fires are then determined in the normal manner with fuze setting read under the time gage line.

NONRESIDENT INSTRUCTION DEPARTMENT

INSTRUCTIONAL MATERIAL

Because of the Army's expanding worldwide commitments, the training requirements of all units, sections, and staffs (active and reserve components) are increasing. The U. S. Army Artillery and Missile School,

through the Nonresident Instruction Department, offers a large amount of instructional material to all artillerymen to aid them in their training mission. Class packets, containing all of the information and material needed by an instructor, and student packets, containing student handout material for a particular class, may be ordered from the Catalog of Instructional Material, published yearly by the NRI Department. With the exception of the National Guard, this material is sent to the using unit at no charge. National Guard units must submit their requests through their State Adjutant General for fund citations.

NUCLEAR WEAPONS EMPLOYMENT OFFICER REFRESHER COURSE

The large number of officers presently holding a MOS prefix 5 has made a program of refresher training in the tactical employment of nuclear weapons based entirely on centralized, resident classes impractical. To meet the need for this refresher training, the Nonresident Instruction Department has provided the Nuclear Weapons Employment Officer Refresher Course, Artillery Subcourse 474.

This course is an unclassified, nonresident-type correspondence course which is primarily designed to accommodate those officers who do not have access to resident instruction. The necessary instructional material will be provided any prefix 5 holder, on an individual basis, upon request to the USAAMS. The request should be submitted on a DA Form 145 through the headquarters which maintains the individual officer's personnel records. Successful completion of this course will demonstrate the necessary proficiency for the retention of the MOS prefix digit 5 and **will meet the Department of the Army requirement for refresher training.**

For additional information concerning courses and materials, write to the: Commandant, U. S. Army Artillery and Missile School, Attn: Nonresident Instruction Department, Fort Sill, Oklahoma 73503.

TARGET ACQUISITION DEPARTMENT

RADAR MAINTENANCE WARRANT OFFICERS

Due to a critical shortage of radar maintenance warrant officers, MOS 211A, USAAMS was assigned the mission of qualifying 28 enlisted men for appointment as warrant officers. Selected personnel attended two separate Field Artillery Radar Maintenance Course Classes, 3-66 and 4-66. Since their previous military experience had qualified them in basic electronics, they attended the last 14 weeks of the normal 26 week course. During the course they studied the repair and adjustments of the AN/MPQ-10A, AN/MPQ-4A and the AN/TPS-25 radar sets. After sucessfully completing the course, they were all appointed warrant officers in MOS 211A. As warrant officers they will be responsible for the tactical employment and operations of Field Artillery Radars.

METRO INFORMATION LETTERS

Metro Information Letter Number 12 was published by the U. S. Army Artillery and Missile School on 20 June 1966. These publications, although not directive in nature, are excellent sources of information and guidance for the artillery meteorological sections in the field.

As an example, **Metro Information Letter Number 12** contains information regarding new developments, new techniques, and procedures. Specifically, such articles as "New Radiosondes AN/AMQ-22 and AN/AMQ-23" and "Accuracy Checks on Computer, CP-223/UM" appear in that newsletter.

If your section does not receive the Metro Information Letter, notify the Office of Artillery Policy and Literature, USAAMS.

TACTICS/COMBINED ARMS DEPARTMENT

AUTOMATIC DATA PROCESSING SYSTEM

All advance and associate advance courses will be given a four-hour block of instruction on ADPS beginning with classes input for FY 67.

ADPS gives the answers. The Army today needs answers to complex problems faster and more accurately than ever before. In this age when rockets are guided by data computed only a tenth of a second beforehand, new challenges are confronting the military staff. Commanders can now ask, "What tank movements have been made by the enemy in the past month?" or "How many privates first class presently stationed in the European theater have had at least 2 years of college, have been trained in nuclear energy, are under the age of 25, and have an AFQT score of 100 or higher?" Up-to-the-minute answers to such questions are now available within a few seconds through the use of the computer.

SURVEYORS CAUTION:

It is possible to melt the plate level of the theodolite (T16 or T2) by leaving the exposed telescope in the vertical position with the objective lens up. In this position, the sun's rays can focus through the optics of the telescope and severely damage the plate level. When not using the theodolite either remove it from the tripod and cover it with the carrying case hood, or cover the instrument on the tripod with the plastic instrument head cover provided for this purpose in the accessory kit, or place the telescope in the horizontal position.

Simple Solution to 6,400-mil Charts

At the outset of the Vietnam conflict, artillery units faced a challenge unique in combat operations. That challenge—to provide fire support in any direction at any time or at the same time—had to be met and resolved before the Artillery could accomplish its mission.

In past combat operations, the enemy's moves could be predicted fairly well because his activities were primarily confined to a sector and his positions could be plotted on battle maps to some degree of accuracy. Not so with Charlie. He's different. And it didn't take long for the artillery units to realize that timely and accurate fire must be provided throughout a 6400-mil zone. In a short time, the units, realizing that their present fire direction center (FDC) procedures were complicated, devised their own solutions to the problem. Unit expedience and initiative resulted in almost as many new methods as there were FDCs—each method providing for rapid fire support in any direction.

The problem in FDC operations centered in the operation of the firing chart. In order to provide 6400-mil coverage, the firing chart and range-deflection protractor (RDP) became so cluttered with color-coded numbers and deflection indexes, that the probability of error increased in obtaining data from the chart. To personnel unfamiliar with FDC operations, an initial glance at one of these charts read like a kaleidoscope — it was definitely pretty but it didn't make much sense. The chart was sometimes confusing even to the chart operator.

Methods ascribed to by units in Vietnam in correcting for FDC deficiencies, were accumulated by the Gunnery Department of the United States Army Artillery and Missile School at Fort Sill, Oklahoma. By monitoring correspondence from Vietnam, interviewing Vietnam returnees, and conducting experiments on its own, the Gunnery Department developed a chart procedure for 6400-mil coverage. The solution is based on the best features of many techniques.

The advantages of this new system are easy application to any situation and simplified operations in a conventional environment.

Simply designed, the new solution requires only one additional piece of equipment, which is merely a modification of an item currently used by the fire direction center. The solution is being incorporated into the revised issue of FM 6-40 and will serve as the standard procedure for all artillery units. It will be the only technique taught at the School.

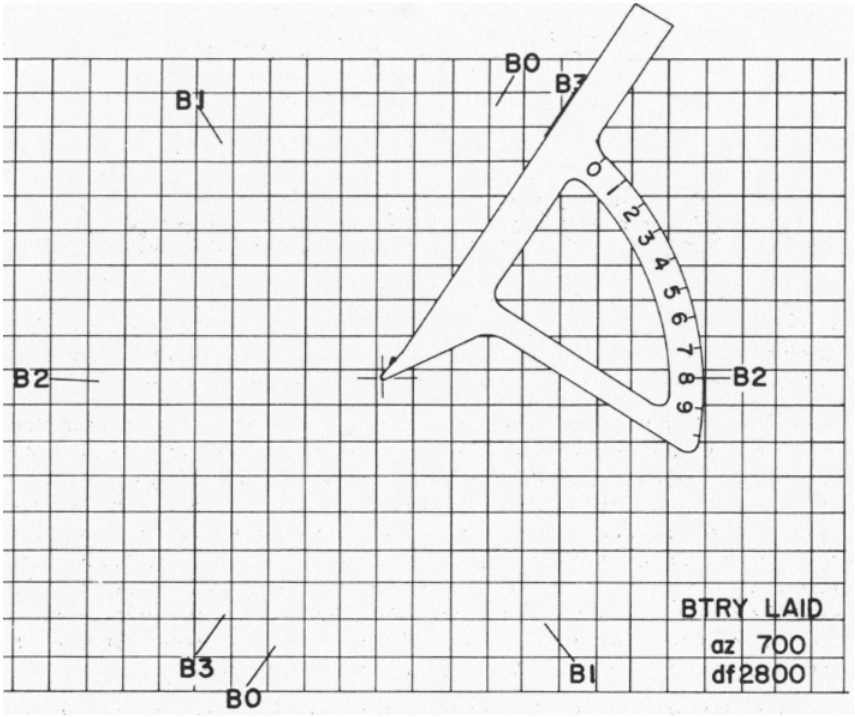


Figure 1.

The new system requires only one row of numbers on the range-deflection protractor. The range-deflection protractor is numbered 0 through 9 from left to right, (fig 1). The chart is set up in the usual manner with the range-deflection protractor oriented with the left edge of the range arm along the azimuth of fire. The deflection index is then constructed at the appropriate aiming point deflection. For weapons with a 6400-mil sight, the aiming point deflection is 3200. For the 105-mm M101 and the 155-mm M114 towed howitzers, the aiming point deflection is 2800 and 2400, respectively.

Deflection indexes are labeled on the chart to indicate the first number in the four-digit deflection reading.

1. For the 105-mm M101 howitzer, the number 2 is placed on the chart opposite the 8 on the RDP arc, with the range-deflection protractor oriented on the azimuth of fire. This is read as 2800 with the 2 read from the chart and the 800 taken from the RDP arc. Two indexes are placed 1,000 mils clockwise from number 2; 1, and 0 consecutively. A third index, number 3, is placed 200 mils clockwise from number 0. The next three indexes, labeled 2, 1, and 0 are placed 1,000 mils apart. The

second index number 3, is located 200 mils clockwise from the last 0 and 1,000 mils counterclockwise from the original index number 2.

2. For weapons with a 6400-mil sight, the chart is labeled with seven indexes numbered clockwise, 0 through 6 at 1,000-mil increments with 400 mils separating the number 6 and 0 indexes (fig 2). In either case, deflection is read by adding the number on the arc of the range-deflection protractor to the appropriate deflection index.

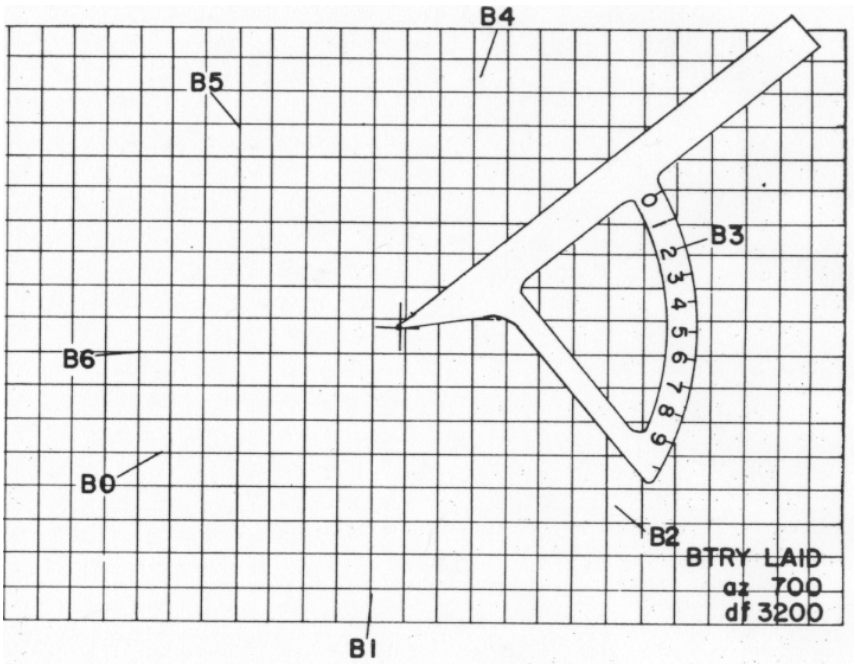


Figure 2.

Each index is labeled with the appropriate battery designation (Bravo battery in figures 1 through 5).

The 105-mm howitzer units can use a 1:25,000 chart, but all other units must use a 1:50,000 chart. The batteries, except for 175-mm gun batteries, are plotted near the center of the chart to permit firing at maximum range in any direction. The 175-mm gun batteries must continue to plot at both the top and bottom or at both sides of a color-coded chart, or follow whatever solution is currently used by the individual unit.

The ability of towed units to rapidly place fire on a target is hampered somewhat when a large deflection shift is required. Loss of time

due to shifting of trails can be alleviated by announcing a rough deflection and a direction immediately after the command BATTERY ADJUST. This rough deflection is determined to the nearest 100 mils in a fraction of a second by use of a modified target grid.

The modified target grid is constructed to provide deflection as opposed to azimuth. This step is accomplished for weapons with the 3200-mil sight by mounting two half scales (each from 0-3200) together on a sheet of acetate (fig 3). After the scales are mounted on the acetate, the chart operator locates and marks the center of the grid.

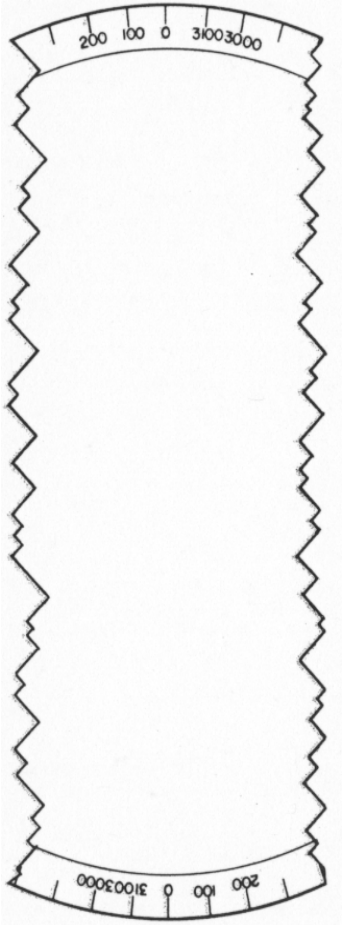


Figure 3.

The grid is placed over battery center and oriented so that the referred deflection on which the battery is laid can be read at the left edge of the range arm and at the deflection index. The grid is then affixed to the chart (fig 4). In this way, when the coordinates of a new target are marked by a pin, the chart operator determines the rough deflection to the nearest 100 mils by "eyeballing" from the battery center to the pin (fig 5).

When a rough deflection is determined, the computer announces to the guns BATTERY ADJUST, ACTION LEFT (RIGHT) (REAR), DEFLECTION (so much). This alerts the gun crew so that they can traverse or shift trails while the firing data are being determined and announced. The target grid can also be used to check the deflection that is to be fired (fig 4).

When the batteries of a battalion are separated by several hundred meters or more, a modified target grid will be required for each unit. This is often the case in Vietnam where batteries are separated by several kilometers and operate that way much of the time. When the units are located close together, within 300-500 meters and laid on a common azimuth, one grid can be used for all batteries by placing it in the center of the battalion area.

The tactical situation existing in Vietnam often requires that one battery be oriented in more than one direction. When this is the case, the

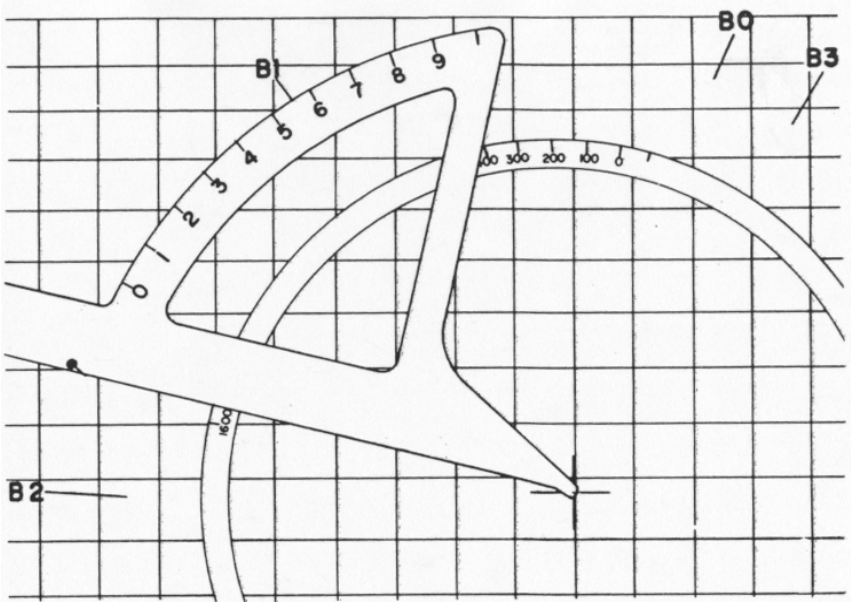


Figure 4.

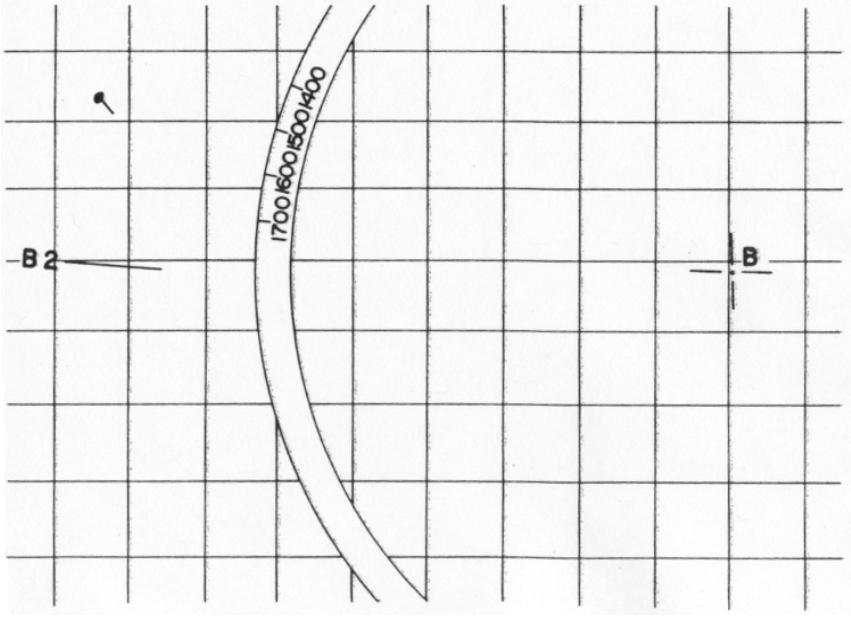


Figure 5.

weapons are laid on a common azimuth of fire but each platoon is pointed in a different direction by announcing the appropriate deflection for the respective platoons. This may also apply to batteries within a battalion.

The use of a target grid has the advantage of roughly orienting guns by deflection, thus eliminating the need for azimuth markers, and providing a good check on the final deflection determined.

ROUND FIGURES

The 1st Battalion, 8th Artillery fired its 150,000th round at a Viet Cong position in War Zone C in November 1966.

The 8th Artillery went over the 150,000th mark on Operation "Attleboro," firing more than 22,300 rounds in less than 12 days.

The artillerymen were providing constant support for 25th Division infantry units, sometimes firing up to five hours without a rest. In addition to the constant fire, the men of the "Automatic 8th" moved their fire bases several times to lend support to the moving infantry units.

The artillerymen were credited with 27 enemy dead and a number of enemy wounded while firing at enemy targets.

BOTTLENECK CAPPED

In order to preclude wind and rain from entering the antenna mast receptacle of antenna base AB-15, the 1st Battalion, 37th Artillery uses the plastic seal from bottles of American champagne. These are used in lieu of cap, antenna base FSN 5820-264-9213, which is difficult to procure. In addition to being much more available, the bottle seals provide tight and effective cover which does not fly off if the vehicle is jarred severely.

It is noted that in addition to seals from champagne bottles, plastic seals from most any other type bottle will prevent dirt and moisture from entering the antenna base. Due to the difference in cost of champagne between overseas and CONUS areas, the above recommendation necessarily is more suited for units stationed outside CONUS.

Speed Shifting

the

155-mm Howitzer, Towed

The Evoution of an Idea

Lt Nathaniel W. Foster
8th Battalion, 6th Artillery

Battery B, 8th Battalion, 6th Artillery, a towed 155-mm unit assigned to the 1st Infantry Division in South Vietnam, is field testing a radically new concept in shifting trails. The basic idea, conceived by the U. S. Army Weapons Command, is the use of pedestal installed at the point of balance of the howitzer to support the weight of the howitzer while the trails are being shifted. Since the howitzer is "trail heavy" when supported on the firing jack, several men and much heft are required to shift trails, and even so, the trails can be shifted only a short distance at a time. In Vietnam, where survival (and R&R in Hong Kong) might depend on the ability to shift rapidly in any direction, a faster and easier method is needed to permit all-round traverse for both direct and indirect fire. Thus, the idea of the pedestal.

Learning of the basic idea, Battery B began to search for a solution. Their first problem was to determine the point of balance on the howitzer. First, they elevated the tube to 300 mils, since the howitzer is laid with the tube at elevation 300 and is returned to that elevation after a mission. Next, they experimented with a jack at various points on the carriage until they discovered that the point of balance is 2 feet 7 inches to the rear of the standard firing jack, or 4 inches to the rear of the end of the carriage. They welded a ½-inch thick metal collar, with a 2½-inch hole in the center, to the carriage at the point of balance and constructed a pedestal from a torsion bar and the base of a firing jack. They then used the regular firing jack to lower the howitzer on the pedestal until all weight was removed from the firing jack. Then, by inserting the trail handspikes in their sockets and applying about 20 pounds of lift on the trails to balance the howitzer on the pedestal, two men

were able to shift the howitzer with ease. In fact, two men were able to shift the howitzer throughout a complete circle in 19 seconds.

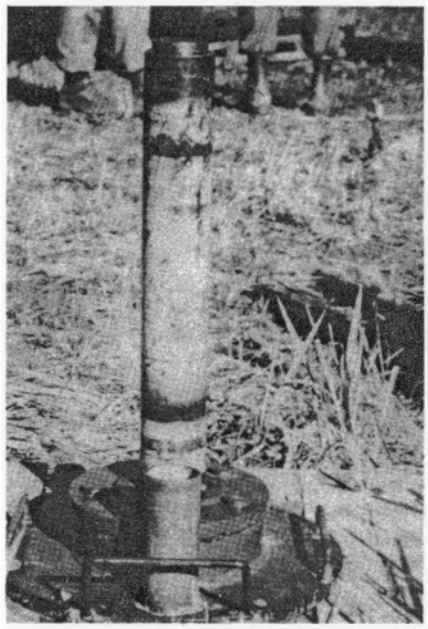


Figure 1. Left, Speed shifting pedestal, 8th Battalion, 6th Artillery,

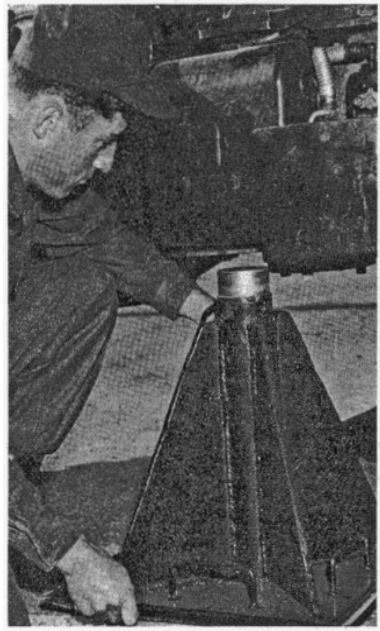


Figure 2. Right, Speed shifting pedestal, 6th Battalion, 16th Artillery,

The advantage of this technique is obvious; the speed of laying and referring the towed 155-mm howitzer is now limited only by the speed of the operator of the aiming circle.

The question may occur to the reader: Since it is so easy to shift this way, why wasn't the firing jack placed at the point of balance in the first place? The answer is simple—the howitzer would likely tip over unless there was some means of preventing tipping. The next question: Then why doesn't it tip over when balanced on the pedestal? Again the answer is simple—it will tend to tip if the trails are raised too high; however, the firing jack or one of the wheels will prevent its tipping too far. Special attempts were made to tip the howitzer with the firing jack fully retracted, but in each case the jack float or one of the wheels made contact with the ground and prevented tipping. Thus, the firing jack is in the correct position for firing, and the pedestal is in the correct position for shifting trails. To insure against tipping, the float must be kept on the firing jack.

Another question you might ask is: What if the pedestal breaks? In this case, the howitzer will drop on its wheels and the jack float. The probability of breakage can be reduced by welding the torsion bar staff to the base.

In studying the development of a speed-shift capability, consideration was given to the permanent installation of a pedestal to the bottom of the carriage. However, past experience in South Vietnam's mud and undergrowth ruled out the installation of any projecting devices.

As the unit continued testing speed shifting, it was determined that the best results were obtained with the wheels unlocked and the float raised just high enough to permit the trail spades to be lifted about 1 foot above the ground. This provided better control, prevented tipping, and reduced the time necessary to reemplace the howitzer on the firing jack for firing.

Note: The following is an extract of a letter written by Lieutenant Foster several weeks after the above article. In this short space of time significant developments have taken place in materiel and technique as described in the following extract.

> Upon testing the basic idea of the speed shifting pedestal, I conceived an idea for modification of the pedestal.
>
> First of all the pedestal had to be made adjustable. I reasoned that if an appropriate jack could be found and welded to a wide base, we would be on our way. By using portions of an armored personnel carrier's road wheels, a base which measured 20 inches across was provided for the jack. By welding another portion of the road wheel system to the "base," more height was achieved. Upon this base was welded an 8-ton capacity hydraulic jack; use of this jack showed the need for a much larger capacity jack (12 to 30 tons) because of leaking seals.
>
> The use of this jack in shifting experiments at the point of balance of the howitzer showed that the hollow piston housing the screw mechanism was too weak and the extra height afforded by the extended screw portion was needed. When the extended screw portion snapped off during shifting maneuvers, the jack was redesigned by replacing the piston and screw assembly with a solid lathe-turned piston which was the total length of the replaced piston and extended screw mechanism. This reduced the working parts to one instead of two inside the jack itself. A rotating top designed like the one already employed on the original jack, but employing two rotating collars, nut and screw held, completed the work on the hydraulic speed shifting jack.
>
> Upon experimenting with the new jack, it was placed under the collar at the balance point of the howitzer and speed jacked without the jack handle until the head of the jack made contact with the balance point of the howitzer. Continued jacking with the jack handle raised the howitzer up off the firing jack with ease, allowing the howitzer to be spun around with the trail handspikes.

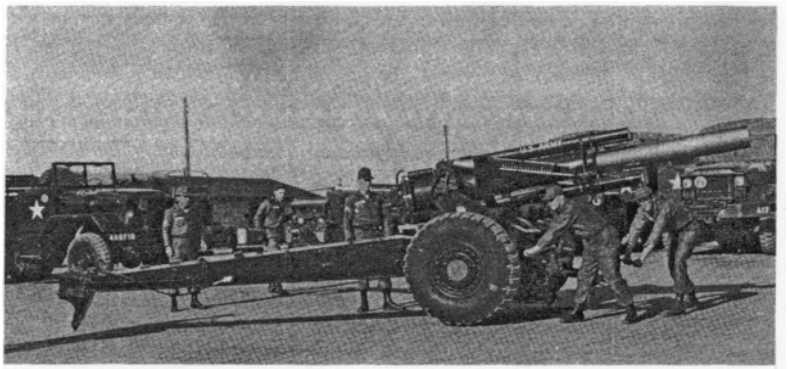
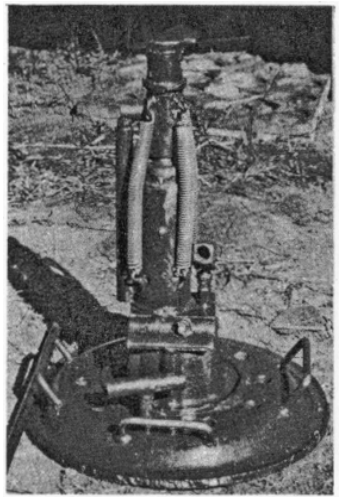


Figure 3. Speed shifting the 155-mm howitzer, 6th Battalion, 16th Artillery.

On the third cannoneers' hop using the jack, the preparation time was cut to 10 seconds. The howitzer could be shifted using the trail handspikes by 1, 2, or 4 people. The time for shifting using 4 people, was:

2 seconds for a 400-mil shift
3 seconds for an 800-mil shift
4 seconds for a 1600-mil shift
9 seconds for a 3200-mil shift



Getting the howitzer back into the ready to fire position necessitated operating the jack's "quick release" mechanism, rapidly lowering the howitzer a few inches onto the firing jack, and pressing the shifting jack head down until sufficient clearance existed (8 inches), allowing the howitzer to fire itself in without the carriage coming into contact with the jack head. This was accomplished in 3-5 seconds.

Figure 4. Speed shifting jack, 8th Battalion, 6th Artillery Republic of Vietnam.

Continued testing resulted in the utilization of a 25-ton screw and ratchet jack which was then fitted with a base and a lathe-turned rotating surface on the jack head. The increased strength and non-hydraulic nature of the jack now made it possible for the howitzer to rest on the shifting jack between fire missions with the firing jack float 4 inches off the

ground and the trail handspikes in the trails allowing for instant shifting.

When the new position is achieved, the No 4 cannoneer can lower the howitzer onto the firing jack. The No 7 cannoneer operates the firing jack, speed jacking until the float makes contact, and then ratchet jacks it until the pressure is off the shifting jack, allowing its removal. (Total time from "stop" to "ready to fire" — 10 seconds).

The screw shifting jack then makes immediate shifts possible at all times after the howitzer has been properly prepared. The rigid pedestal can be made to operate in the system. A rotating surface should be made on top of the jack. The howitzer should be lowered by the firing jack to the pedestal and the float raised 4 inches off the ground, causing the howitzer to rest on the shifting pedestal and the two spades. Again the trail handspikes are left in the trails between fire missions. The howitzer is then ready to be shifted. If the howitzer has been "shot in" in the present position, the firing jack float should be raised all the way to the "fully up" position to allow for the spades to be lifted out of the holes. If the howitzer has been shot in very deeply, the pedestal cannot be brought under the carriage, hence the need for an adjustable jack. The extra time required to jack the howitzer up off the pedestal makes it the least desirable. After the howitzer is shifted to the required direction, the firing jack float is speed jacked down until it touches the ground and then the jack handles are used to raise the howitzer high enough to clear the pedestal. The pedestal is then removed and the howitzer is fired. Tipping the pedestal is faster than removing it completely and serves the same purpose.

The efficient employment of the system definitely allows for fire to be brought on any target involving a shift faster than all present Army howitzers with two possible exceptions: the M108 and the M109. Here the outcome would depend on the crews and the race would probably be close.

Note: USAAMS was concerned that the effectiveness of the speed-shifting technique would be largely nullified by the time necessary to dig out the trail spades following intensive firing in soft earth. Lt. Foster's reply gave us the following information:

In answer to your question about digging in, we have shot in until the trails were buried. To relay, the crews got on one trail at a time and, using the jack and the trail handspikes in the hole at the rear of the trail, the spades were broken loose in a matter of seconds. In some cases after digging in has occurred, during a lull the dirt is shoveled from the top of the spade.

Recently, on Operation Birmingham around the Cambodian Border, the jacks and adjustable pedestals were used with great success. One gun by actual count shifted a total of 33 times in

16 hours to fire for advancing infantry of the 1st Division. They were used under fire to swing around and bring direct fire upon attacking VC in a matter of seconds. This battery, with the use of these jacks and adjustable pedestals, has on this operation expended over 7,200 rounds and shifted day and night for 19 days with an average crew of 6 men including the chief of section. This shifting was done in rice fields that caused the trucks and howitzers to become stuck countless times and required the help of VTR's and APC's to pull them around.

The speed shifting jacks and adjustable pedestals have proven their worth under the worst kinds of combat conditions of "Birmingham."

A wooden platform made from the tops of ammunition pallets and PSP have proven to be a solid foundation for the jacks in marshy areas.

The key to the successful use of this equipment is proper prior preparation . . .

The problem of pressing the hydraulic jack down to make it clear the collar on the howitzer was solved, using one or both of two methods. The hydraulic jack was modified with 2 guides to keep the piston from turning inside the cylinder, and springs were attached over the guides, allowing the jack to distend itself completely when the quick release was activated. The second expedient was to cut the collar, forming a U instead of a circle, allowing the jack to be pulled out, similar to the way the firing jack float is disengaged.

A cap was turned to fit on top of the open-end rotating head and both the top collar and the cap were tempered to resist the mangling of the top by weight of the howitzer. Perhaps after the cold rolled steel parts have been turned to the right specifications it would be wise to temper all of them.

The use of 90-weight oil in the hydraulic jack virtually eliminated the leaky hydraulics of the jack. The weather in this area shows need for a heavier hydraulic jack is evident. The reservoir walls should be doubled in strength and the cylinder through which the piston operates should be thickened. Perhaps the internal construction of a 12-, 20-, or 30-ton hydraulic jack would eliminate this problem.

As with any new concept, utilization under actual combat conditions proves to be the most valid test. The speed shifting pedestal has been subjected to such a test and, with subsequent improvements, has proven its worth. Rarely is the realization of a new concept the product of a single effort, but more often it is a product of coordination and exchange of ideas. The successful implementation of the speed shifting pedestal was a result of such teamwork and serves equally well in exemplifying the evolution of an idea.

Defense of the Artillery Battery

Capt F. H. Hemphill, Jr., USMC, T/CAD

The demoralizingly effective firepower of artillery operating in a guerrilla environment coupled with the guerrilla's relative freedom of movement makes artillery batteries prime targets for guerrilla attacks. Such attacks may range from unsupported attempts at sabotage through infiltration attacks, either unsupported or supported by indirect fire, to full-scale attacks in force, supported by mortars, light artillery, recoilless rifles, and other weapons. Because in guerrilla operations our infantry units operate over larger areas and are more widely separated than in conventional warfare, and because artillery must therefore move more often to support the infantry units, the battery's defensive problems are magnified. Longstanding defensive principles still apply in such situations, but the techniques with which they are applied must be adapted to meet the tactics of the Communist or other guerrilla forces.

From a defensive point of view, there are three basic situations to consider: convoy security while the battery is on the road, security measures to be taken when the reconnaissance party or the battery arrives at a new position, and security requirements for the battery once it is operating in a position. Each of these situations will be discussed against the framework of Vietnam, with some successful techniques being presented in each case. The following general warning concerning any such techniques should be kept in mind: the greatest danger in operating against an enemy with an intelligence system as good as that of the VC is being consistent and predictable. A technique which provides a defensive strength can cause a defensive weakness if the enemy knows that you use it and if he can count on your using it. The Vietnamese Communist believes in precise plans and careful rehearsals. If his enemy changes his techniques, the VC may delay, or possibly cancel his attack, since his doubt about the enemy's actions may counter the Communist's advantage of surprise. With this in mind, let us first consider the defensive problems of convoy security while the battery is moving on the roads.

AMBUSH REACTION TECHNIQUES

Ambushes are particularly effective against convoys, since the speed of the vehicles may prevent their occupants from detecting enemy presence before the entire convoy is in the "kill zone." Ambushes may last from a few minutes to an hour or longer and may range in mission from harrassment to total destruction. Regardless of the duration or mission of an ambush, the first few minutes of contact are critical; therefore, good preparation and quick reaction are the keystones for minimizing the effects of an ambush.

Since the ambushing force has the distinct advantage of having his weapons sighted in, a logical means for reducing the effect of the ambush is to use the speed of the vehicles to break out of the kill zone as quickly as possible. Although this technique should usually be attempted, it may not always be possible, since the ambushing force will often barricade the road, mine it to blow up the first vehicle, or deploy in an L-shaped or a horseshoe formation to block the convoy by fire.

Whether or not this attempt is successful, all personnel aboard the vehicles must be prepared to quickly return a heavy volume of fire from the vehicles, and, if the convoy is stopped, to dismount and deploy as infantry against the ambushers. To facilitate these defensive reactions, canvas and sideboards should be removed from the vehicles, troops should be facing outboard, and equipment and sandbags should be placed to afford protection for personnel. Particular attention should be paid to the rear of vehicles since the VC often position weapons to fire into the open rear. Although tailgates may be tilted outward at a 45-degree angle or placed flat to facilitate dismounting from the vehicle, some consideration should be given to placing sandbags or other protective material at the rear.

Care should be exercised in using sandbags since their great weight can severely restrict the operating capability of vehicles on the poor roads in some areas of South Vietnam. For this reason, sandbags should not be used to excess. They are beneficial when placed on floorboards as protection against mines and when used to build protective fighting parapets, but the use of sandbags may be limited by the possible use of vehicles for resupply and by the restrictions resulting from road conditions.

As previously mentioned, personnel must be prepared to deploy as infantry against the ambushers if vehicles are forced to stop. Such preparation can be accomplished through extensive drills involving a variety of situations in various terrain conditions. Personnel aboard each vehicle should be organized in fire teams and squads and should be trained to move **toward** the firing, since the side of the road opposite that from which the firing is coming is often mined or boobytrapped or has punji stakes emplaced, either in the open or hidden in the grass or brush. The necessity for aggressiveness and a high volume of fire must be emphasized since these are the major tools that the ambushed unit must use to overcome the inherent advantages of the ambushers. Although the counterattack may take the form of a frontal assault, **all**

personnel should be alert to the possibility of an envelopment, since such a counterattack takes advantage of the fact that the ambushing force is not generally deployed in depth and is delivering most of its fire to the direct front. In particular, if the ambush has not been designed to include the entire convoy in the kill zone, personnel at the ends of the convoy should be prepared to employ this technique.

Two other techniques which can be used for convoy protection are the use of aerial artillery or other tactical air support, and the employment of planned ground artillery concentrations. If carefully planned for immediate reaction, both techniques can be very advantageous in minimizing the effects of an ambush. Air support may be able to spot and attack an ambush force before the convoy arrives, and an air observer spotting for emplaced artillery may be able to accomplish the same thing. However, success in either technique may be the exception rather than the rule because of the difficulty in spotting carefully hidden ambushes. Whenever possible, artillery concentrations from other batteries should be preplanned at likely ambush locations, and personnel with the convoy should be prepared to call for and adjust these fires, as a preventive measure in advance of the convoy's arrival, if feasible, and, of course, during an ambush if such fires will not endanger friendly personnel.

SECURITY AND THE RECONNAISSANCE PARTY

Although the possibility of ambush is great in the guerrilla environment, the most critical time for the artillery battery or its reconnaissance party is still the first few minutes in the new position area. Any advance activity by battalion reconnaissance parties or survey personnel may cause new areas to be mined or ambushes to be laid in these areas. In some situations, these possibilities may warrant modification of the usual procedures for employing the reconnaissance party by the battery.

The normal three-vehicle reconnaissance party consists of 20 to 25 people. The primary function of this party is to prepare the position to minimize the time required for the battery to occupy the position and prepare to fire. Each of the personnel who go forward in this party normally has some primary function other than security, such as laying wire, guiding gun trucks, or performing similar tasks, and generally several of the battery's key personnel are along to perform functions within their areas of responsibility. When the unit is operating in areas where the enemy is apt to lay ambushes or attack in strength, the size of the reconnaissance party must be increased to include additional personnel whose primary function is to provide security for those members of the party who have specific tasks to perform, or the use of the recon party must be foregone and the battery sacrifice the time saved by its use in order to insure tactical integrity of the unit. If the size of the party is increased, one or more of the vehicles used should be larger than a 3/4-ton vehicle, since the troop-carrying capacity of the one 1/4-ton and two 3/4-ton vehicles normally used is only about 24. One of

the support vehicles might be used for this purpose, or a complete gun section might be taken forward if this would not materially hamper the support capability of the battery in the old area.

Regardless of the number of people in the party, it must be organized to conduct a quick, efficient, and aggressive sweep of the new area. Assignment of sectors of responsibility for the initial sweep should be preplanned, perhaps based on a "clock" system oriented on the axis of entry into the position. Personnel should also be assigned to man early warning outposts or listening posts upon completion of the initial sweep. These posts will be limited in number and cannot be placed too far from the position area, particularly in heavily populated areas in which the guerrilla could be in the immediate area without being recognized as such. Each of the personnel assigned to man these posts must be assigned to perform that task as a primary duty or must be relieved, when necessary, to perform other tasks assigned to him.

In addition to having a plan for the initial sweep, the recon party must be prepared to mobilize in the event of an attack. Since the members of the party will be deployed all over the position area while they are performing their duties, a defendable area within the position should be selected for the assembly of the party in the event of a concerted ground attack. A signal for assembly in this area should be planned; however, such an assembly against sniper activity would probably not be necessary nor even advisable. Aggressive and immediate action by three or four men against a sniper is usually more effective.

SECURITY DURING THE OCCUPATION

If a battery is occupying an area in which considerable enemy activity is expected, it may be necessary to forego employing the recon party. If this is done, the members of the battery will operate in three functional areas when the battery arrives at the new position. Some members of the battery will perform the initial sweep of the area and set up local security; others will be assigned to protect the vehicles, which will probably be dispersed near the entrance to the position; and a third group will prepare the position for the occupation. Dispersing the convoy at the entrance to the position allows the battery commander to make his reconnaissance and plan the occupation in such a way that all vehicles can be directed to their final stopping points without causing the confusion that would result if the vehicles were dispersed within the position area itself. Sufficient personnel must be assigned to protect the vehicles during these critical minutes when the battery personnel are dispersed over an area larger than that which they are normally required to defend. In some cases it may not be feasible to hold the vehicles outside the position, and the battery commander will have to reposition vehicles within the position area as necessary after he has made his plan for the occupation.

This plan for the occupation will be a very abbreviated version of the type the battery commander would use if he were using a reconnaissance party. About the only decision that must be made before the occupation

takes place is the location of the various installations; all other tasks can be performed during the occupation and laying of the battery. The battery commander may locate all installations himself, or he may indicate general areas and have his key personnel select the exact locations. In either case, once the decisions have been made, the battery commander must insure that all key personnel know the location of each of the various installations. He must further insure that routes to be taken by the various vehicles are established so that each vehicle can move to its unloading point without delay.

Even if a reconnaissance party is used, the arrival of the firing battery itself in the position area is still a critical time, since it is a period of great activity for all personnel. During this period the outposts or listening posts established by the reconnaissance party must be maintained, and new ones probably will have to be established. Personnel must know what general sector of the perimeter they are to occupy in the event of an attack even though they will not have the time initially to actually look at the ground they are assigned to protect. As the various elements of the battery complete preparations to fire, more people will be freed to prepare defense positions, clear fields of fire, and determine routes to the positions from work areas.

DEFENSE OF THE POSITION

Once in a position area, the battery faces the usual problems involved in defending itself against a normal infantry attack in force. At the same time the battery must cope with a defensive problem peculiar to a guerrilla environment: that of defending itself against infiltration-type attacks aimed at damaging or destroying key installations, equipment, or personnel—such defense generally requiring that the defensive perimeter be tightened—while at the same time providing the dispersion necessary to protect these same installations, equipment, and personnel from destruction by "hit-and-run" mortar or light artillery attacks. Both the infiltration-type of attack and hit-and-run attack are used to great advantage by the VC and both are difficult to detect in advance, particularly in densely populated areas.

Early detection of the attackers is the key in protecting against the infiltration attack. To achieve this, the density of the battery's defensive perimeter must be increased beyond what would normally be required. The placement of additional personnel on the perimeter is the obvious solution; however, there are simply not enough personnel in the artillery battery to provide the proper defensive perimeter in this situation for a "normal" battery position area and still be able to operate on a 24-hour basis. This problem may be alleviated somewhat in a battery which is operating independently, since additional personnel must be provided for a battery to operate independently and security requirements may be anticipated by this augmentation.

The alternate solution is to reduce the size of the position area and tighten up the defensive perimeter. By doing this, the battery can be defended by available personnel and still operate continuously in most situations. Care must be taken in reducing the size of the position area,

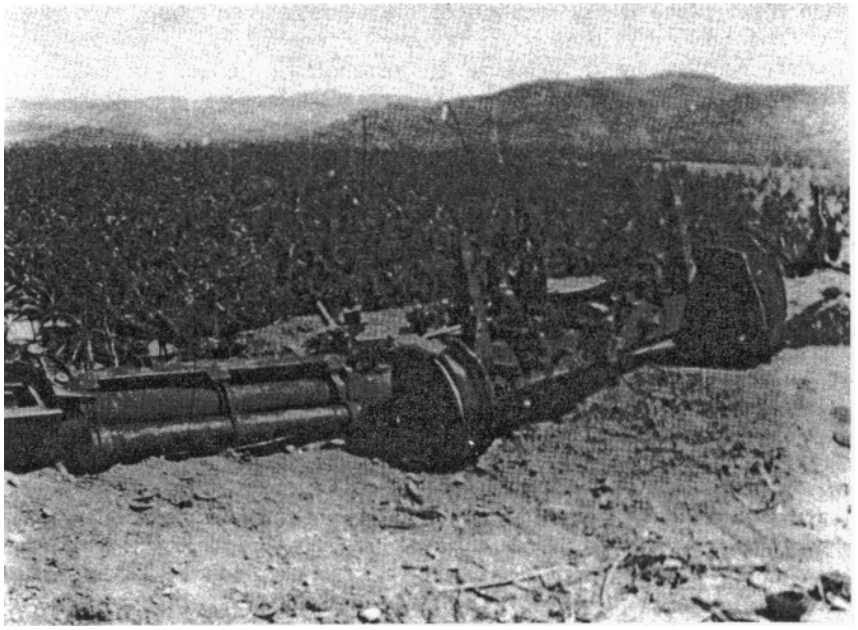


Figure 1. Enemy infiltration is bad for the health of a battery.

however, since placing installations and equipment too close together increases both the likelihood and the danger of a mortar or artillery attack. This aspect will be discussed later in more detail; however, at this point it is sufficient to say that this technique is justifiable in many situations.

Another technique for increasing the density of the perimeter is the employment of small roving patrols at night and the occasional movement of local security positions during the night. Roving patrols of three to five men should be used primarily within the defensive perimeter to cover less heavily protected areas or within a few hundred meters of the position to deny free enemy movement outside the position. Operation of patrols on a regular basis beyond a few hundred meters from the position only invites ambush, and in fact any operation of small patrols outside the perimeter should be carefully coordinated with listening posts or other detection means. Patrols within the perimeter should stop often to listen; should frequently inspect barbed wire, trip flares, and other devices for evidence of tampering; and should avoid following any sort of timetable. The patrol should occasionally drop off men in a new position to listen for a while, and the passage of the patrol should be used to allow personnel to move to new local security positions without being detected. Local security positions are easily spotted during the daytime, and the preparation and use of alternate defensive positions is almost mandatory. Finally, these small patrols can be used as a reaction force in the event of an infiltration-type attack.

Figure 2. Note elevated machine gun position.

Another method of preventing successful infiltration attacks is to select and occupy positions in the open rather than in wooded areas, jungles, or other areas with good approach routes. Since the enemy to date has had no air capability, this technique is feasible, and quite often the occupation of such positions will be required by the mission since supported units are operating over larger areas and a 6400-mil capability is required. But even if such positions are not required by the mission, they are desirable from a defensive point of view, since they provide good visual coverage of approaches and excellent fields of fire for both small arms and the howitzers. This type of position particularly enhances the direct fire capability of the howitzers with new ammunition.

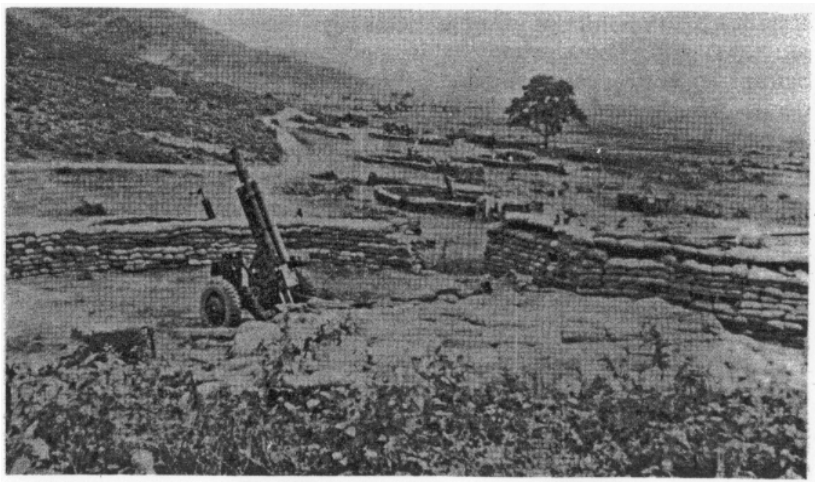


Figure 3. U. S. Marine Battery, Republic of Vietnam. Open spaces give the best fields of fire.

The advantages of such open terrain can be increased by the judicious use of illumination. Trip flares and illumination hand grenades can be employed to great advantage, and if it can be preplanned, mortar or artillery illumination is also useful. A technique which some units have employed with success is to place vehicles so that their headlights illuminate critical areas of the perimeter. This technique does have the disadvantage, however, of drawing fire to the battery's all-important vehicles. Then, too, care must be taken to prevent silhouetting friendly personnel on the perimeter. An alternate technique is to remove the vehicle headlights and place them on poles in key locations, but this takes time and is relatively inconvenient. Still one other technique some units have found effective is to fire their own illumination by using high angle fire with charge 1. This will provide illumination to within 300 or 400 meters of the perimeter.

Figure 4. Barbed wire slows down and channelizes the enemy.

The use of barbed wire obstacles, trip wires, trip flares, and noisemaking devices alleviates defensive problems somewhat, but the installation of such devices is time consuming and their locations are difficult to conceal in densely populated areas. Then, too, animals and children in such areas often trip or disable flares and noise-making devices in the daytime, either accidentally or intentionally. The use of mines or boobytraps in such densely populated areas may be precluded by the danger to the children and animals in the area.

The second problem of position area defense in a guerrilla environment is that of defending against mortar or artillery attacks. The basic defense against this type of attack is the passive defensive measure of dispersing equipment, installations, and personnel. The major factor in determining how far apart to disperse these elements is the effective bursting diameter of the munitions used by the enemy. To date, the Communists in Vietnam have depended primarily on the smaller mortars (60-mm and 82-mm or equivalent), but the confirmed presence of mortars of 120-mm size cannot be completely ignored. Nevertheless, reducing the 50-meter distance usually set as the guide for the dispersion of vehicles and installations should be considered as an allowable risk in order to reduce the size of position areas to gain the advantages mentioned above.

Another technique for reducing the danger of mortar or artillery attacks is to use helicopters to emplace artillery for specific missions and

Figure 5. In wet weather, everything must be sandbagged, built from the ground up.

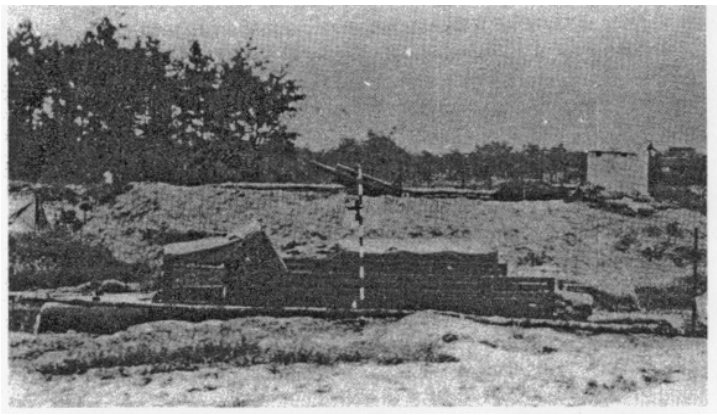


Figure 6. Where the weather is dry, you can dig in. Don't neglect the vehicles.

then to displace it before the enemy has time to coordinate an attack. The tactical situation will dictate whether or not this technique can be used effectively, of course, but even if continuous support is required for a day or longer, the method still will reduce the effectiveness of mortar attacks since less equipment will be in the position.

Regardless of the time a battery spends in a position and the degree to which installations within the position are dispersed, much emphasis must be placed on sandbagging installations and taking other steps to improve the position. The enemy's flexibility and good intelligence system make this essential. Much physical labor will be involved in such protection, since the heavy rains and poor drainage which are

characteristic of much of South Vietnam require that many installations be built from the ground up, with sandbags, instead of being dug in. The prevailing weather and drainage conditions also cause the sandbags to deteriorate rapidly, requiring constant replacement and repair of installations.

SUMMARY

The defense of the artillery battery is of great importance in a guerrilla environment because the battery is more susceptible to attack than in conventional warfare and because the battery's presence can have such a significant effect on the guerrilla's capabilities. Basic defensive principles still hold true in a guerrilla environment, but the techniques with which they are applied must be adapted to meet the enemy's capabilities and techniques.

Expanded Communicatons In Vietnam

Major Eugene O. Roverse
Communications Officer
Hqs, 1st Air Cav Div Arty

Communications in the 1st Cavalry Division Artillery have passed combat testing with flying colors. The radio nets being employed were described in the July 1965 issue of **ARTILLERY TRENDS.** Wire communications remain limited to CP locals and units tying into the division four channel VHF system at the brigade or division artillery. Radio equipment, which was reduced to the bare minimum before leaving CONUS, satisfies the system requirements; however, various means of mounting radio sets have been devised to reduce the number of radio vehicles required.

One specific requirement which the division artillery accomplished soon after its arrival in Vietnam was to establish and operate a full-time operations center in the division base camp and to maintain the capability for establishing a second operations element for distant field operations. The basic defense plans and continuous short-range tactical operations in the area of the base necessitated this full-time artillery headquarters. A "jump CP," complete in all respects, has been organized for operations conducted away from the base area. This forward artillery element is a good example of a "lean and mean" air assault headquarters. Two ¼-ton trucks with trailers can transport all the organic communications equipment required in the forward area. To round out the required communications facilities, division furnishes a radio set AN/MRC-95 and a ¼-ton trailer-mounted VHF terminal to provide the external channels. The key to the success of the communications system has been emphasis on basic communication techniques rather than the practice of any unusual or heretofore unknown trade secrets.

The division artillery headquarters operates three basic radio nets—a fire direction net, FM; an operations/fire direction net, FM; and a command/fire direction net, SSB. All artillery battalions and the division artillery aviation battery operate in all three of these nets. The division

artillery command net, FM, has been discarded, and all commanders now operate in the operations/fire direction net, FM. This reduces the number of radio vehicles that a unit is required to airlift and frees an additional frequency for use as a relay channel. Communications security is enhanced by the use of voice scramblers (KY-8's) in the operations/fire direction net, FM, and with on-line equipment (KW-7's) in the teletype net. Meteorological data are transmitted by both voice and teletype in the command/fire direction net, SSB, which eliminates the meteorological net, SSB. A frequency for use by all survey parties in the division is provided in the SOI. External communications with division are established in the division command/operations net, FM; the division operations/intelligence net, FM; and the division command/operations net, SSB. An additional division net, monitored by the division artillery headquarters, is the division organic spot report net, UHF.

In addition to operating a command/fire direction net, FM, and a fire direction net, FM, the 105-mm battalions may establish up to three additional FM fire direction nets, if required. These nets provide the individual firing batteries with a clear channel of communication with the liaison officer and forward observers with the supported infantry battalion, with the aerial artillery conducting strikes in the supported battalion's zone of operations, and with the Air Force tactical air control party. During battalion-size air assault operations these additional nets are necessary because of the volume of traffic inherent in making initial contact. When the firing batteries of the battalion are positioned beyond the range of FM radio equipment, communications are maintained in the battalion command/fire direction net, SSB, by using radio sets AN/PRC-47.

The aerial artillery battalion, the aerial artillery batteries, and the division artillery aviation battery each operate a command/fire direction net, FM, and an air traffic control net, UHF, for internal communications. In addition, the aerial artillery battalion operates a command/fire direction net, SSB, when the batteries are operating beyond the range of FM equipment. The battalion headquarters and each firing battery are authorized radio sets AN/PRC-47 for use in this net.

The ability to maintain communications over the great distances and the rugged terrain encountered in Vietnam has been possible primarily through the use of the new series of FM and single-sideband radio equipment. In the words of one commander, "They are almost too good to be true." FM radio relays are frequently used; however, airmobile tactics leave few good relay sites secured and safe to occupy. To overcome this problem, a division-maintained airborne relay (a CV-2 aircraft with 12 radios for a six-channel automatic relay capability) is available on a 1-hour notice. One channel in the airborne relay is allocated to division artillery for use in the division artillery fire direction net, FM. Through this relay any unit in the division can quickly call for fire. The relay frequency is known as the "quick fire" channel, and the frequency designation is published prominently in all division operation orders.

Additional channels in the airborne relay are allocated on a priority-of-need basis. Through the use of airborne and ground relays, division artillery easily maintains FM communications with units deployed from the South China Sea to the Cambodian border. In the use of FM communications, emphasis is placed on proper siting and on obtaining the maximum performance from the sets. On more than one occasion a station allowing its power source to drop below a full charge has lost contact. RC-292 antennas are used on all radios except those of the ever moving forward observers, and placing antennas in treetops is a common oractice. Because of the wide frequency coverage of the new radios, the operator must elevate the antenna as high as possible and accurately adjust the antenna to the operating frequency.

AM communications have become extremely reliable as a result of studying the effects of various antenna systems and operating frequencies. All team chiefs are now experts on antenna construction and characteristics as outlined in FM 24-18, Field Radio Techniques. Another publication which has proved to be an invaluable reference is "Let's Talk About Tactical Antennas," a pamphlet published by the U. S. Army Radio Propagation Agency, Fort Monmouth, New Jersey. These two publications should be to communications personnel what the "Exec's Handbook" is to the firing battery. Radio teams know that once in position they must keep working until they find the right antenna combination. At the division artillery base and in the forward area the half-wave horizontal dipole antenna is employed. The battalion radio teams have found that a simple long wire placed above the jungle canopy will give excellent results and will outperform any antenna that does not clear the treetops.

The "skip distance" factor has definitely affected AM communications in Vietnam. No single frequency will work well throughout an entire 24-hour period. A trial and error approach to the problem has resulted in low- and high-frequency assignments for the division artillery command/fire direction net, SSB. An extremely low frequency has eliminated the serious nighttime fading which was initially encountered. During daylight hours a frequency around 5 mc will work loud and clear.

The full-time use of all communications equipment and the constant moving required by the 1st Cavalry's operations require an extremely close inspection program. Radios and telephones are rotated to get them to the shops for maintenance. Radios are "peaked" before they are returned to service. PLL's, the nemesis of stateside inspections, have become the communicator's best friend in Vietnam. Generators are used to prevent the constant operation of vehicles, and in some cases a generator and spare truck batteries replace radio vehicles. In the division artillery headquarters, both in the base and in the forward area, all radios are table-mounted, using the generator and spare battery method. This eliminates the need for vehicles and remote control equipment and results in an astronomical saving of batteries (BA-30).

Professional experience and know-how were the basis for the success of communications in Vietnam; however, the magic ingredient is, as it always was and always will be, command emphasis!

COLLIMATOR-

The Easy Aiming Reference

The infinity aiming reference collimator is on the way. Already there are units wondering what to do with the thing, and rest assured that one day before long you will walk into your battery and find 6 strange cylindrical cases staring you in the face, and a puzzled supply sergeant wondering what to do with them.

"Put 'em away and don't let me see 'em again," you say. "What are they for?"

"They're a substitute for aiming posts, or something," says a bright young lieutenant who reads ARTILLERY TRENDS.

"Substitute for aiming posts! What do we need them for? Another piece of junk to break and pay for. And who knows how to use 'em?"

We do. And by the time you finish this article, you'll have a pretty good idea.

The first thing you must understand is that the collimator is not a complicated instrument. It's just a tube with a reticle, mounted on a tripod. It does the same thing as aiming posts, but it's quicker and more convenient.

Figure 1. Collimator set up for daylight action.

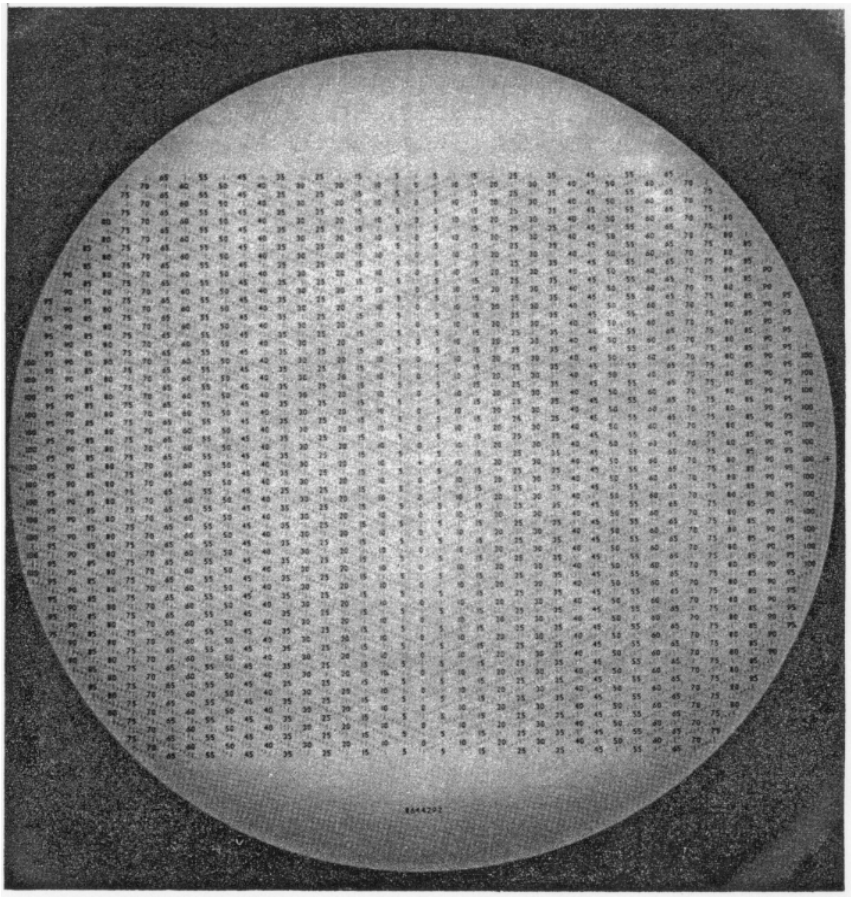


Figure 2. Reticle of infinity aiming reference collimator.

To set it up you simply plant it on the ground 15 to 48 feet from the panoramic telescope, level the cant bubble on the collimator, aim it toward the panoramic telescope using the top mounted notch sights, aline it as you would aiming posts, and when the gunner gives the signal, clamp the tube tight and let it alone.

As shown in figure 1, the collimator is set up for daylight operation. For nighttime action, a light source in the form of a cap-like adapter is merely fitted onto the open end of the collimator cylinder. The battery power supply is shown next to the left trail of the howitzer in figure 1. (For use with the self-propelled artillery, an external power source is not required.)

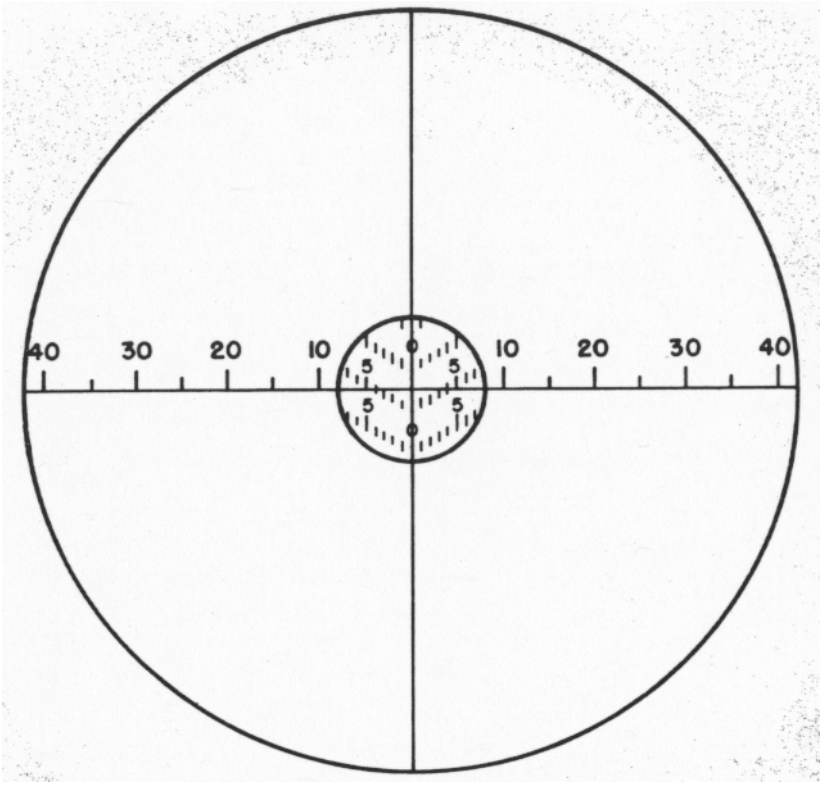


Figure 3. Ready for action.

Figure 2 is a representation of the entire reticle of the collimator but only small portions of it are visible through the panoramic telescope at any one time.

The gunner will have a sight picture similar to what you see in figure 3. When a fire mission is announced, the gunner need only set the deflection on the panomaric sight then traverse the weapon until the hairlines of the sight reticle cross at the + mark in the center of the collimator reticle.

This is equivalent to having your aiming posts on line. And it's a lot quicker than dashing 100 paces and adjusting each post, to say nothing of the fact that on an evening in Vietnam, dashing 100 paces into the night may preclude your ever returning to your buddies on the guns.

Notice in figure 2 how the rows of tick marks slant upwards both to the left and right of center. The numbers on the reticle increase in an upward direction. This enables the gunner to know whether the rows of hash marks slant up in a left or right direction. Note also that the rows of tick marks on the collimator reticle are divided into 5-mil increments,

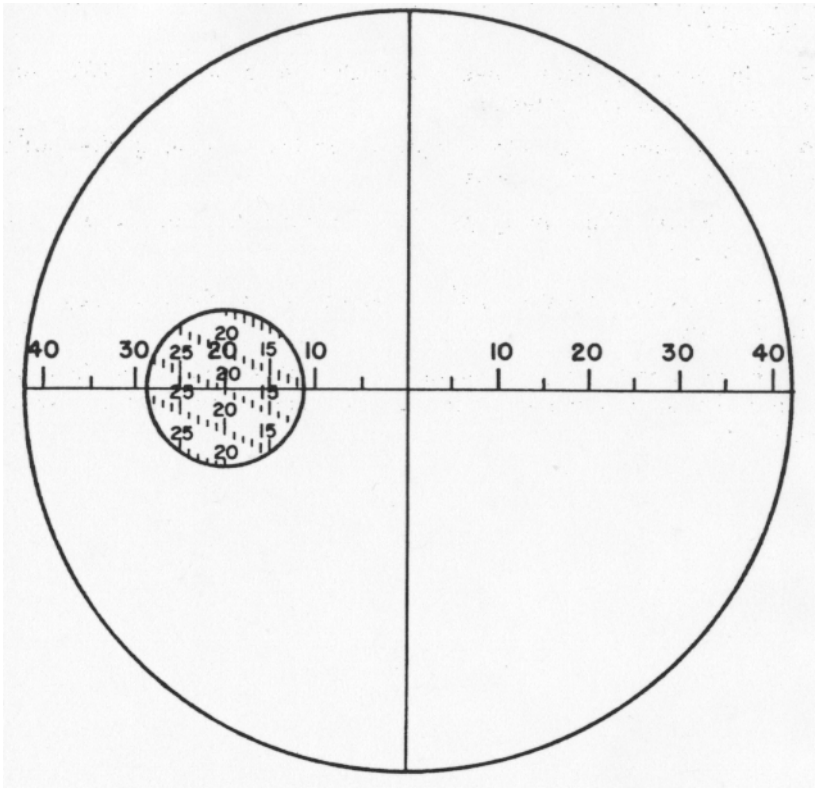


Figure 4. Sight picture indicating left displacement.

from 0 to 100 on each side. The reticle on the panoramic telescope consists of a verticle crosshair and a horizontal crosshair, the latter of which is numbered in 10-mil increments and, like the reticle of the collimator, is divided into 5-mil increments. Hence, figure 4 clearly indicates a left displacement of 20 mils which has been compensated for by merely aligning the appropriate numbers and increments.

The mil scales of some panoramic telescopes number up to 80, while others go up only as far as 40, but the procedure remains the same: aline the number on the right reticle with the corresponding number on the collimator reticle. When 2 or more numbers are visible on the collimator reticle, aline them all with their corresponding numbered tick marks on the collimator reticle.

It takes about 15 minutes to get the knack of operating with the

infinity aiming reference collimator, and the advantages are more than worth the effort.

- No longer is there a need for a clear field of vision 100 meters out from the panoramic telescope.

- The likelihood of night lighting devices revealing the pattern position is substantially diminished.

- Gone with the aiming posts is the old calibrated eyeball near-far-line sight picture.

- It takes less time to set up the collimator than it does to set up aiming posts.

As things stand now, if you're in an active cannon artillery unit, you'll have the collimator by the end of this year. Use it. It's easy and it's worth it.

Vietnam's -

(*Aerial*) **A**

(*Rocket*) **R**

(*Artillery*) **A**

Reprinted from Army Aviation Magazine

One of the most unique organizations in the world, the US Army's 2d Battalion, 20th Artillery, part of the 1st Air Cavalry Division, is cur-recently operating in the mountainous, guerrilla-haunted central highlands of this war-torn nation.

The 20th is the first and only aerial rocket artillery (ARA) battalion in the world, and its sphere of operations, compared with even the largest conventional caliber artillery units, can only be described as enormous.

Equally enormous is the volume of firepower available within the organization—its three firing batteries have a combined firepower of 1,728 2.75 inch rockets, the equivalent of 48 battalions of 155mm howitzers, or to put it another way, one such battalion firing 48 rounds per gun.

The main weapons system employed by the flying artillerymen is a

pair of rocket pods, each housing 24 2.75 inch rockets—and all 48 of these can be delivered in just four seconds.

The rockets are of a type that have been in service for several years and they are due to be replaced soon with a larger, more lethal rocket with a heavier warhead, but the same diameter, allowing them to be fired from the existing pods.

The development of aerial rocket artillery can be traced back to the early days of the airmobility experiments conducted at Ft. Benning, Ga. According to Major Joseph Lahnstein, the Battalion Executive Officer, the aerial concept was born when a means of fire support had to be found for highly mobile air-transported troops beyond the range of conventional artillery.

VARIOUS SYSTEMS USED

Combat experience in Vietnam has shown that the 48-rocket system, while undoubtedly effective, can be improved. An alternate weapons system, consisting of a half-dozen wire-guided missiles mounted three on each side of a Huey, was used with considerable success against hard targets—armored vehicles, thick masonry buildings, and caves. In addition, the guided missiles, which were the modified SS-11 type, used by the Army as an infantry anti-tank weapon, have been directed against point targets with devastating accuracy.

"But we still needed a more flexible system, one that could combine the inexpensive, but very accurate SS-11, with its capability for hitting hard point targets," explained Chief Warrant Officer Robert Maxwell, a pilot with the 20th.

Maxwell is the designer of just such a system. Blending the best of both previous systems, Maxwell mounted a wire-guided SS-11 on each side outboard of the rocket pods, then, to make up for the difference in weight, blocked off 12 rocket tubes on each side, and came up with a 24-rocket and two-guided missile system that offers the pilot a choice of the best features of both types of weapons. Because of the difference in weight between the two systems, Maxwell's rig permits the use of the newer, heavier rockets.

ALL ARTILLERY-TRAINED

Still another alternative to the rockets and missiles carried by the 36 Hueys in the firing batteries are the quad-machine gun outfits sported by the headquarters battery ships. These are four slightly modified M-60 machine guns, two on a side, aimed and fired by the co-pilot.

Usually the 20th receives targets beyond the range of the tube artillery, but sometimes its fire is used to supplement the conventional fire. All of the battalion's commissioned officers are artillery branch trained, and "Even our warrant officers get to feel that they are artillerymen after a while," comments the battalion's veteran commander, Lt. Col. Nelson Mahone.

This helps keep the battalion oriented on their tactical role as flying artillery.

"Many people tend to class all armed helicopters as gun ships, but we consider ourselves a breed apart, and our success with artillery

tends to support this," says Col. Mahone, an Army pilot for nearly twenty years.

The ARA is an artillery unit, and although they have on occasion performed the tasks usually assigned to gun ships, their real worth is demonstrated by the praise infantry leaders lavish on them.

One battalion commander with the memory of the Plei Me fighting still fresh in his mind said, "The enemy was all around us, and the volume of fire was murderous. We were taking casualties right and left, when the ARA arrived over us. Suddenly, we were alive again. They took the breath of death out of our faces and blew it back towards Charlie (the Viet Cong)."

Other infantrymen are quick to point out that only ARA can deliver quick, heavy fire as close as fifty yards to the front of friendly troops, and have virtually no danger of hitting their own soldiers.

Another unique capability of the ARA is as a counter-battery weapon, particularly against mortars. At the cavalry base camp at An Khe as well as at temporary field encampments, aerial searchlights are employed, and the combination of an armed, blacked-out Huey following the searchlight ship has been termed "the most effective counter-mortar weapon in Vietnam" by Cavalry Division officials.

The men of the 20th proudly wear the unit's distinctive **Griffin** patch on their shirt pockets. The **Griffin** was a mythical creature with the head, wings and talons of an eagle and the body of a lion. Like the **Griffin**, the aerial artillerymen have proven that they can successfully combine the strength and power of the artillery with the speed and range of the helicopter.

IMPROVEMENT OF ARTILLERY TARGET ACQUISITION EFFECTIVENESS

"If our firepower is to be effective, we must have a fully responsive target acquisition system," General Harold K. Johnson, Chief of Staff, said recently. "Our system is neither responsive enough nor adequately comprehensive to serve the purposes that we would like."

The problem of locating targets for attack by artillery is continuously under study by the U. S. Army Artillery and Missile School. The School is monitoring the development of several items of equipment which will, if successful, increase the artillery's target acquisition capability in the future. In the meantime, the School has conducted a study of our present target acquisition capability to determine how the effectiveness of our present capability can be improved. Two recommendations have emerged from this study.

The first recommendation is a proposed reorganization of artillery target acquisition elements. For maximum responsiveness, artillery target acquisition systems should be organic to the lowest echelon consistent with the following principles:

The range of the target acquisition system of any given echelon should be compatible with the depth of that echelon's area of influence.

The width of the area covered by the target acquisition system of an echelon generally should not exceed the width of that echelon's area of influence.

Implementation of the principles listed above would require reorganization of the artillery target acquisition elements in the direct support artillery battalion, the division artillery headquarters battery, and the field artillery target acquisition battalion (FATAB).

The direct support artillery battalion should include those target acquisition systems that locate targets within the brigade area of influence. The elements of the proposed target acquisition platoon of the direct support artillery battalion (fig 1) are discussed below.

Observation section. Three battalion observation posts are required, each equipped with Laser rangefinders, night observation devices, and infrared flash-detecting devices, when available. Making this section organic to the direct support battalion is essentially a relocation of flash ranging capability from corps level to brigade level. Targets located by flash ranging are normally within the brigade area of influence. The observation posts would supplement the existing forward observer parties employed with the infantry or armor companies.

AN/MPQ-4A radar section. This section is presently organic to the direct support artillery battalion.

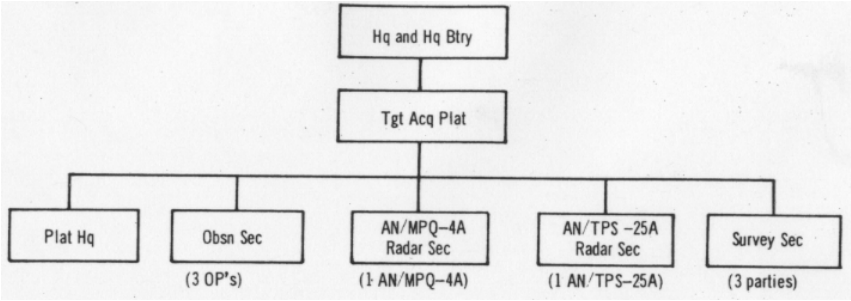


Figure 1. Target acquisition platoon direct support artillery battalion.

AN/TPS-25A radar section. Making this section organic to the direct support battalion is essentially a relocation of the capability to locate moving targets from division level to brigade level. Targets located by the AN/TPS-25A radar are normally within the brigade area of influence. Because this radar locates moving targets, target information should be transmitted directly to a battalion FDC.

Survey section. A two-party survey section already exists in the direct support artillery battalion. An additional survey party is required to provide survey control for the additional target acquisition devices. Because of the added target acquisition devices, the section should have a reconnaissance and survey officer to coordinate and control the reconnaissance and survey function, which is now performed by the target acquisition platoon leader.

Division artillery is responsible for counterbattery activities within the division area of influence, but the primary locators of counterbattery targets are presently found in the field artillery target acquisition battalion at corps artillery. These target acquisition systems should be relocated to division artillery. The resulting target acquisition platoon in division artillery (fig 2) is discussed below.

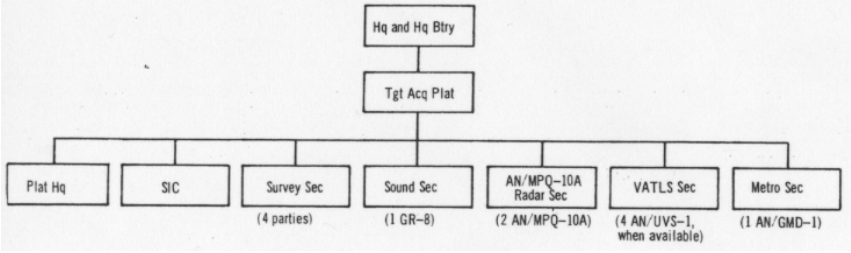


Figure 2. Target acquisition platoon, division artillery.

Survey information center. This element is presently organic to division artillery.

Survey section. The existing two-party survey section in division artillery should be augmented by two additional survey parties to provide survey control for the additional target acquisition devices.

Sound section. Making the sound section organic to the division artillery is essentially a relocation of the sound ranging capability from corps level to division level. Targets located by sound ranging are normally within the division area of influence.

AN/MPQ-10A radar section. Making this section organic to division artillery is essentially a relocation of the capability to locate counterbattery targets from corps level to division level. Targets located by counterbattery radar are normally within the division area of influence.

VATLS section. Four AN/UVS-1 visual airborne target locator systems (VATLS) should be organic to the division artillery target acquisition platoon when the VATLS equipment becomes available. Three of these systems would be habitually utilized by the direct support artillery battalions. The fourth would be used to supplement the battalions' capability and to perform missions for division artillery.

Metro section. This element is presently organic to division artillery.

Ground data receivers. The division artillery should be provided with ground data receivers for both infrared (IR) and side-looking airborne radar (SLAR) systems.

The recommendation for reorganization of target acquisition elements would relocate at lower echelons all of the target location systems presently found in the FATAB. However, there would still be a mission for this battalion. The mission would include providing metro data and survey control and locating targets beyond the capability of lower echelons. The elements of the proposed FATAB (fig 3) are discussed below.

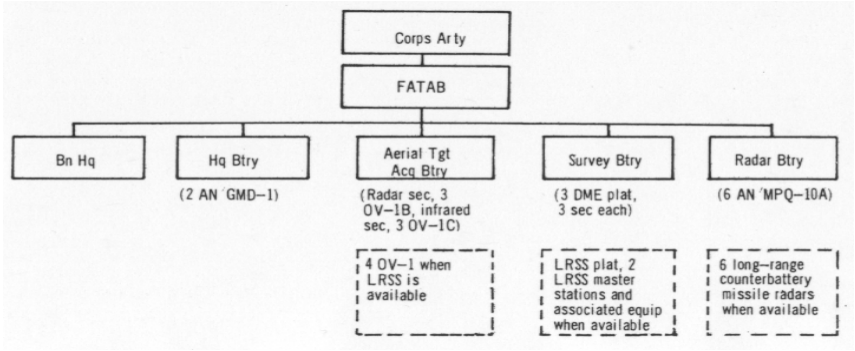


Figure 3. Proposed FATAB

Headquarters and headquarters battery. The elements currently in this battery, with the exception of the survey platoon and survey information center, should be retained. Some adjustment of personnel and equipment may be necessary.

Aerial target acquisition battery. The aerial target acquisition battery, which will provide a target acquisition capability beyond that of division artillery, should have the following elements:

A battery headquarters.

An operations platoon with the necessary control elements and an imagery interpretation section. This section should include ground data receivers for IR and SLAR.

An airfield/aircraft service platoon.

A flight platoon with three OV-1B (SLAR) and three OV-1C (IR) aircraft.

An LRSS (long-range survey system) aerial section with OV-1 aircraft, when available.

Survey battery. Some of the survey elements presently organic to the field artillery target acquisition battalion should be reorganized into a survey battery. The survey information center presently organic to the headquarters and headquarters battery should be relocated in the survey battery. Three survey platoons, consisting of a headquarters and three survey parties each, will be required. A long-range survey system platoon should be added when the LRSS equipment becomes available.

Radar battery. A radar battery should be organic to the field artillery target acquisition battalion. This battery will require six AN/MPQ-10A radars in order to supplement the counterbattery role of the radars in the division artilleries. This requirement is critical in view of the widening of corps frontages. The AN/MPQ-10A radars should be replaced by an appropriate number of long-range counterbattery/missile radars, when available.

This proposed reorganization of existing artillery target acquisition elements has the following advantages:

Increased target acquisition capability in the direct support artillery battalion (by addition of three OP's and the AN/TPS-25A radar and provision of a VATLS system for employment with each DS battalion).

Increased effectiveness of flash ranging and AN/TPS-25A radar (because of shortened lines of communication to a firing element).

Increased counterbattery target acquisition capability at division artillery (by addition of sound ranging and AN/MPQ-10A radars).

Increased target acquisition capability at corps artillery (by addition of Mohawk aircraft).

The second recommendation to improve artillery target acquisition effectiveness is a proposed change in target intelligence procedures. At all echelons, combat intelligence agencies produce a large amount of information concerning enemy units and installations. Someone must

extract targets for timely attack by fire support agencies from this mass of intelligence information. This is a responsibility of the G2 and of the fire support coordination element (FSCE). The G2 is interested in all intelligence information, but he is primarily oriented toward providing the commander with enemy information upon which the commander can base a plan of action. The G2's interest, therefore, is not directed to the determination of specific target intelligence. The processing of target intelligence (i.e., location, size, shape, composition) is often ignored or delayed, thereby preventing the timely engagement of targets.

The FSCE is the prime consumer of target information/intelligence at division/corps level. Artillery intelligence personnel assigned to the FSCE have the following functions:

Collate, evaluate, and synthesize into targets that information of the enemy which is available from all sources and agencies.

Furnish a link between the artillery S2, the FSCE, and the force G2 on target information.

Keep tactical operation center (TOC) personnel informed of the current status of appropriate targets confronting the division.

Provide a continuous flow of information from artillery target acquisition agencies into intelligence channels (G2 operations).

Submit requests to appropriate intelligence and artillery target acquisition agencies for target information.

Current doctrine does not prescribe where the artillery intelligence personnel of the FSCE should perform these functions. It has been proposed that, as an operating element in the target intelligence function, artillery intelligence personnel of the FSCE should be physically located and integrated with the G2 element of the TOC. This would not detract from, nor interfere with, the G2's general staff responsibility for intelligence. Rather, it would assist the G2 in the performance of his overall intelligence function and would also provide timely target intelligence directly to the FSCE, where the appropriate fire support agency could then be assigned to attack the target.

The following additional personnel would be required in the FSCE of corps and division artillery to perform the functions of target intelligence on a 24-hour basis:

Corps artillery, TOE 6-501E			
Job title	**Grade**	**MOS**	**Number**
Intel sgt	E8	13Z50	1
intel sgt	E7	13E40	1
clk typist	E4	71B30	2
Division artillery, TOE 6-302E			
Tgt acq off	Capt	1154	1
Intel sgt	E7	13E40	1
Clk typist	E4	71B30	2

The current title and MOS of the artillery intelligence officer (59301) of the FSCE should be changed to target acquisition officer (1154). An officer with MOS 1154 is more familiar with the artillery's target intelligence requirements.

Additional personnel are also required in the division artillery FDC to handle the increased counterbattery functions resulting from the transfer of more of the counterbattery responsibility from corps artillery. The division artillery FDC is already strained to maintain a 24-hour capability. The following additional personnel are required:

Job Title	Grade	MOS	Number	Notes
Asst S2	Capt	59301	1	Also the cbtry intel officer
Asst S2	LT	9301	1	
Cbtry intel spec	E4	13E20	2	

This proposed change in target intelligence procedures will speed the processing of targets suitable for attack by artillery. Artillery intelligence personnel will have early access to raw intelligence data and can insure that potential targets are not lost in the mass of raw data available. This proposal is a modification and refinement of the target intelligence center concept discussed in the article "Nuclear Firepower" in the July 1965 issue of **ARTILLERY TRENDS.**

If these two recommendations by the School are improved for implementation, it is considered that the effectiveness of the artillery's target acquisition capability would be greatly enhanced.

EMPLOYMENT OF THE HONEST JOHN IN A CONVENTIONAL WAR

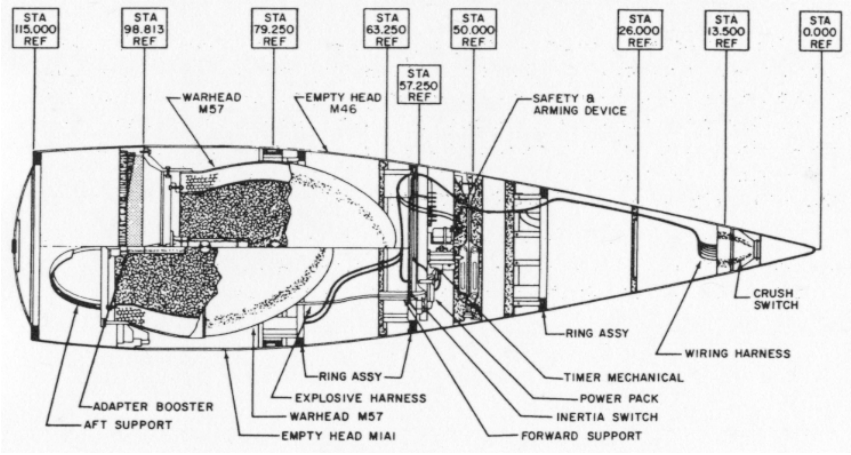


Figure 1. Cutaway view M57 HE warhead.

GENERAL

The employment of the Honest John in a nuclear war has overshadowed its capability for providing fire support in a conventional war. In addition to its nuclear and chemical warheads, the Honest John has a high explosive warhead.

HIGH EXPLOSIVE WARHEAD M57

The high explosive warhead M57 (fig 1), commonly referred to as the NATO warhead, is designed to give the commander a nonnuclear capability against personnel and soft targets. It consists of approximately 170,000 preformed, spherical, steel pellets bonded in a plastic matrix, and sandwiched between two aluminum alloy shells. An explosive charge of approximately 412 pounds of composition B is contained within the inner shell. An explosive harness assembly connects the fuzing system to detonators in the rear of the explosive charge. The fuzing system permits only an impact burst.

SUITABLE TARGETS

The radius of effects of the M57 warhead gives it good casualty/damage results against large area type targets consisting of personnel and wheeled vehicles. Such targets would be reserve assembly areas behind the enemy's forward dispositions and generally out of range of all divisional tube artillery. These targets have a good vulnerability and a stay time in excess of the target acquisition-mission processing-HJ delivery time. An unclassified lethality table for the M57 has been developed for peacetime use in the U. S. Army Artillery and Missile School (fig 2).

PERSONNEL																		
Target diameter (M)		400						600						800				
Target posture		OFFENSE			DEFENSE			OFFENSE			DEFENSE			OFFENSE			DEFENSE	
Percent casualties		30	20	10	15	10	5	30	20	10	15	10	5	30	20	10	15	10	5
Range	8,000	1	-	-	1	-	-	1	-	-	1	-	-	2	1	-	2	1	-
	16,000	1	-	-	1	-	-	1	-	-	2	1	-	2	1	-	2	1	-
	24,000	2	1	-	2	1	-	2	1	-	2	1	-	3	2	1	3	2	1
	32,000	3	2	1	3	2	1	3	2	1	3	2	1	4	3	2	4	3	2

Figure 2. Lethality table for Honest John M57 HE warhead.

TARGET ACQUISITION AND INTELLIGENCE

The table and figures are unclassified and hypothetical. They are to be used for instructional purposes only.

Offensive Posture - First round - one half standing, one half prone; Subsequent rounds - All prone.

Defensive Posture - First round - one half prone, one half in foxholes; Subsequent rounds - all in foxholes.

Targets suitable for attack by HJ with the HE warhead are most likely to be acquired by intelligence agencies responsive to the division G2. These agencies include long range reconnaissance patrols, aerial surveillance, and AN/TPS-25 radar. Since the bulk of the target information will be collected and collated at division level, the target recognition will occur in the G2 element at the DTOC, specifically by the artillery intelligence officer of the FSCE. The artillery intelligence officer of the FSCE is responsible for the development of target intelligence from the mass of information available in the G2 element. He then passes this intelligence on potential nuclear and chemical targets to the "nuclear" target analysts in the FSCE.

TARGET ANALYSIS

The "nuclear" target analysts also analyze the target to determine its suitability for attack by HJ with the high explosive warhead. Targets which are obviously suited for attack by conventional tube artillery are sent to division artillery. Those targets suited for the air attack are given to the TASE. These elements then advise the Chief of the FSCE as to the effects of each weapon system on the target. The Chief of the

FSCE, within the authority delegated by the commander, then determines the best weapon/delivery means combination for the attack of the target.

EMPLOYMENT OF THE DIVISIONAL HONEST JOHN BATTALION

The divisional HJ Bn is habitually given the tactical mission of general support or general support reinforcing. Thus, its fires are immediately responsive to the division commander. Because of the great amount of firepower available with the HJ warheads, the division commander has a readily responsive system with which he can influence the action within his area of responsibility. The firing batteries of the HJ Bn are positioned by the Chief, FSCE, in coordination with the division artillery S3, within the authority delegated by the division artillery commander. Communications between the FSCE and the HJ Bn are maintained over both the division artillery C/FD (FM) and the C/FD (AM) nets. The C/FD (AM) net is not only the "nuclear" net, but also should and could be used for all HJ missions (nuclear, chemical and HE).

ASSIGNMENT OF WARHEADS

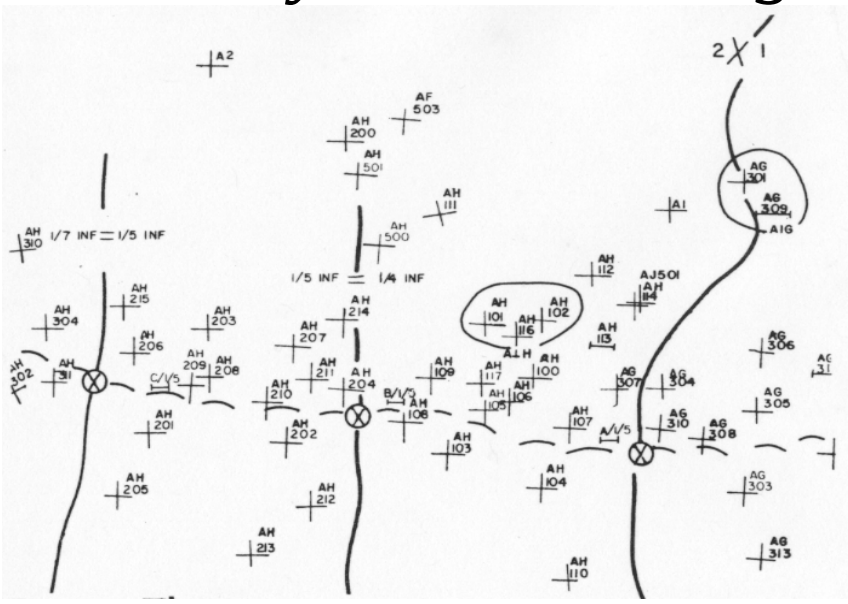
Because of the low density, the HJ round with the HE warhead will be assigned from field army to corps and then to division. Further assignment within the division could be made to brigade in unusual tactical situations; for example, where the brigade is on an independent mission with an HJ unit assigned a tactical mission of general support reinforcing or reinforcing the artillery unit in direct support of the brigade. However, in normal situations, it would be illogical to make an assignment of these rounds to brigade when command and control of the HJ Bn is at division level.

SUMMARY

The command and control procedures for the employment of the HJ with nuclear warheads are ideally suited and adaptable to the HJ with the high explosive warhead and in fact for all HJ warheads.

Commanders should realize that the Honest John is a good flexible weapon system that can provide varied responsive fire support in many types of warfare.

Artillery Fire Planning



From This . . .

Lt Col Walter L. Mayo, Jr
Tactics/Combined Arms Dept

TYPICAL FAMILIAR SCENE

Major Dash, the S3, had just finished his part of the briefing for Colonel Ruff, the brigade commander, on the plan for the attack tomorrow morning. Major Dash then introduced Captain Redleg, the artillery liaison officer of the direct support battalion, who briefed the commander on the fire support plan, the artillery organization for combat, and positioning. Captain Redleg then presented his piece de resistance, the artillery fire plan. Captain Redleg smiled inwardly as he thought to himself, "This should keep the old man happy." He knew that a lot of time and effort had gone into the preparation of this fire plan.

Every known and suspect enemy location was tick marked on the overlay of the graphical portion. In addition, there were concentrations on practically every hilltop, road junction, and landmark from the line of departure to and beyond the objective. Reflecting about the old days when concentrations were plotted as circles, he thought what a great "measle sheet" this would have been. After placing the overlay on the briefing map, he explained the fire plan to Colonel Ruff, pointing

out the scores of planned fires on the graphical portion and in the target list, the schedule of fires for the preparation, and the table of groups of fires on call. Colonel Ruff commented, "That's a damn fine plan you Redlegs have there, Captain. I can see that the artillery has done its homework in producing such a fine product."

MEASLE SHEET

Although the locale and participants may change, this same scene is re-enacted at division and corps levels. Not only the same scene but also the same information is repeated. Thus, each of the fire plans at the division and corps artillery levels has a graphical portion and a target list consisting of literally hundreds of concentrations. And if the corps commander looked carefully at his artillery fire plan, he would see that many of the concentrations were on targets such as platoon strong-points, machinegun nests, OP's, etc.

UNNECESSARY DUPLICATION

These are the same targets that were included in the artillery fire plan supporting Colonel Ruff's brigade. Furthermore, Captairr Redleg's direct support battalion S3 determined that all these targets were within range of his 155-mm batteries and that the maximum fire required to knock out the least vulnerable target would be two volleys from one battery. Yet these same targets were indiscriminately included in the division and, in turn, the corps artillery fire plans. Thus, the division and corps artillery fire plans have now reached such gross proportions that they are for all practical purposes completely unmanageable and useless except perhaps as historical (or hysterical) records.

WHAT HAPPENS AT ARTILLERY BATTALION LEVEL

Consider, for example, the S3 of the divisional 155-mm 8-inch battalion which has the mission of general support or general support-reinforcing. He receives the division artillery fire plan. He checks the graphical portion and orders his operations sergeant to copy it on acetate to put over the operations map. Quickly perusing the target list, he estimates that there are over 200 concentrations. That quick glance ends his consideration of the target list. He checks the schedule of fires for the counter-preparation, the programs of fire, and the table of groups of fires on call. The 50 concentrations assigned to his unit are plotted on the firing chart, current firing data are obtained, and the concentrations are assigned to the firing batteries. As for the other 150 concentrations on the target list within range, the S3 knows it would be impossible to plot all of these on the firing chart or to keep current firing data on all of them. And, if he had sufficient time to reflect, he might mentally challenge the value of such a list.

PARKINSON'S LAW

How did we in the artillery ever get ourselves saddled with this SIW (self-inflicted work)? Does a huge "measle sheet" really mean that the supported force is going to receive a greater amount of more responsive fire support? Who sold the supported force commanders on the idea that the more concentrations we had on a map, the better the artillery was doing its job? Is this present system really timely, workable, and humanly feasible? Does either the division artillery or the corps artillery need a list of concentrations on targets such as a machinegun, recoilless rifle, platoon strongpoint, etc., particularly since the S3 of the direct support artillery battalion is not going to fire more than two battery volleys on them? Do we need to plot every road junction, bridge, and hilltop in the sector? Are all these concentrations Plotted on the overlays of the liaison officers and FO's before the attack? Is this present system dictated by doctrine in any of the manuals? I think most of us agree that we have been the victims of a "topsy-like" growth, Parkinson's law, and self-hypnosis. We have created and have been selling a glittering but spurious product.

DOCTRINE

Let us consider information published in FM 6-20-2, Field Artillery Techniques, dated January 1962, with change 1, dated 3 January 1963. In paragraph 94 of this manual is a discussion of the procedure for artillery fire planning. Subparagraph 94f specifies, "Depending on the situation, fire planning may vary from the checking of direct support battalion fire plans in a rapidly moving situation to the preparation of the complete and highly detailed plans required in the attack of a fortified position." The paragraph continues, "Fire plans of direct support artillery are augmented **when necessary** by general support and reinforcing fires and integrated with the fire plan of the division artillery." The manual, then, is not dictatorial, but permissive, as any good manual on tactics should be.

NORMAL SITUATION

Thus, fire planning depends upon the situation. And since tacticians have a proclivity toward basing plans on the normal, usual, or general type of situation, what should be the **normal** fire plan techniques? What would be the average number of targets in a DS battalion and division artillery fire plan? The number of concentrations plotted by each echelon in the following example is intended only as a representative illustration. While this discussion is primarily related to the present manual system of fire planning, it inherently considers the application of FADAC in the solution of technical firing data. For example, even FADAC is limited in its memory capacity for the cannon program to 88 targets. Consider a tactical situation with a division on line preparing for an attack. Two brigades are up and one is in reserve. The 1st Brigade has three battalion-size task forces, two up and one back. The 2d Brigade has three battalions up and one back. This brigade is going to make the main effort. Each of the task forces has two companies up and one back.

DS ARTILLERY BATTALION

The artillery battalion in direct support of the 2d Brigade then has six FO's on line. Assume that there are 12 targets located in the zone of each company. Of these 12 targets, some will be planned for attack by the recoilless rifles and 81-mm mortars of the company and the 4.2-inch mortar platoon of the battalion. Let us assume that the FO ends up with 5 of these 12 targets. This makes a total of 30 for the FO's on line. Crank in an additional 30 targets from the three artillery liaison officers with the battalions on line, to include perhaps 5 concentrations scheduled or on call by the 4.2-inch mortar platoon, 5 generated by the DS artillery battalion S2, 5 from the brigade FSCC, and 5 sent down from division artillery.

Let us say then that the direct support artillery battalion now has 60 concentrations to be planned. Some will be scheduled for the preparation; some will be placed on call, and firing data will be kept current; and others will be placed on call, but current firing data will not be computed. The S3 assigns concentrations to the schedule of fires, to the table of groups of fires on call, and perhaps to a series of fires. Concentrations have been continuously assigned to programs of fire. He determines the number of fire units, volleys, and fuze and shell combinations for these assigned concentrations. Those targets (10, perhaps) which are out of range or on which additional fires are needed are sent to division artillery with a request that the targets be scheduled or placed on call. When the fire plan is completed, it is sent to the brigade for approval. Copies are dispatched to division artillery and the liaison officers. The liaison officers in turn notify each FO of the concentrations planned in his sector. Each FO plots these concentrations on his map overlay. Additional overlays are given to the company commander, platoon leaders, and mortar observers to enable them to call for fires in emergencies.

The S3 now determines on which of the 50 concentrations he needs to keep current firing data. He realizes that he must keep data current on those concentrations on which immediate fire for effect might be requested. He therefore selects those concentrations which are in the table of groups of fires on call, in the programs of fires, and, in a defensive situation, in the schedule of fires for the counterpreparation and the barrages. (Current firing data need not be kept on those concentrations for which a definite time for firing has been established or will be established sufficiently in advance to compute the data, such as preparations, H&I fires, etc.)

COMPLETED

With a sigh of relief, the S3 takes a long drag on his 50th cigarette; the fire plan is momentarily completed. Whereupon a messenger from division artillery arrives with the division artillery fire plan. A careful check of both the battalion and the division artillery fire plans reveals that the prior coordination was effective. Division artillery honored the battalion's requests, and the battalion fire plan includes all

those concentrations assigned to them by division artillery as well as those concentrations short of the no-fire line (NFL) on which division artillery had planned to fire.

DIVISION ARTILLERY

While the DS artillery battalions were developing their fire plans, the division artillery S3 was busy on his. The S2 picked up 20 targets of concern to the division. Corps artillery sent 15 concentrations down. The division FSCE forwarded 10 more, and each DS battalion requested division artillery to plan 10 consecrations in its sector.

The division artillery S2 analyzes the targets and recommends the relative priority for attack. Targets such as a machinegun position, a recoilless rifle, and a platoon strongpoint, which are not capable of even limited interference with the division level plan of maneuver are sent down to the S2 of the DS artillery battalion concerned. Targets which are out of range or on which division artillery needs, or envisions the need for, additional fire support are sent to corps artillery. Targets short of the no-fire line are coordinated with the DS artillery battalion. Targets obviously unsuited for artillery attack are sent to the division FSCE for possible attack by other fire support means.

The division artillery S3 goes through the same basic procedures as the DS artillery battalion S3 in preparing his fire plan. Upon completion, a copy of the plan is sent to division for approval. Additional copies are sent to all subordinate and adjacent units and to the next higher artillery echelon. Upon receipt of the DS artillery fire plans, the division artillery S3 checks them to insure completeness, to eliminate duplications, and to reconcile conflicts. His efforts in these fields should be minimal, since integration and coordination will have been effected during the concurrent planning.

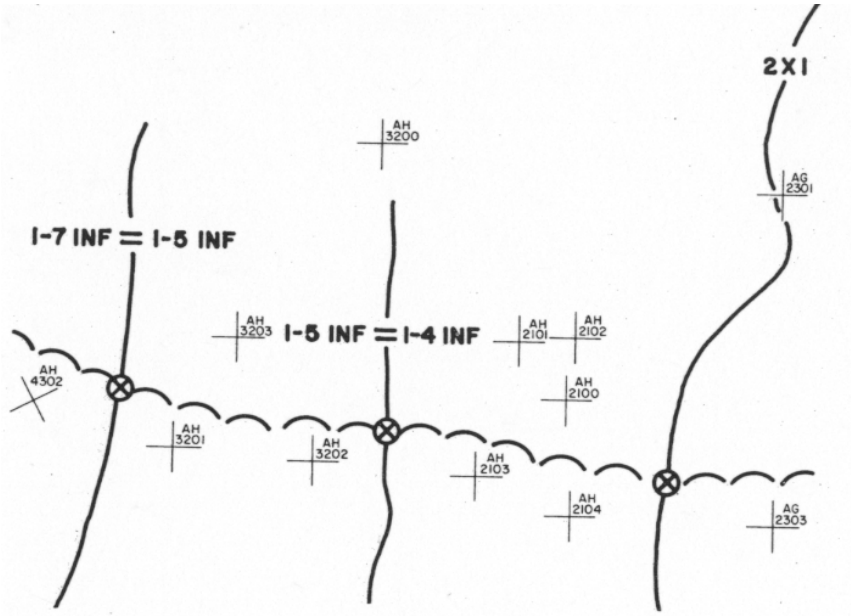
REQUIREMENTS

The method of fire planning illustrated above meets the following requirements:

- To the extent possible, fires are planned as requested by the lower echelons.
- The requirements of the supported force and higher echelons are accepted and included in the plan as they are received.
- The next higher artillery echelon supplements the fires of lower echelons.
- Lower artillery echelons request the next higher artillery echelon to plan fires on targets which are beyond the capabilities of weapons at the lower echelons.
- Higher artillery echelons may direct lower artillery echelons to plan fires on targets critical to the force as a whole.
- The fire plans of the lower echelons are augmented (but not **duplicated**) by the fire plan of the higher echelon.
- Economy of effort and timeliness in the production of fire plans are accomplished.

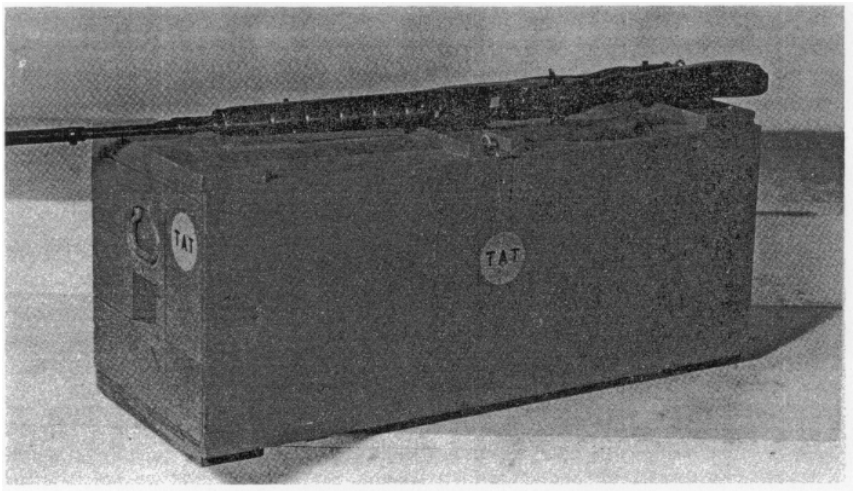
LEAN AND MEAN

We have always had a good basic product to sell—artillery support. Unfortunately, through the years the formal artillery fire plan has been festooned with costly time-consuming gimcracks. It's about time we stripped off the chrome, streamlined the old machine, and geared it up to meet the demands of modern warfare.



. . . To This.

ARSTRIKE Book Box



Lieutenant Colonel Charles M. Hunter
Formally with
HQ, 6th Battalion, 27th Artillery
APO San Francisco 96307

From battery to brigade a common problem exists in determining how to store and transport all the publications necessary in the employment of modern artillery. In garrison, these regulations, circulars, and manuals are normally filed in glass-front bookcases which are neat; functional, and readily available. The major drawback to the use of these glass-front bookcases is that they are completely unsuitable for, and usually unavailable to, units engaged in field operations. The one-drawer filing cabinet is equally unsuitable for the needs of a tactical unit. It is true that these filing cabinets are compact, mobile, and sturdy; however, they do not facilitate the ready filing and locating of file folders or binders.

Movement of publications creates another problem. In preparation for CONUS field exercises, staff officers and NCO's normally select the publications which they anticipate they will require, pack them in a box, and are in business upon arrival in the field. For the unit alerted for oversea assignment, transportation of the necessary publications is not so simple. Special containers must be built for shipping the publications to the unit's new location. Current directives authorize the installation packing and crating shop to build whatever number of wooden boxes the alerted organization requests.

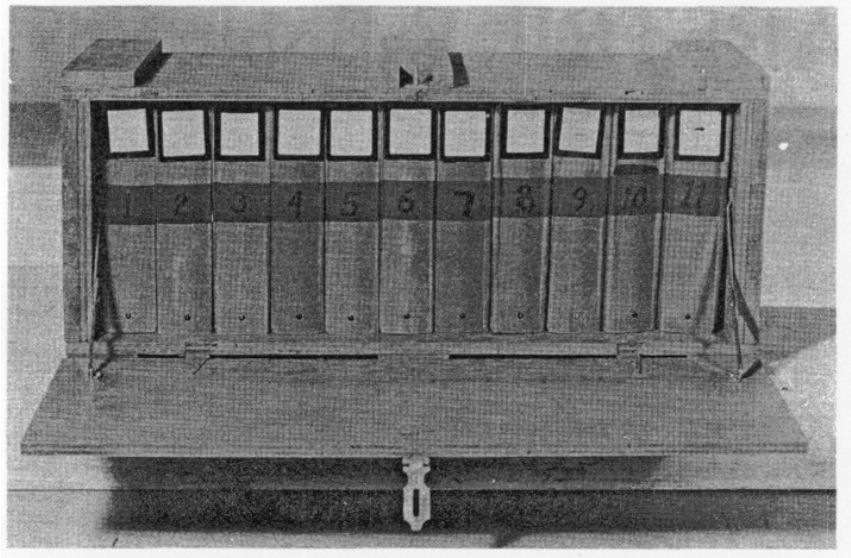


Figure 1. ARSTRIKE Book Box Opened

There is, however, a better solution to this problem of storing for units moving overseas. This solution is the ARSTRIKE Book Box. The Book Box satisifes the requirements of CONUS units participating in field exercises, and also appears to be well suited for use by Reserve units in transporting the necessary publications to summer encampments or to active duty. The design feature which makes the ARSTRIKE Book Box unique is that the boxes can be stacked one on top of another. The box opens from the side and across the top, as shown in figure 1. At the bottom of the box is a row of three cleats, which function as "spreaders." The lid has two hinges on one side, a center locking hasp on the other, and an inside restraint at each end so that its lid can be opened to form a writing ledge. In this respect the box is similar to the old desks of New England.

The ARSTRIKE Book Box is constructed of ¾-inch plywood. The exterior is painted gray to harmonize with other government issue office furniture. The carrying handles are attached at each end of the box in order to expedite "move out." To close station, march order, the clerk needs only to close and secure the front lid of the box. Two men can lift the top box off the stack and carry it out. In building an ARSTRIKE Book Box, each handle should be constructed so that it is large enough to accommodate a gloved hand.

The number of ARSTRIKE Book Boxes required within a unit will naturally depend upon the type of unit. An 8-inch howitzer battalion could effectively use 44 boxes. Figure 3 shows the suggested distribution of boxes within a battalion. Many activities within the battalion

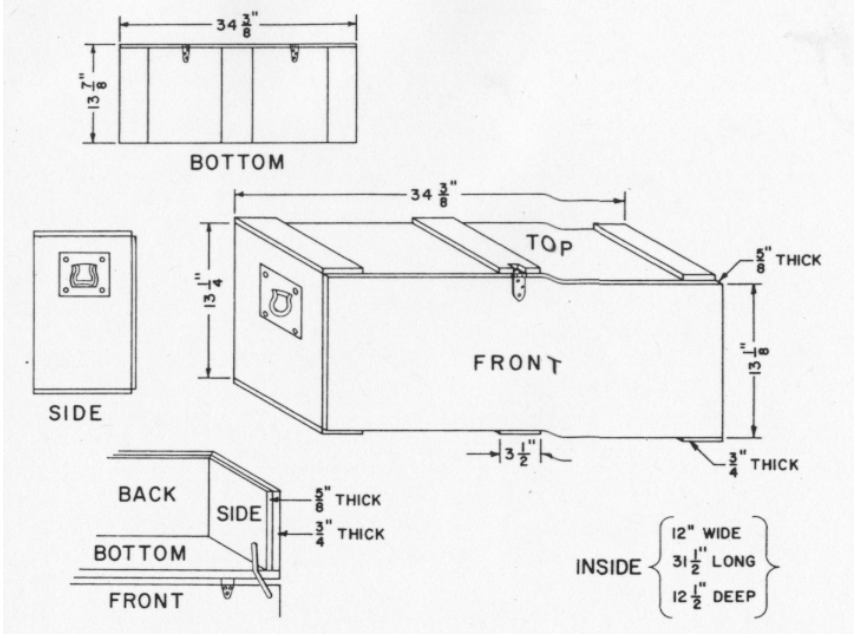


Figure 2. Schematic Of ARSTRIKE Book Box

such as maintenance sections, would be allocated only ARSTRIKE boxes; under normal supply procedures they would receive glass-front bookcases.

If your unit has a mission that requires you to "move out", the ARSTRIKE Book Box may be the answer to your problem of storing and transporting publications.

The concept of the ARSTRIKE Book Box has been submitted by the author under the Army Incentive Awards program. The suggestion is now being evaluated by the U. S. Army Test and Evaluation Command.

Headquarters and Headquarters Battery

1.	Adjutant/Sergeant Major	2
2.	Intelligence Officer (S2)	1
3.	Operations Officer (S3)	3
4.	Survey Section	1
5.	Wire Section	1
6.	Radio Section	3
7.	Battery Headquarters (1st Sgt)	1
8.	Battery Maintenance Section	2
9.	Battery Supply Section	1
10.	Battery Training Section	2
	Total	17

Firing Batteries

1.	Battery Headquarters (1st Sgt)	1
2.	Battery Maintenance Section	1
3.	Battery Supply Section	1
4.	Battery Training Section	2
	Total	5

Service Battery

1.	Battalion Supply Office (S4)	5
2.	Battalion Maintenance Office	1
3.	Battalion Personnel Office	2
4.	Battery Headquarters (1st Sgt)	1
5.	Battery Maintenance Section	1
6.	Battery Supply Section	1
7.	Battery Training Section	1
	Total	12

Figure 3. Distribution of ARSTRIKE Book Boxes within a battalion.

MOS Evaluation System And *YOU*

By Maj R. M. Balzhiser
Target Acquisition Dept

The MOS (military occupational specialty) evaluation system is a valuable aid to the unit commander and is of vital importance to each soldier who participates in the system. It aids the commander by providing an incentive to each soldier to become more proficient at his job and by providing to the commander a report on the proficiency of each soldier in relation to the proficiency of others in his MOS code. The MOS evaluation system is important to the soldier because it can affect his assignment, his promotion, and his pay. In spite of the importance of the MOS evaluation system, it is little understood by both commanders and soldiers. Detailed requirements for operation of the MOS evaluation system are contained in AR 600-200. However, this regulation does not discuss some of the inner workings of the system and does not point out the relation of the system to daily operations at unit level. This article will explain the MOS evaluation system for artillery specialties to include the role of the U. S. Army Artillery and Missile School (USAAMS) in the system, the manner in which test materials are developed, the significance of test scores, and the responsibilities assigned and advantages that accrue to the individual and to the unit commander.

Who is Eligible?

All soldiers who are in pay grade E3 or above and who have 24 months of active duty (18 months for RA personnel with a total commitment of at least 4 years' service) are subject to MOS evaluation. Each eligible soldier is tested annually in his primary MOS (PMOS) and every other year, alternately, in his secondary MOS (SMOS) and additional MOS (AMOS). Sergeants major are not required to take the MOS evaluation test after initial verification of their MOS, unless they desire to compete for superior performance pay in the PMOS.

How Does the System Work?

The Enlisted Evaluation Center (EEC) at Fort Benjamin Harrison, Indiana, is responsible to the Deputy Chief of Staff, Personnel, for operation of the MOS evaluation system. The MOS evaluation test is prepared each year by the responsible service school, under the supervision of the EEC. First, the test outline is prepared for each skill level in the

MOS. This is a detailed breakdown of the skills and knowledges listed for the particular MOS code in AR 611-201. Based on the relative importance and complexity of the various subareas of the MOS, the outline indicates the number of questions that will be prepared for each subarea. For example, a test for cannoneers will probably contain some questions on communications, but it will contain more questions on howitzers than on communications.

The next step is preparation of the test questions and the reference list. Question writers are usually instructors assigned to the U. S. Army Artillery and Missile School who present instruction and prepare School examinations in the area being tested. The test questions are based on DA publications, not on School reference material. The question writer has available to him a statistical analysis of each question used in the previous year's test. Using these analyses, he can improve the question used the previous year or he can write new questions. When the questions have been written, the question writer prepares the reference list from the reference listed on the file card for each question. Each reference listed on the reference list must be used for at least five questions. This restriction reduces the number of references the individual must study to prepare for the MOS evaluation test.

The EEC prepares the MOS Test Aid from the information provided by USAAMS. The MOS Test Aid is issued to each individual as a study guide and can help the individual being tested by pointing out the specific references that were used in preparing the test questions. The test outline, except for the number of questions allocated to each subarea, is printed in the MOS Test Aid. Specific references to chapters or sections of manuals are listed in the MOS Test Aid for each subarea of the MOS.

The EEC prepares the MOS Test Booklet by selecting 50 percent of the test questions prepared by USAAMS.

After the MOS evaluation test is administered and scored, the raw scores are converted into Army standard scores. An Army standard score is similar to "grading on a curve." The individual's score indicates his position relative to that of all others who took the test. The average is 100; therefore, one-half of the soldiers in each MOS code will score above 100. All scoring and administration is handled by the EEC. The individual's test score is averaged with his CER (commander's evaluation report) score to arrive at his MOS evaluation score. The relative weights assigned to the test and to the CER are not available, even to the USAAMS staff. While reading the discussion that follows, remember that three scores are involved: the test score, the CER score, and the MOS evaluation score, which is an average of the other two. The only score available to the individual and to his commander is the overall score—the MOS evaluation score.

There is one exception to the use of the normal Army standard score in connection with the test score. In a normal distribution, approximately 7 percent of those taking the test would score below an

Army standard score of 70. The use of an Army standard score, without modification, would mean that every year 7 percent of the personnel in each skill level in each MOS would be below acceptable standards. This would be extremely undesirable. The number of unqualified personnel in each MOS code will vary, because people vary and MOS requirements vary. The Army standard score must be adjusted. The minimum number of questions which must be answered correctly to attain a passing score (70) on the test is recommended by USAAMS to the EEC. This recommendation is established by the responsible USAAMS department, based on an analysis of the number of questions correctly answered by each individual in the previous year's test and the difficulty of the current test compared to that of the previous year's test. Those individuals who do not know enough about their MOS to answer the minimum number of questions will receive a test score below 70.

The Multiple Hurdle Concept

A recent addition to the MOS evaluation system is the multiple hurdle concept. Previously, a man could score extremely low on his MOS test and still verify his MOS if he received an exceptionally high CER score. Under the multiple hurdle concept, a minimum qualifying score is established (by the EEC or DA) for the MOS test and for the CER. An individual who fails to attain both of these minimum scores will receive an MOS evaluation score of 40. The minimum MOS score should not be confused with the raw MOS test score which is equated to a standard score of 70, as dicussed in the preceding paragraph. A soldier can attain the minimum score on both the MOS test and the CER and still fail to verify his MOS, if the weighted average of his test score and his CER score is below 70.

MOS Evaluation Data Report—Aid for Everyone

An MOS evaluation data report is forwarded to each individual through his unit commander. It contains information of value to the individual and to the commander. It contains the individual's MOS evaluation score; that is, the composite, weighted average of his MOS test score and his CER score. It also contains an evaluation of the individual's performance (in relation to that of all others who took the test in his MOS code) in each of the major subareas of the MOS. This evaluation indicates to the individual (and to the commander) the areas in which additional study is required. Although the MOS test score and the CER score are not shown in the MOS evaluation data report, a careful analysis of the performance of an individual in the subareas of the MOS in comparison with the MOS evaluation score may indicate the general level of the CER score. For example, if an individual scored above average in each subarea of the MOS, but received an MOS evaluation score of 90 (10 points below average), he must have received a below-average CER score. The unit commander may learn something about the effectiveness of his unit training program by analyzing the individual reports of all personnel with a particular MOS code in his unit. For example, if all the section chiefs in a unit scored below average in communications, the unit commander can improve the proficiency of his unit and assist his section chiefs by increasing emphasis on communications in his unit training program.

Let's examine the significance of the MOS evaluation score. A soldier must attain a score of at least 70 to verify his MOS. If he fails to verify his MOS, reclassification is at the discretion of his commander. If he fails twice, consecutively, to verify his PMOS, reclassification is mandatory. This means that individuals who are not qualified in their MOS code may be reclassified to a lower skill level in their MOS, which would probably mean a reduction in grade.

Evaluation Score and Promotion

To be eligible for promotion, a soldier must attain an MOS evaluation score of 110. Because this is an Army standard score, approximately one-third of the personnel in each skill level in each MOS will attain a score of 110.

Proficiency Pay

Eligibility for proficiency pay (pro pay) is also established by the MOS evaluation score. (After eligibility for a specific MOS is established, the individual's commander is the final authority in deciding if pro pay will be awarded. The commander's decision may be favorably influenced by a high MOS evaluation score and by above-average performance in the subareas of the MOS.) In MOS's designated for specialty pay, eligibility is established by verifying the individual's MOS (attaining an MOS evaluation score of 70). In MOS's not designated for specialty pay, provision is made for superior performance pay. In combat MOS's, an average of 20 percent of the personnel will be eligible for superior performance pay; in noncombat MOS's, an average of 5 percent. This does not mean that in each combat MOS 20 percent of the personnel will draw superior performance pay. For each skill level of an MOS authorized superior performance pay, DA determines the percentage of personnel that will draw superior performance pay. This percentage is based on several factors, including retention rates and training time. If a particular MOS involves long, expensive training at government expense and a large number of personnel in this MOS are not reenlisting, the Army will encourage reenlistment in this MOS by authorizing a larger percentage to receive superior performance pay. In such an instance, the cutoff score for superior performance pay in each MOS code is established to pass the percentage of personnel selected by DA.

Responsibilities

The regulation covering the MOS evaluation system spells out specific responsibilities of the unit commander and of each individual who is subject to MOS evaluation. The unit commander is responsible for establishing on-the-job training and self-study groups to assist his personnel in preparing for annual testing. He should also insure that references listed in the MOS Test Aids are available in the unit for each MOS assigned in his unit. Each individual is required to maintain proficiency **in all duty positions** for his PMOS and for his secondary and

additional MOS's. The Nonresident Instruction Department, USAAMS, has two types of instructional material available which will assist in meeting these responsibilities—unit training packets to assist the unit commander in his training program and extension courses to assist the individual in maintaining proficiency in his MOS.

What are the advantages of the MOS evaluation system?

For the individual. The annual examination and its attendant rewards provide an incentive to the individual to increase his knowledge of and become more proficient in his job. The MOS evaluation test allows the individual to compete on an Army-wide basis with all others in his MOS code and to have his performance evaluated objectively. He is furnished with an evaluation of his ability in each major subarea of the MOS. He is assured that merit is recognized, because those soldiers who attain an MOS evaluation score of 110 are eligible for promotion. In addition, proficiency in an MOS is rewarded with specialty pay or superior performance pay.

For the unit commander and the Army. Objective evaluation of individual proficiency in an MOS on an Army-wide basis and provisions for rewarding the most proficient personnel encourage competent individuals to remain in the service. As individual proficiency is increased through continuing study, unit proficiency is also increased. The information provided to the unit commander concerning each individual's performance is a valuable aid in making personnel decisions and in planning unit training.

Every soldier subject to MOS evaluation and every commander who understands his responsibilities in connection with the system and knows the advantages available to him from the operation of the system can make it work for him.

SAMPLE FIRE REQUEST

Work on the standardization of artillery fire direction procedures and terminology was completed in July 1966 with the termination of the fourth meeting of the Quadripartite Ad Hoc Working Group on Artillery Fire Direction. Attending the meeting held at Fort Sill, Oklahoma, were representatives of the Australian, British, Canadian and United States Armies.

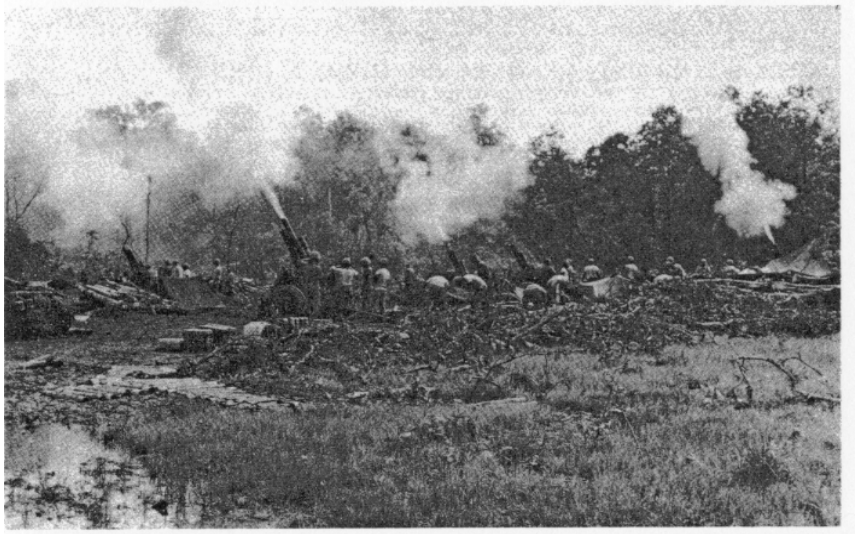
Subsequent to this meeting, the impending changes to the field artillery forward observer's call for fire, subsequent corrections, and the radio telephone procedure for the conduct of fire were incorporated into Training Circular 6-1, dated 1 September 1966. The following sample fire request was extracted from this circular.

Observer to FDC:	BAR BELL 18, THIS BAR BELL 25, FIRE MISSION, OVER.
FDC to observer:	BAR BELL 25, THIS BAR BELL 18, SEND YOUR MISSION, OUT.
Observer to FDC:	GRID 314627, DIRECTION 2100, MACHINEGUNS FIRING, TIME, ADJUST FIRE, OVER.
FDC to observer:	*Repeats back the message, terminates with OUT, and after the fire order is issued transmits: BATTALION, 2 ROUNDS, TARGET AB402, OVER.
Observer to FDC:	BATTALION, 2 ROUNDS, TARGET AB402, OUT.
FDC to observer:	SHOT, OVER.
Observer to FDC:	SHOT, OUT.
Observer's spotting—	AIR, DOUBTFUL, 100 RIGHT.
Observer to FDC:	LEFT 200, OVER.
FDC to observer:	LEFT 200, OUT. — — —, SHOT, OVER.
Observer to FDC:	SHOT, OUT.
Observer's spotting—	AIR, OVER, 10 LEFT.
Observer to FDC:	RIGHT 20, DROP 400, OVER.
FDC to observer:	RIGHT 20, DROP 400, OUT. — — —, SHOT, OVER.
Observer to FDC:	SHOT, OUT.
Observer's spotting—	MIXED, SHORT, LINE.
Observer to FDC:	ADD 200, UP 20, OVER.
FDC to observer:	ADD 200, UP 20, OUT. — — —, SHOT, OVER.
Observer to FDC:	SHOT, OUT.
Observer's spotting—	AIR, OVER, 5 RIGHT.
Observer to FDC:	DROP 100, OVER.

Note. Observer elects to ignore small deviation, since he is able to obtain a range spotting.

FDC to observer:	DROP 100, OUT. — — —, SHOT, OVER.
Observer to FDC:	SHOT, OUT.
Observer's spotting—	AIR, RANGE CORRECT, LINE.
Observer to FDC:	FIRE FOR EFFECT, OVER.
FDC to observer:	FIRE FOR EFFECT, OUT. — — —, SHOT, OVER.
Observer to FDC:	SHOT, OUT.
FDC to observer:	ROUNDS COMPLETE, OVER.
Observer to FDC:	ROUNDS COMPLETE, OUT. — — —, END OF MISSION, MACHINEGUNS SILENCED, OVER.
FDC to observer:	END OF MISSION, MACHINEGUNS SILENCED, TARGET AB402, OUT.

Lessons Learned in Vietnam



The following material finds its origin in two sources: first, information extracted by the U.S. Army Artillery and Missile School from correspondence which has passed between U.S. Artillery Units in Vietnam and USAAMS, and second, efforts by departments of the School to solve problems experienced by units in Vietnam.

6400-MIL TRAVERSE FOR THE 175-MM GUN AND 8-IN HOWITZER

The following was received from a Battery Commander stationed in Vietnam with the 6th Battalion, 14th Artillery:

My 175mm self-propelled battery is now stationed in Vietnam in general support of the 1st Cavalry Division (Airmobile). We were plagued by sudden fire missions, both day and night, necessitating faster than normal shifts. To accomplish this we have done the following: taken two 105 ammo box rods and welded a fork in one of them. A set is then used in tandem with a cylinder placed between and pointing toward the center of a circle in which the gun is positioned. Since the M110 and M107 have 533 mils right and left traverse, we have placed the stakes out every 400 mils whenever practical. A one inch white stripe is painted on the gun deck directly from the driver's hatch to the front. The driver has merely to aline this stripe on the appropriate marker when announced by the Battery Executive Officer. At night a flashlight is placed in the rear of the cylinder, which has the forward end crimped vertically. The driver then alines his weapon on this beam of light. If an odd azimuth is ordered, such as 4750, then the Chief of Section merely has to estimate its location and, using the removable

cylinder in his hands, directs the gun in. This may cause an error, however the speed of laying offsets this slight error in that the turret can still traverse to correct firing azimuth. At a later time the gun could be relayed so that the tube is in center of traverse. The light is very effective and does not violate light discipline. We have found that the M110, 8 inch howitzer, can relay within 100 mils in under 3 minutes with the M107, 175mm gun, utilizing only an additional couple of minutes to lock down the tube. This time includes laying of the piece, however is not inclusive of aiming post placement or infinity collimator positioning.

We have also found that constant swabbing of the bores in the M107 and M110 have caused the turret ring to be a "catch-all" for the dirt and residue. This tends to reduce the effectiveness of the protective coating of sealing grease applied to the ring. We have removed the bolts and plates on the top rear of the turret ring assembly and installed a 24 inch square piece of canvas. The plate and bolts are reinstalled allowing the canvas to fall over the ring and covering it. The canvas does not interfere in any way with normal operation of the weapon system.

FIRING PROCEDURES IN THE PADDIES

The initial portion of the fire order to the firing battery has been modified because of the 6,400-mil requirement. The azimuth to the nearest 100 mils is given as the second element of the fire command; for example, BATTERY ADJUST, AZIMUTH 2400. Each section has azimuth stakes every 1,600 mils. All weapons not already engaged in another mission are shifted to the center of traverse and to the announced azimuth. This fast shifting of trails has long been practiced by 105-mm howitzer units; however, for the 155-mm howitzer units, this has not been a simple problem. The solution is to fabricate a pivot for use underneath the bottom carriage of the 155-mm howitzer at the center of gravity. By lowering the howitzer onto the pivot by use of the firing jack, only two men are required to traverse the weapon. (See "Speed-shifting the 155-mm Howitzer", page 17). Two pairs of aiming posts or a combination of one pair of posts and a collimator are used to insure that at least one set of posts is always visible.

The cannon are placed on the ground in a star-, H-, or diamond-shaped formation to achieve generally uniform area coverage in any direction.

The observers on the ground depend on those in the air and vice versa. In jungle operations, the ground observer may not be able to see beyond 50 meters, and his field of vision may contain no terrain features identifiable on a map. Therefore, coordination between the air and ground observers must be closer than is normally necessary. The air observer must keep track of the infantry and the ground FO. He relays the missions and adjusts fires by "creeping" toward the FO, if necessary. When the FO can hear the rounds, he makes a "by sound" adjustment to the desired location. If there is no air observer available, the first rounds in adjustment are time-fuzed WP, a combination which

is acceptable for the 155-mm weapons and authorized on a combat emergency basis for the 105-mm weapons. After the observer sees the WP airbursts, HE shell is used; then rounds are sound adjusted again, if necessary. Fuze delay has been very effective in penetrating jungle canopies.

Metro support is not always available for batteries operating separately, but the weather is generally seasonably stable. For this reason, a GFT setting based on experience factors is often a key to more accurate fires.

Ingenuity in overcoming unusual obstacles to effective fire is as important as it ever was. Fortunately, from after-action reports received from artillery units in Vietnam, there seems to be no shortage of this ingenuity or of professional know-how in these units.

VEHICLE RECOVERY OPERATIONS

The most common vehicle problem encountered with vehicles in Vietnam has been that of vehicle recovery. This is due primarily to the long rainy seasons, the soft soil texture, and the high water table prevalent in that region. In many areas, it is inadvisable for vehicles to leave the roads; however, military operations often demand that they do. Ground which appears to be hard often will not even support a ¼-ton vehicle. At other times, the third or fourth vehicle of a column will sink into the mud, stopping the column and causing the remaining vehicles to become immobilized. The many high, steep-banked, narrow, and sharply crowned roads which wind through the small villages and swampy rice paddies of Vietnam are also contributing factors to the problem of vehicle recovery.

Because these roads become very slippery within minutes after a rain begins, the most common recovery operation is that of recovering a vehicle which has skidded off the road into a ditch. Such recovery can be accomplished by either of two methods—by towing or by winching. Recovery by towing is the preferred method because it is usually faster and simpler depending, of course, on the relative sizes of the vehicles involved. If the towed vehicle is smaller than the vehicle towing it, the operation is usually short and successful. If the immobilized vehicle is larger than the towing vehicle, the winching recovery method must be used. In Vietnam the use of a deadman is normally impractical because the soil will not hold, and the trees are not large enough to use as anchors. Therefore, the use of one or more vehicles as an anchor has proved to be the best method for winching operations. The most important aspect in this connection is that drivers must be properly trained in winching operations, to include the rigging of a snatch block and the use of a deadman as an anchor, when practical.

For towing operations, each vehicle should be equipped with a tow chain or improvised tow line. Drivers must be trained in the use of tow chains or lines with snatch blocks and in the specific procedures for pulling a vehicle back onto a narrow, slippery, dikelike road.

The tank recovery vehicle (TRV) is too heavy for most bridges in

Vietnam. However, since most terrain obstacles in Vietnam have been overcome through the imaginative, aggressive reconnaissance and action of the battalions involved, the heavy battalions in particular like to have the TRV available in the event that it might possibly be used in some recovery operation.

In some cases, the CH-47 helicopter has been used for recovery operations with the helicopter towing or lifting the immobilized vehicle to firm ground.

Another vehicle problem in Vietnam is that of vehicle maintenance. Because of the prevailing conditions of soil and climate, special care must be taken to insure that vehicles are not damaged by dust, moisture, or sand and mud. Special care must therefore be given to the following areas of maintenance:

Air cleaners and fuel filters must be cleaned daily. Vehicles must be lubricated weekly.

Vehicle wheel cylinders must be cleaned frequently to prevent condensation and rust which will cause the wheel brake cylinders to lock. Cleaning of wheel cylinders during scheduled maintenance is normally sufficient. However, periodic checks should be made during periods of inactivity.

Wheels should be removed and brake linings should be cleaned frequently to prevent sand and mud damage to the vehicle brake system. This should be done more frequently than the periodic inspection.

A 50-weight oil should be used in generators instead of the 30-weight oil which is too light for the hot climate in Vietnam.

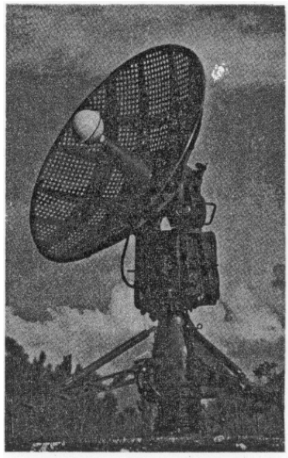


Figure 1. Rawin Set

IMPROVED PIBAL METRO DATA FOR VIETNAM

Because a considerable number of visual metro flights are being conducted by metro sections in Vietnam, it is believed that the procedure used for such flights in Korea during 1952 and 1953 might also be used to advantage in Vietnam; therefore the following procedure is recommended:

Issue pilot balloon observation (PIBAL) teams adiabatic-type Altitude-Pressure-Density Charts ML-574/UM. (These charts have been issued to the electronic metro sections in Vietnam.)

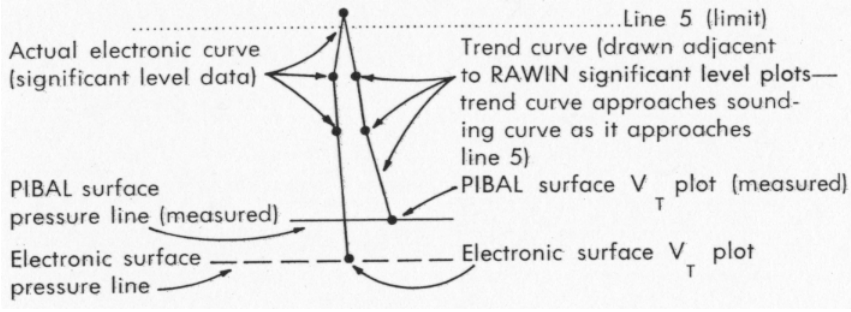
Establish communications between an electronic (rawinsonde) section and the PIBAL teams.

Coordinate to insure that both the electronic section and the PIBAL sections make metro observations simultaneously.

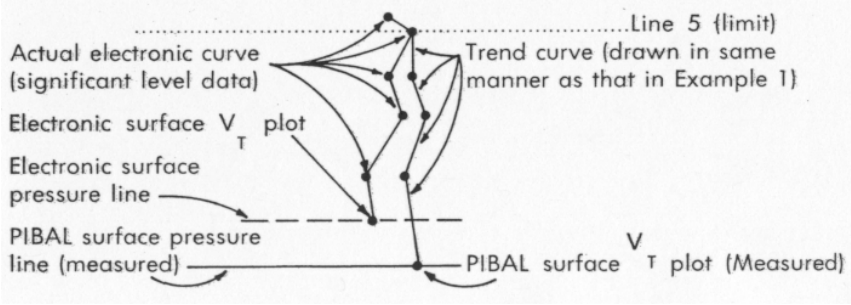
Have the PIBAL teams track the pilot balloon and measure winds in the normal manner to the maximum height possible, and have the electronic section measure winds in those zones which are beyond the capability of the PIBAL teams.

Plot on the chart ML-574/UM both the surface pressure and virtual temperature values determined by the PIBAL sections and the significant level data aloft obtained by the electronic section. Then draw a trend line from the PIBAL surface data to significant levels aloft, beginning with the first significant level plotted above the electronic station's meteorological datum plane (MDP).

Example 1. PIBAL station above electronic MDP.



Example 2. PIBAL station below electronic MDP.



It is recommended that the trend line be drawn to coincide with the electronic curve at line 5. It is below this level that major significant daily atmospheric changes occur. Early morning temperature inversions should be disregarded as they are not of significance when this procedure is used.

Caution: The limits of the NATO or computer metro message line 5 are always used as the limit for trending the PIBAL virtual temperature curve. Furthermore, the method of trending from the PIBAL measured V_T plot at surface to each of the significant levels aloft must be dictated by the prevailing changes in the atmosphere for the particular geographical area in which measurements are made. These changes can be determined by examining the temperature trends on rawinsonde observations taken in the area or by requesting the information from the Air Weather Service.

There are limitations to this system. The electronic station and PIBAL teams should be at approximately the same altitude, and they should not be separated by any large terrain features. Furthermore, they should not be separated by a distance greater than 25 miles unless stable atmospheric conditions prevail over a wide area.

Although these limitations are severe, situations may exist in Vietnam, as they did in Korea, in which this technique could be used. In such situations, better meteorological data can be obtained by using this method than that which can be obtained by PIBAL teams using the standard technique.

EMPLOYMENT OF COUNTERMORTAR RADAR AN/MPQ-4A

AN/MPQ-4 radars are being employed in Vietnam in static defense of certain locations and by direct support artillery battalions. The basic techniques of operation have not been changed; however, units in Vietnam report that operators arriving there from other units frequently have had too little practical experience in their units after graduating from radar school.

Of particular importance is experience in registration and adjustment of artillery and mortar fire. These are vital techniques and CONUS commanders should provide the personnel of their countermortar radar sections an opportunity for practical application of their training in this area.

The Viet Cong apparently have learned what the AN/MPQ-4 is, have determined its maximum range, and are able to detect when it is being operated. In one instance, after an AN/MPQ-4 had been installed at a particular location, the entire district experienced a sharp drop in mortar attacks.

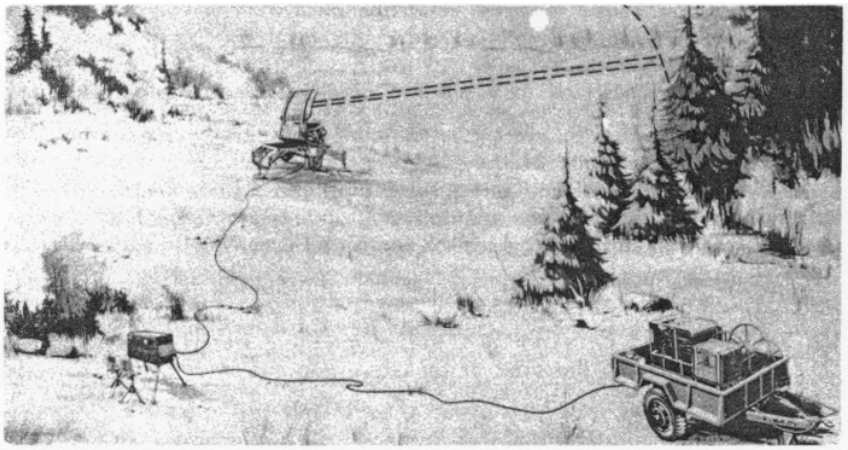


Figure 2. MPQ-4A Radar

However, the first night that the radar was nonoperational, there was a mortar attack in the district—the first in 2 weeks. The Viet Cong may have learned that the radar was not operating by determining that the generator, which was only 100 meters from a main highway, was not operating. Two nights later, simultaneous mortar attacks were launched against three outposts beyond the maximum range of the radar, which indicates that the Viet Cong have learned the maximum range of the radar.

In supporting Vietnamese units, radar sections must make some modifications of standard procedures. Some Vietnamese units orient on magnetic north rather than grid north; the radar section should then do the same. A member of the radar crew should be in the Vietnamese FDC to insure that the radar reports are completely understood by the Vietnamese. In addition, it is absolutely essential to check the position of friendly troops to insure that the mortar located by the radar is an enemy mortar. This requirement is a constant one in a fluid situation such as that which exists in Vietnam.

One of the most significant problems encountered by the AN/MPQ-4 radar section in Vietnam is that of being able to rapidly point the radar antenna to the proper area when a mortar attack begins. One technique, developed by a unit in Vietnam, is described below.

Upon notification by the FDC or S2 that a unit or area at a specific coordinate is receiving mortar fire, the plotter determines the pointing azimuth from the radar to the unit or area under attack. After the radar has been pointed in that direction, the next round received should be seen on the radar scope passing first through the upper beam and then through the lower beam, indicating that the radar has observed an impact area. By strobing this round's intercepts, the operator can analyze

the azimuth and range of both upper and lower beam video and determine in which direction to move his azimuth to detect the weapon location. In using this technique, the following general rules can be applied:

If the upper beam video is to the right of the lower beam video with very little range difference and if the range of the lower beam video must be decreased from that of the upper beam video, the azimuth of the radar should be increased clockwise, by 200 mils, for weapon location. By making the first azimuth change 200 mils, the impact area can still be observed by the radar and possibly the weapon location and the impact area can be observed simultaneously. If, during the next observed round, the weapon location is not detected, the azimuth should be increased an additional 400 mils. The azimuth should be increased clockwise by 400 mils after each pointing direction has been observed for a short time until the weapon is located. If the upper beam video is to the left of the lower beam video as indicated on the scope by a decreasing lower beam range, the radar pointing azimuth must be decreased in a counterclockwise direction and the remaining procedures described above must then be performed.

Because of the limited range of mortars and the tactical employment of friendly troops, it is unlikely that a change in the pointing azimuth will be greater than 1,600 mils. However, if the impact location shows an increase in the lower beam video range as compared to the upper beam video range, this will indicate that the azimuth of the weapon location from the radar is greater than 1,600 mils. The azimuth analysis of the video in this instance would be the same as that indicated above.

One other possible alternative, which would be more accurate in determining the azimuth for the radar from an impact location, is to determine the coordinates of the lower beam intercept and the coordinates of the impact location. Plotting the two sets of coordinates will give an approximate azimuth of fire of the mortar. An estimation of range from the radar to the impact point will give the approximate location of the mortar and an estimation of the azimuth for the radar antenna. However, this procedure is more time consuming than the other method described.

A template can be made 445 mils in deflection representing the azimuth and range coverage of the radar at any given time. If the intelligence on the plotting map is current, the plotter can place this template on the map to agree with the current radar pointing azimuth and can tell at a moment's glance exactly what area and what enemy concentrations are being covered by the countermortar radar.

The AN/MPQ-4 radar is being employed successfully in Vietnam to provide survey control to firing batteries. This technique which is described in paragraphs 45 and 46, FM 6-161, should be practiced at every opportunity by radar sections in CONUS assignments.

AN/MPQ-4A RECEIVER CRYSTAL TROUBLE?

Recent reports from commanders in Vietnam indicate an unusually high rate of failure of receiver crystals for the countermortar radar set AN/MPQ-4A. This type of malfunction indicates a problem in the radio-frequency (RF) system of the radar. Some of the possible causes are moisture in the waveguide, low keep-alive voltage, or a missing crystal shield.

Because the dehydrator of this radar does not cause the dry air to circulate throughout the waveguide, it is possible for moisture to collect in the waveguide through condensation. This moisture will settle in a low section of the waveguide and cause the RF energy to arc. This reduces output power and may possibly cause crystal failure or transmitting-receiving (TR) tube burnout if the arcing should occur near the TR tube. To eliminate or reduce the moisture accumulation, remove the waveguide drain plug located in front of the magnetron in the transmitter compartment. Turn on the set and let the dehydrator run. Since the dry air enters the waveguide near the scanner, there will be a circulation of dry air throuh the waveguide. Allow the set to run in this manner for 20 minutes twice weekly (or more often in areas of high humidity). This should purge the RF waveguide of any moisture.

Before replacing defective crystals, check the keep-alive voltage and TR tube. To check the keep-alive voltage, read from pins A or B of P1602 to ground with a multimeter TS-352 or an equivalent 20,000 ohms-per-voltmeter. The meter should read -600 volts DC. If it reads -500 volts or less, the keep-alive power supply is at fault. The most probable cause of the malfunction is the keep-alive rectifier CR 1601. If the voltage at pins A or B of P1602 is correct, check the voltage at the cap of the TR tube. To check this voltage bore a hole in the plastic shield that covers the cap. This hole must be large enough to allow insertion of a test meter lead tip to touch the cap. From this cap of the TR to ground, the voltmeter should register -425 volts, or approximately 200 volts less than the rectifier supply voltage. If the voltage is -325 volts or less, replace the TR tube.

In replacing a receiver crystal, make sure that the plastic sleeve is in place. If the crystal sleeve is missing, the crystal will continue to operate until the radar is jarred; then, if the crystal touches the case, it will short.

If the plastic sleeve is missing, cut a shield of the same length as the original shield from the plastic shield that covers the test lead tip on a TS-352. Use this shield as a sleeve to insulate the crystal.

These three preventive measures should be taken to increase the life of the receiver crystals. Remember, therefore, to purge the moisture from the waveguide, to check the keep-alive voltage, and to check the insulation of the crystals.

LOST AND FOUND

Recent reports from Vietnam have stated that infantry units and forward observers have had difficulty in locating themselves. This has been particularly true in jungle areas due to the dense vegetation and even in relatively open areas where map coverage is poor.

This is not a new problem. U.S. units in Southeast Asia in WWII encountered the same basic challenge. Many of the solutions developed during those days have been resurrected and found to be still valid. The artillery can be of great help in assisting maneuver units to locate themselves. It would be of value to refresh ourselves with some of these techniques.

Artillery can fire check rounds (smoke or WP) on terrain features visible to the FO. The coded location of these features can be sent to the FO and plotted on his map. By obtaining a compass reading to these points and back plotting, the FO can locate himself by resection.

Artillery can fire a two or three round High Burst close above the FO and transmit its coded coordinates. Additionally, illumination rounds can be used during daylight hours for location purposes.

Artillery can fire WP rounds for the FO. The FO (in coordination with an AIR OP if necessary) can use these rounds for orientation.

Even at night the artillery can be of great assistance by firing illumination rounds, a high burst, or HE with a PD fuze. The FO can materially assist in locating himself with HE/PD if he is proficient in adjusting artillery by sound. In point of fact, this type of adjustment capability is a **must** for all FO's with forces involved in jungle operations.

Another technique which was used with success by the Israeli Army in the Negev Desert campaign involved the use of searchlights.

Two searchlights were placed behind the lines — each one in a known position. On request of FO, company or battery commander, the searchlights would illuminate with a pencil beam straight up at 90° By plotting the locations of each light on a map; shooting an azimuth to each beam and then back plotting on a map, the unit location is then obtained by resection. Variations of this method could include the use of helicopters with lights hovering over known positions or even firing pyrotechnics.

While obviously none of the techniques discussed are precise enough for survey control, they do fulfill the need for assisting units in locating themselves.

A well trained FO and an artillery unit can be of immense value to supported maneuver units not only in their traditional role of providing fire support but also in other areas such as unit location.

GUNNERY PROBLEMS AND SOLUTIONS IN VIETNAM

A 105-mm howitzer battery has been helicopter landed in position. It is working separately in support of an infantry battalion and has a 6,400-mil zone of responsibility. The ground observers cannot see terrain features and the air observer cannot see most of the troops on the ground. It might be difficult, to say the least, to provide proper fire

support under these conditions. However, the U.S. artillery units in Vietnam are well acquainted with all of these situations. Some of their solutions to these problems are presented here, together with some developments which may help them.

RDP FOR 6400-MIL CHART

Providing a 6,400-mil capability is the joint responsibility of the FDC and the firing battery. The FDC may make use of a 3,200-mil arc range-deflection protractor which has a range scale of 1:50,000. The battery is plotted in the center of a standard 1:25,000 grid sheet, but all plots are made on a scale of 1:50,000 so that the maximum range in any direction can be read and used. With the 3,200-mil arc protractor, only two deflection indexes are required for 6,400-mil coverage.

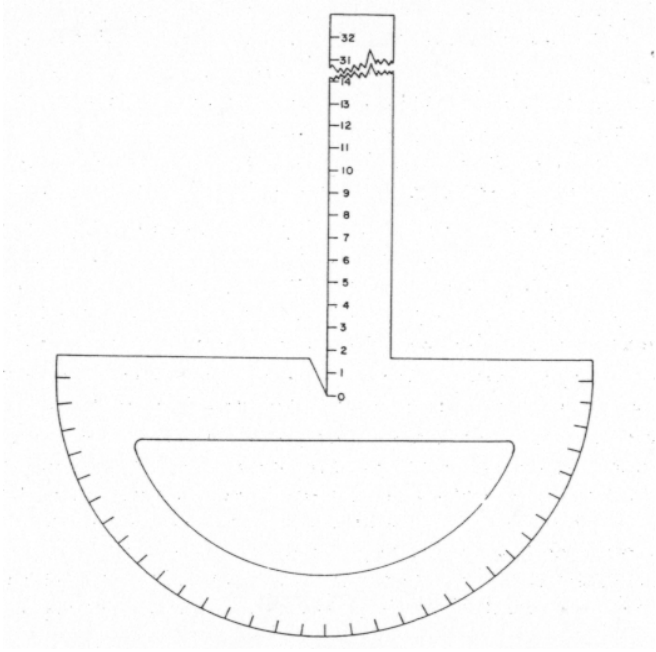


Figure 3. 6400-MIL TRANSFERS ARC PROTRACTOR

Wind cards, which provide a means for computation of ballistic wind corrections, will enable transfer in any direction based on corrections obtained from only one registration. Revised GFT's for the transonic and supersonic charges 6 and 7 for the 105-mm howitzer will enable low-angle transfers outside present range limits. High-angle "sticks" are being revised to permit valid transfers among charges 1 through 5. The resultant enlarged transfer limits will permit the air observer to register wherever he can find a satisfactory point which can be located on the map.

ALPHABETICAL INDEX
ARTILLERY TRENDS 1965

ARTICLES

SHORT SUBJECTS

RESIDENT COURSES

U. S. Army Artillery and Missile School

Listed are the officer and enlisted resident courses scheduled to be taught at the United States Army Artillery and Missile School during the period 1 November 1966 through 1 June 1967.

OFFICER COURSES

COURSE	CLASS NO	REPORT	CLOSE	INPUT
1. 2-6-C11	3-67	26 Feb 67	10 Mar 67	40
(Formerly 6-A-C6)	4-67	14 May 67	26 May 67	42
FA Field Grade Officer Refresher (2 Weeks) (Max Cap: 60)				
2. 2-6-C20	9-67	29 Nov 66	17 Feb 67	94
(Formerly 6-A-C20)	10-67	31 Jan 67	7 Apr 67	114
FA Officer Basic	11-67	28 Feb 67	5 May 67	114
(9 Weeks)	12-67	28 Mar 67	2 Jun 67	113
(Max Cap: 105)	13-67	25 Apr 67	30 Jun 67	116
	14-67	23 May 67	28 Jul 67	116
	15-67	20 Jun 67	25 Aug 67	115
3. 2-6-C22	1-67	1 Jul 66	28 Feb 67	108
(Formerly 6-A-C22)	*2-67	26 Sep 66	26 May 67	108
Artillery Officer Career	3-67	3 Jan 67	18 Aug 67	108
(32 Weeks)	4-67	27 Mar 67	9 Nov 67	109
(Max Cap: 120)	(*Includes 45 Non-US)			
4. 2-6-C23	3-67	6 Jan 67	24 May 67	112
(Formerly 6-A-C23)	4-67	30 Mar 67	16 Aug 67	111
Associate FA Officer Career (19 Weeks) (Max Cap: 120)				
5. 2G-F1	2-67	16 Apr 67	22 Apr 67	22
(Formerly 6-A-F5)				
Division Artillery Staff Officer Refresher (1 Week) (Max Cap: 60)				
6. 2E-F4	2-67	22 Jan 67	3 Feb 67	36
(Formerly 6-A-F6)	3-67	18 Jun 67	30 Jun 67	35
Senior FA Officer (1 Week, 5 Days) (Max Cap: 60)				
7. 2E-F12	2-67	18 Nov 66	9 Dec 66	30
(Formerly 6-A-F19)	3-67	2 Mar 67	22 Mar 67	30
Nuclear Weapons Employment (3 Weeks) (Max Cap: 35)	4-67	25 May 67	15 Jun 67	30

(The above course (2E-F12) is conducted for selected graduates of each Associate Field Artillery Officer Career Course)

COURSE	CLASS NO	REPORT	CLOSE	INPUT
8. 2E-F14	2-67	5 Mar 67	17 Mar 67	29
(Formerly 6-A-F20)	3-67	18 Jun 67	30 Jun 67	29
Nuclear Weapons Employment (Res Comp) (2 Weeks) (Max Cap: 35)				
9. 2E-F13	2-67	8 Jan 67	10 Feb 67	15
(Formerly 6-A-F26)	3-67	28 May 67	30 Jun 67	15
Nuclear Weapons Employment (5 Weeks) (Max Cap: 35)				
10. 4C-0200	4-67	2 Jan 67	21 Mar 67	40
(Formerly 6-A-0200)	5-67	2 Feb 67	21 Apr 67	40
Communications Officer	6-67	30 Mar 67	16 Jun 67	40
(10 Weeks, 5 days)	7-67	8 Jun 67	25 Aug 67	36
(Max Cap: 40)				
11. 2E-1154	3-67	18 Jan 67	31 Mar 67	13
(Formerly 6-A-1154)	4-67	5 Apr 67	16 Jun 67	13
Artillery Target Acquisition Officer (10 Weeks, 1 Day) (Max Cap: 20)				
12. 2G-1183	2-67	11 Jan 67	3 Mar 67	39
(Formerly 6-A-1183)	3-67	5 Apr 67	25 May 67	38
Artillery Survey Officer (7 Weeks, 1 Day) (Max Cap: 40)				
13. 2F-1190-D	3-67	19 Feb 67	31 Mar 67	23
(Formerly 6-A-1190D)				
Sergeant Officer (5 Weeks, 4 Days) (Max Cap: 25)				
14. 2F-1190-E	2-67	9 Jan 67	7 Mar 67	28
(Formerly 6-A-1190E)				
Pershing Officer (8 Weeks) (Max Cap: 30)				
OFFICER/ENLISTED COURSES				
15. 2-6-F1	16-67	6 Nov 66	2 May 67	253
(Formerly 6-N-F1)	17-67	13 Nov 66	9 May 67	253
FA Officer Candidate	18-67	20 Nov 66	16 May 67	253
(23 Weeks)	19-67	27 Nov 66	23 May 67	253
(Max Cap: 120)	20-67	4 Dec 66	29 May 67	253
	21-67	11 Dec 66	6 Jun 67	252
	22-67	2 Jan 67	13 Jun 67	252
	23-67	8 Jan 67	20 Jun 67	252
	24-67	15 Jan 67	27 Jun 67	252
	25-67	22 Jan 67	3 Jul 67	252
	26-67	29 Jan 67	11 Jul 67	252
	27-67	5 Feb 67	18 Jul 67	252
	28-67	12 Feb 67	25 Jul 67	252
	29-67	19 Feb 67	1 Aug 67	252
	30-67	26 Feb 67	8 Aug 67	252
	31-67	5 Mar 67	15 Aug 67	252

	32-67	19 Mar 67	29 Aug 67	127
	33-67	26 Mar 67	5 Sep 67	127
	34-67	2 Apr 67	12 Sep 67	127
	35-67	9 Apr 67	19 Sep 67	127
	36-67	16 Apr 67	26 Sep 67	252
	37-67	23 Apr 67	3 Oct 67	252
	38-67	30 Apr 67	10 Oct 67	252
	39-67	7 May 67	17 Oct 67	252
	40-67	14 May 67	24 Oct 67	252
	41-67	21 May 67	31 Oct 67	252
	42-67	28 May 67	7 Nov 67	252
	43-67	4 Jun 67	14 Nov 67	252
	44-67	11 Jun 67	21 Nov 67	252
	45-67	18 Jun 67	28 Nov 67	252
	46-67	25 Jun 67	5 Dec 67	252
16. 2-6-F2	1-67	10 Mar 67	27 May 67	120
(Formerly 6-N-F2)	2-67	2 Jun 67	19 Aug 67	120
FA Officer Candidate				
(Res Comp)				
(11 Weeks)				
(Max Cap: 120)				
17. 2F-F1/121-F1	3-67	22 Jan 67	27 Jan 67	16
(Formerly 6-D-F28)	4-67	30 Apr 67	5 May 67	16
FADAC Operators				
(1 Week)				
(Max Cap: 18)				
18. 4B-F1/121-F2	2-67	29 Jan 67	10 Feb 67	14
(Formerly 6-D-F29)	3-67	9 Apr 67	21 Apr 67	14
FADAC Maintenance				
(1 Week, 5 Days)				
(Max Cap: 24)				
19. (Course or pending)	4-67	2 Nov 66	9 Nov 66	13
FA Searchlight	5-67	6 Dec 66	13 Dec 66	13
(5 Days)	6-67	16 Jan 67	23 Jan 67	13
(Max Cap: 13)	7-67	28 Feb 67	7 Mar 67	13
(MOS: 1198/17E40)	8-67	3 Apr 67	10 Apr 67	13
	9-67	15 May 67	22 May 67	13
	10-67	19 Jun 67	26 Jun 67	13
20. 4F-F4/121-15B30	3-67	5 Feb 67	22 Mar 67	31
(Formerly 6-N-161.2)	4-67	5 Apr 67	19 May 67	31
Sergeant Missile				
Battery				
(6 Weeks, 2 Days)				
(Max Cap: 32)				
21. 4F-214E/121-21G20	5-67	22 Nov 66	26 Apr 67	20
(Formerly 6-N-163.2)	501-67	3 Jan 67	22 May 67	21
Pershing Specialist	6-67	14 Feb 67	5 Jul 67	21
(19 Weeks, 3 Days)	7-67	21 Mar 67	8 Aug 67	21
(Max Cap: 32)	8-67	2 May 67	20 Sep 67	21
	9-67	6 Jun 67	24 Oct 67	21

		PHASE I REPORT	PHASE II REPORT	CLOSE	
22. 4C-211/104-26B20	5-67	3 Jan 67	29 Mar 67	12 Jul 67	33
(Formerly 4C-211/104-211.3)	6-67	9 Feb 67	5 May 67	18 Aug 67	33
FA Radar Maintenance	7-67	21 Mar 67	14 Jun 67	27 Sep 67	33
(Phase I :12 Weeks, 1 Da)	8-67	27 Apr 67	24 Jul 67	3 Nov 67	33
Phase II:14 Wks, 2 Da)	9-67	7 Jun 67	31 Aug 67	15 Dec 67	33
(Total: 26 Wks, 3 Da)					
(Max Cap: 24)					

COURSE	CLASS NO	REPORT	CLOSE	INPUT
		ENLISTED COURSES		
23. 5B-F1/420-93F20	7-67	25 Nov 66	17 Feb 67	35
(Formerly 5B-F1/420-103.1)	9-67	6 Jan 67	17 Mar 67	36
Artillery Ballistic	502-67	13 Jan 67	24 Mar 67	36
Meteorology	10-67	10 Feb 67	21 Apr 67	36
(9 Weeks, 4 Days)	11-67	3 Mar 67	11 May 67	36
(Max Cap: 40)	12-67	17 Mar 67	25 May 67	36
	13-67	21 Apr 67	30 Jun 67	36
	14-67	12 May 67	24 Jul 67	36
	15-67	26 May 67	7 Aug 67	36
24. 101-F2	3-67	2 Dec 66	20 Feb 67	15
(Formerly 6-R-F24)	4-67	10 Feb 67	17 Apr 67	15
AN/TRC-80 Operations (Pershing)	5-67	21 Apr 67	26 Jun 67	15
(9 Weeks)				
(Max Cap: 15)				
25. 101-F4	3-67	26 Feb 67	19 May 67	37
(Formerly 6-R-F31)	4-67	7 May 67	1 Aug 67	37
Communications Chief				
(12 Weeks)				
(Max Cap: 40)				
	1-67	16 Nov 66	15 Dec 66	37
26. 412-F1				
(Formerly 6-R-F34)	2-67	1 Jun 67	29 Jun 67	37
Artillery Survey NCO				
(4 Weeks)				
(Max Cap: 80)				
27. 250-F1	3-67	4 Jan 67	24 Mar 67	65
(Formerly 6-R-F37)	4-67	21 Mar 67	8 Jun 67	100
FA Operations and Intelligence Assistant				
(11 Weeks, 1 Day)				
(Max Cap: 65)				
28. 610/611-F1	5-67	4 Dec 66	17 Feb 67	20
(Formerly 6-R-F38)	6-67	8 Jan 67	10 Mar 67	20
Master Mechanic	7-67	19 Feb 67	21 Apr 67	20
(9 Weeks)	8-67	12 Mar 67	12 May 67	20
(Max Cap: 40)	9-67	23 Apr 67	23 Jun 67	20
	10-67	14 May 67	14 Jul 67	20
29. 121-163.2X	3-67	14 Feb 67	5 Jul 67	20
(Formerly 6-N-163.2X)	4-67	21 Mar 67	8 Aug 67	15
Pershing Specialist (non-US)				
(19 Weeks, 3 Days)				
(Max Cap: 32)				
30. 121-15E20	4-67	21 Nov 66	24 Jan 67	35
(Formerly 6-R-163.1)	5-67	8 Jan 67	24 Feb 67	34
Pershing Missile Battery	6-67	12 Feb 67	31 Mar 67	34
(6 Weeks, 4 Days)	7-67	16 Mar 67	3 May 67	34
(Max Cap: 35)	9-67	30 Apr 67	16 Jun 67	34
	10-67	21 May 67	10 Jul 67	34

31. 221-17B20	503-67	10 Nov 66	25 Jan 67	71
(Formerly 221-156.1)	504-67	9 Dec 66	21 Feb 67	71
FA Radar Operation	505-67	20 Jan 67	20 Mar 67	71
(8 Weeks, 2 Days)	506-67	17 Feb 67	17 Apr 67	71
(Max Cap: 35)	12-67	17 Mar 67	13 May 67	71
	507-67	14 Apr 67	12 Jun 67	71
	508-67	12 May 67	11 Jul 67	71
	509-67	9 Jun 67	7 Aug 67	71
32. 412-17C20	5-67	3 Mar 67	25 Apr 67	17
(Formerly 412-155.2)	6-67	28 Apr 67	21 Jun 67	17
Artillery Sound Ranging				
(7 Weeks, 2 Days)				
(Max Cap: 28)				
33. 198-35D20	501-67	13 Jan 67	24 Apr 67	14
(Formerly 198-205.1)	502-67	10 Mar 67	19 Jun 67	13
Weather Equipment	503-67	5 May 67	15 Aug 67	13
Maintenance				
(14 Weeks)				
(Max Cap: 14)				
34. 611-63C20	14-67	6 Nov 66	21 Dec 66	37
(Formerly 6-R-632.1/.2)	504-67	20 Nov 66	20 Jan 67	37
Tracked Vehicle Mechanic	15-67	27 Nov 66	27 Jan 67	37
(7 Weeks)	16-67	4 Dec 66	3 Feb 67	37
(Max Cap: 40)	505-67	2 Jan 67	17 Feb 67	37
	17-67	8 Jan 67	24 Feb 67	37
	18-67	15 Jan 67	3 Mar 67	37
	19-67	22 Jan 67	10 Mar 67	37
	506-67	29 Jan 67	17 Mar 67	37
	20-67	5 Feb 67	24 Mar 67	37
	21-67	12 Feb 67	31 Mar 67	37
	22-67	26 Feb 67	14 Apr 67	37
	23-67	5 Mar 67	21 Apr 67	37
	24-67	12 Mar 67	28 Apr 67	37
	507-67	19 Mar 67	5 May 67	37
	25-67	26 Mar 67	12 May 67	36
	26-67	2 Apr 67	19 May 67	36
	27-67	16 Apr 67	2 Jun 67	36
	28-67	23 Apr 67	9 Jun 67	36
	29-67	30 Apr 67	16 Jun 67	36
	508-67	7 May 67	23 Jun 67	36
	30-67	14 May 67	30 Jun 67	36
	31-67	21 May 67	7 Jul 67	36
	32-67	4 Jun 67	21 Jul 67	36
	509-67	11 Jun 67	28 Jul 67	36
	510-67	18 Jun 67	4 Aug 67	36
35. 412-82C20	12-67	4 Nov 66	20 Jan 67	83
(Formerly 412-153.1)	13-67	18 Nov 66	2 Feb 67	83
Artillery Survey	14-67	2 Dec 66	15 Feb 67	83
Specialist	15-67	6 Jan 67	8 Mar 67	83
(8 Weeks, 2 Days)	16-67	13 Jan 67	15 Mar 67	83
(Max Cap: 90)	17-67	20 Jan 67	22 Mar 67	83
	18-67	27 Jan 67	29 Mar 67	83
	19-67	10 Feb 67	12 Apr 67	83
	20-67	3 Mar 67	2 May 67	83
	21-67	10 Mar 67	9 May 67	83
	22-67	17 Mar 67	16 May 67	83
	23-67	24 Mar 67	23 May 67	83
	24-67	7 Apr 67	7 Jun 67	83

	25-67	28 Apr 67	28 Jun 67	83
	26-67	5 May 67	6 Jul 67	83
	27-67	12 May 67	13 Jul 67	82
	28-67	19 May 67	20 Jul 67	82
	29-67	2 Jun 67	2 Aug 67	82
	30-67	23 Jun 67	23 Aug 67	82
	31-67	30 Jun 67	30 Aug 67	82
ASubScd 11-311 (31D20)	9-67	4 Nov 66	23 Feb 67	40
Communication Electronics	10-67	18 Nov 66	8 Mar 67	40
Equipment Repairman	11-67	2 Dec 66	21 Mar 67	40
(13 Weeks)	12-67	2 Jan 67	4 Apr 67	40
(Max Cap: 40)	13-67	13 Jan 67	17 Apr 67	36
	14-67	27 Jan 67	1 May 67	40
	15-67	10 Feb 67	15 May 67	40
	16-67	24 Feb 67	26 May 67	40
	17-67	10 Mar 67	12 Jun 67	36
	18-67	24 Mar 67	26 Jun 67	40
	19-67	7 Apr 67	11 Jul 67	40
	20-67	21 Apr 67	25 Jul 67	40
	21-67	5 May 67	8 Aug 67	37
	22-67	19 May 67	22 Aug 67	40
	23-67	2 Jun 67	5 Sep 67	40
	24-67	16 Jun 67	19 Sep 67	40
13AIN (Formerly 142.1)	11-67	11 Nov 66	18 Nov 66	8
Nuclear Projectile	12-67	25 Nov 66	2 Dec 66	8
Assembly	13-67	2 Dec 66	9 Dec 66	8
(1 Week)	14-67	9 Dec 66	16 Dec 66	8
(Max Cap: 30)	15-67	6 Jan 67	13 Jan 67	8
	16-67	13 Jan 67	20 Jan 67	8
	17-67	27 Jan 67	3 Feb 67	8
	18-67	3 Feb 67	10 Feb 67	8
	19-67	10 Feb 67	17 Feb 67	8
	20-67	24 Feb 67	3 Mar 67	8
	21-67	3 Mar 67	10 Mar 67	8
	22-67	10 Mar 67	17 Mar 67	8
	23-67	24 Mar 67	31 Mar 67	8
	24-67	31 Mar 67	7 Apr 67	8
	25-67	14 Apr 67	21 Apr 67	8