

ARTILLERY TRENDS



JUNE
1964

US ARMY
ARTILLERY AND
MISSILE SCHOOL



Instructional Aid Number 30

● COVER

Shooting or protecting a circle and engaging targets that are more than 18,000 meters away with a conventional or nuclear projectile are just two of the "capabilities plus" of the artillery's newest fully armored self-propelled 155-mm howitzer, the M109. More capabilities and the tactical employment of this weapon are featured in THE M109 on page 9.

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ARTILLERY TRENDS is a publication of the United States Army Artillery and Missile School appearing only when sufficient material of instructional nature can be gathered.

INSTRUCTIONAL MATERIAL FOR ARTILLERYMEN

The US Army Artillery and Missile School (USAAMS) offers a large amount of instructional material to all artillerymen for their information or for instructing others. In the February 1963 issue of ARTILLERY TRENDS, a similar list appeared on page 2 which contained an error in the portion pertaining to class packets. To correct that error and to eliminate possible misinterpretation of information pertaining to other training material available, the following list is published.

- **ARTILLERY TRENDS.** ARTILLERY TRENDS is an instructional aid published by the USAAMS whenever sufficient material is available. Distribution is made to every artillery unit down to battalion level and to individuals enrolled in an artillery extension course. Other individuals who are authorized patrons of the Book Department, USAAMS, may obtain ARTILLERY TRENDS through the Book Department, USAAMS, by subscription at a cost of \$1.00 for four issues. The address for ARTILLERY TRENDS is: **Commandant, U. S. Army Artillery and Missile School, ATTN: AKPSIPL-ARTILLERY TRENDS, Fort Sill, Oklahoma 73504.**

- **Field Artillery Extension Courses.** Extension course instruction is a progressive program of individual instruction administered by correspondence methods. Detailed information concerning enrollment procedures and available subcourses, special courses, and career courses and their scope are contained in the current issues of the Catalog of Extension Courses (USAAMS) and in DA Pamphlet 350-60. Units or individuals desiring a copy of the current Catalog of Extension Courses, or other pertinent information should write to: **Commandant, U. S. Army Artillery and Missile School, Nonresident Instruction Department, ATTN: AKPSINI/EC, Fort Sill, Oklahoma 73504.**

- **Class Packets.** Classes for units, sections, and staffs are available, and each class packet contains all material necessary to teach a class, including instructor's manuscript, instructional aids such as Vu-Graph slides, and the necessary student materials. This material will assist unit commanders in conducting their training. Classes are available at no charge to all active Army units and Reserve units. National Guard units may receive the packets **on a reimbursable basis.** For the Catalog of Instructional Material or more information write to: **Commandant, U. S. Army Artillery and Missile School, Nonresident Instruction Department, ATTN: AKPSINI/RC, Fort Sill, Oklahoma 73504.**

- **Book Department.** A wide variety of artillery items can be purchased from the Book Department, including the latest in FDC equipment, items for the forward observer, books of general and specific interest to artillerymen, and artillery "morale" items. For a complete list, request a catalog from: **Commandant, U. S. Army Artillery and Missile School, ATTN: Book Department, Fort Sill, Oklahoma 73504.**

- **POI's.** Resident programs of instruction can often be of value in establishing or revising a training class program. For programs of instruction write to: **Commandant, U. S. Army Artillery and Missile School, Director of Instruction, ATTN: Plans Division, Fort Sill, Oklahoma 73504.**

utility tactical transport . . .



The Armed UH-1B

Lieutenant John N. Tragesser
USA UTT Helicopter Company
Republic of Vietnam

Numerous types of helicopters merged with even more numerous combinations of weapons systems have been tried and tested during recent years to achieve a successful marriage of helicopter and weapons system for effective employment in large-scale or counterinsurgency warfare. This marriage has created an effective armed vehicle—the utility tactical transport (UTT) helicopter—which can be used in both defensive and offensive situations. The employment and use of the armed UTT helicopter has been extremely instrumental in establishing a sound and workable armed helicopter doctrine that should certainly influence the armed helicopter and its tactics of tomorrow.

UTT ARMAMENT

To fulfill the role of the armed UTT helicopter, one version, the UH-1B, or Iroquois, helicopter that is currently being employed in counterinsurgency warfare, was recruited and armed with the XM6 (Emerson) (fig 1). This kit consists of four M60 machineguns, two mounted on each side of the UH-1B. The XM6 kit incorporates a gunner's sight with a pistol grip handle (fig 1), which allows the copilot to traverse, elevate, and depress the machineguns to rain deadly fire on a target 72 degrees to either side of the helicopter at a maximum effective range of 800 meters.

In addition to the machineguns, the U. S. Army Utility Tactical Transport Helicopter Company has locally manufactured a rocket system (fig 2) consisting of eight rocket tubes on each side of the helicopter to work in conjunction with the XM6 machinegun kit.

The rocket tubes, which are boresighted to the machineguns, are fired only when the machineguns are in the "stowed," or horizontally fixed, position. The pilot aligns the UH-1B with the target and effects elevation and depressing of the guns, to maintain alignment, by changing the attitude of the helicopter. When the desired sight picture has been attained, the pilot activates the machineguns and continues to fire until the rounds strike the target. The machinegun rounds serve as **spotting** rounds for the rockets, which are fired in single pairs or in a

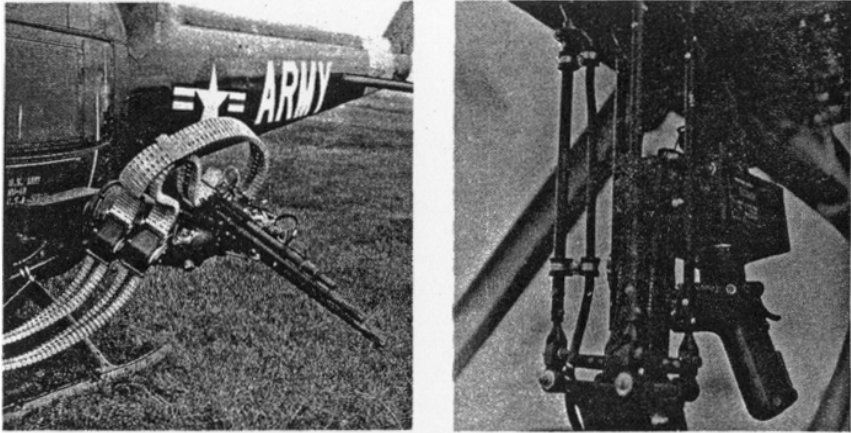


Figure 1. XM6 kit mounted on UH-1B (left). Gunner's sight with pistol grip handle (right).

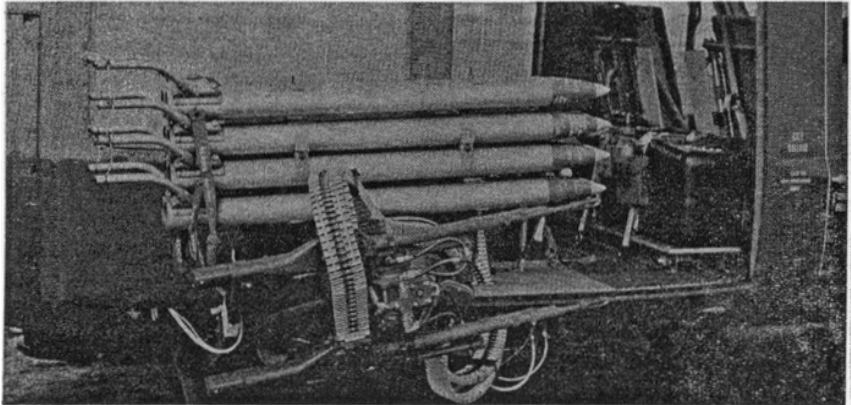


Figure 2. Rocket system with XM6 kit.

salvo (ripple) of pairs. If the rocket tubes are accurately boresighted, the rockets will impact where the machinegun bullets are striking. Currently, the UTT's basic ammunition load consists of 4,000 rounds of 7.62-mm machinegun ammunition and sixteen 2.75-inch high explosive (HE) rockets (fig 3).

Another weapons system has recently been undergoing evaluation—the M3 kit which consists of 24 rocket tubes mounted on each side of the UH-1B (ARTILLERY TRENDS, April 1963, page 2, and November 1963, page 9). The pilot, sighting through a Mark 8 aircraft gunsight, electrically fires the rockets in single pairs or salvo (ripple) pairs in less than a second. The UH-1B mounted with the M3 kit is employed on prestrike missions and in reinforcement of the helicopters armed with the XM6 kit; results have been highly successful.



Figure 3. In addition to the armament, a cargo door gunner provides flank protection.

TACTICS

This array of effectiveness and accurate firepower combined with a highly maneuverable vehicle is the foundation from which the present armed helicopter tactics have been developed. Although these tactics are sound and workable, seasoned by 1 year of combat employment, they are by no means the complete or final answer to the role of the armed helicopter.

The primary mission of the armed helicopter is to protect troop-carrying (escorted) helicopters from insurgent action while engaged in heliborne assault missions. In addition, the armed helicopter provides protection for resupply helicopters and medical evacuation helicopters and is used for reconnaissance and direct fire missions on known enemy strongholds.

The number of armed helicopters to be used in a particular mission is dictated by the enemy situation and the number of escorted helicopters to be protected. If a mission requires the protection of four or less helicopters into an area previously secured by friendly troops, one fire team consisting of two UH-1B's armed with the XM6 kit is sufficient to insure successful accomplishment of the mission.

A heliborne assault into known enemy areas requires a platoon of armed UH-1B's composed of two fire teams and the platoon leader's aircraft which is normally armed with the M3 kit—a total of five armed helicopters.

SIMULATED PLATOON MISSION

The following simulated platoon-size mission requires that protective escort be provided for 12 troop-carrying helicopters on a heliborne assault mission.

The first task, en route protection of the escorted helicopters from the staging area to the landing zone, is accomplished by one of four protective formations. In most instances, Alfa formation (fig 4) is used with one fire team on each side of the escorted helicopter formation and the armed helicopter platoon leader at the rear of the flight in an

advantageous position which allows him to effectively control his fire teams and reinforce either fire team as required by the situation.

Whenever possible, flight altitude is maintained at a minimum of 1,500 feet, which is normally out of range for any insurgent ground fire that might be encountered en route to the landing zone. If an element of surprise is desired in the landing zone or there is not sufficient time for the heavily loaded escorted helicopters to climb to altitude, the escorted helicopters will fly at contour level while the armed helicopters engage targets that present a hostile threat to the escorted helicopters.

If the landing zone is known to be in an area of intense enemy activity, the platoon leader will dispatch a fire team to precede the flight into the landing zone, prestriking and neutralizing all areas of suspicious nature.

As the escorted helicopters set down in the landing zone, the two fire teams maintain racetrack orbits on each side of the landing zone, reconnoitering the takeoff route of the escorted helicopters and the immediate area up to 1,500 meters in all directions from the landing zone. If any insurgent activity is encountered on the reconnaissance, the fire team engages and neutralizes the hostile threat (fig 5). Flight altitude for reconnaissance depends on the terrain; contour flying is used over dense jungle and wooded areas, and an altitude of 300 feet is used over open areas with little vegetation.

As the last element of escorted helicopters departs the landing zone, the armed UH-1B's form a protective formation around the escorted helicopters. If the flight to the landing zone was at contour, the flight returns at an altitude of 1,500 feet to avoid unnecessarily exposing the flight to insurgent ground fire.

After the heliborne assault mission is completed, the armed helicopters normally remain on a standby status at the staging area to fulfill mission requirements—such as protection of medical evacuation

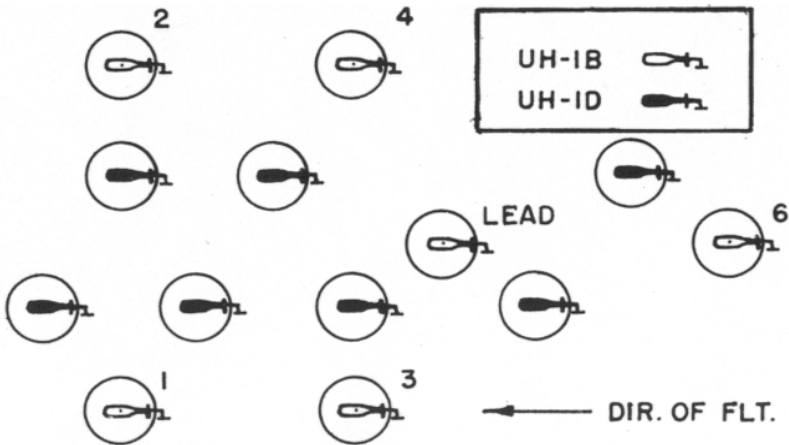


Figure 4. Alfa formation is employed when the enemy and friendly situations are unknown.

helicopters, protection of resupply helicopters, and reconnaissance—from the ground commander.

MEDICAL EVACUATION/RESUPPLY MISSIONS

The protection of medical evacuation or resupply helicopters is normally accomplished with one fire team. En route protection is provided with one armed helicopter on each side of the escorted helicopters. Upon reaching the landing zone, a single, circular orbit is set up around the landing zone, and the procedure for reconnaissance remains the same as that for a heliborne assault mission with one exception: the ground commander should provide some visible means of marking the outermost boundaries of the landing zone to prevent the armed UH-1B's from engaging a target which would unknowingly endanger friendly troops.

RECONNAISSANCE MISSION

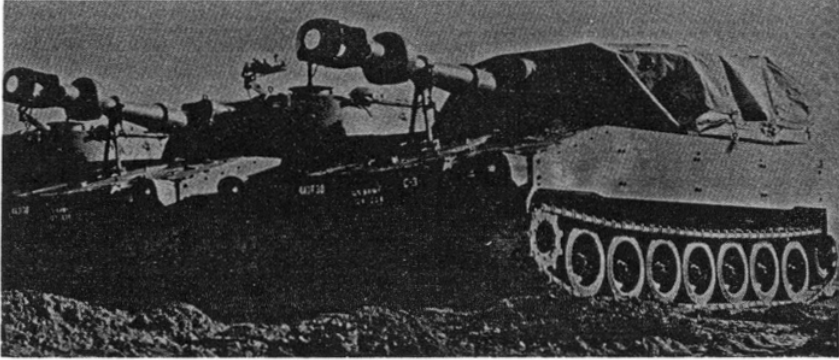
A minimum of two fire teams, four armed helicopters, are employed for reconnaissance missions. Upon arrival over the area to be reconnoitered, one fire team descends to contour and remains in a loose, right-echelon formation (approximately 50 meters between helicopters) while the second fire team remains at an altitude of 700 feet and behind the fire team at contour. This position effectively allows the second fire team to engage any hostile target encountered by the pair of UH-1B's at contour. Upon completion of the mission, both fire teams return to the staging area, where the information obtained is compiled, assembled, and reported to the ground commander.



Figure 5. Fire teams escort the troop-carrying helicopters (left). UH-1B engages target at landing zone (right).

Although these are current tactics, the role of the armed helicopter is not limited to these tactics alone. As the speed, range, and weapons capabilities of the armed helicopter improve, the UH-1B will assume a myriad of roles, and an aviation oriented ground commander will greatly enhance the success of his mission through effective employment of the armed helicopter.

capabilities plus . . .



THE M109

Lieutenant Colonel Walter R. Davis
570th Artillery Group

"We need a howitzer with a greater traverse capability than this thing." This statement was heard often in past combat actions from crewmen shifting trails on a 155-mm howitzer or from an S3 with a fire mission outside traverse limits. Today, the artillery has that "much needed" weapon in the form of the M109, the new self-propelled 155-mm howitzer currently entering the inventory. But, now that the artillery has the weapon, why is the M109 an improvement when compared to its predecessors?

This weapon is capable of a maximum range of more than 18,000 meters, which is an increase of 3,400 meters; an effective high-angle minimum range of about 2,250 meters, a 650-meter advantage; on-carriage traverse capability of 6,400 mils, an increase of 5,344 mils; a road speed in excess of 35 miles per hour; and an emplacement time of less than 3 minutes. In addition, the M109 howitzer weighs approximately 11,500 pounds less than its predecessor, the M44, while retaining full armor. Traverse and elevation can be accomplished in seconds with its hydraulically operated turret. These features, combined with the accuracy and nuclear capability of the M109, make it an unusually versatile general purpose weapon.

CAPABILITIES ENHANCE TACTICS

Commanders can exploit the capabilities of the M109 howitzer to allow greater ease and flexibility in the provision of fire support. The 6,400-mil traverse and increased range will permit a commander more flexibility in selecting a primary sector of fire and more ease in delivering timely and accurate fire within this sector. Rapidity of traverse and

elevation will allow a commander greater ease in firing outside the primary sector should the need arise. In "line of contact" situations, characteristic of World War II and Korea, combat proven methods of employment, such as tree-line positions (fig 1) and other places of concealment, will be enhanced with the capabilities of the M109. Though few positions offer an unobstructed 6,400-mil field of fire, many offer clear fields in excess of the traverse capability of other weapons. Shifting trails or turning and relaying howitzers no longer need be a problem in units equipped with the M109. While position selection must still be based on the mission to be accomplished, consideration may also be given to selecting those positions that will permit maximum utilization of the weapons capabilities.

In a highly mobile situation, encountered by a maneuvering task force in a nuclear environment or other fluid battlefield situations, the M109's 3-minute emplacement time can provide a commander with more responsive fire support.

To meet a threat from any direction, such as an enemy penetration on the flank, the capabilities of the M109 can be exploited to their utmost.

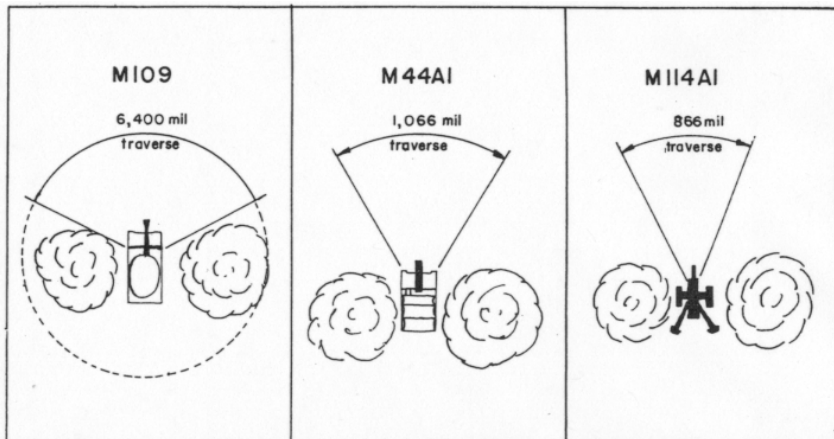


Figure 1. Comparison of traverse capabilities of M114A1, M44A1, and M109 in a tree-line position.

STAR FORMATION

In a tactical situation wherein a commander is required to "shoot a circle" or defend a 6,400-mil sector, a star formation would be appropriate in the position area. This formation consists of a howitzer located on each point of the star and the base piece located in the center; thus, a firing battery can provide a circle of protection or fire support. The star formation is approximately 150 meters in diameter. The width of the sheaf resulting from such a configuration will be nearly 100 meters less than the standard parallel sheaf (fig 2). However, the depth of the sheaf could be expected to be roughly 150 meters. Minor adjustments

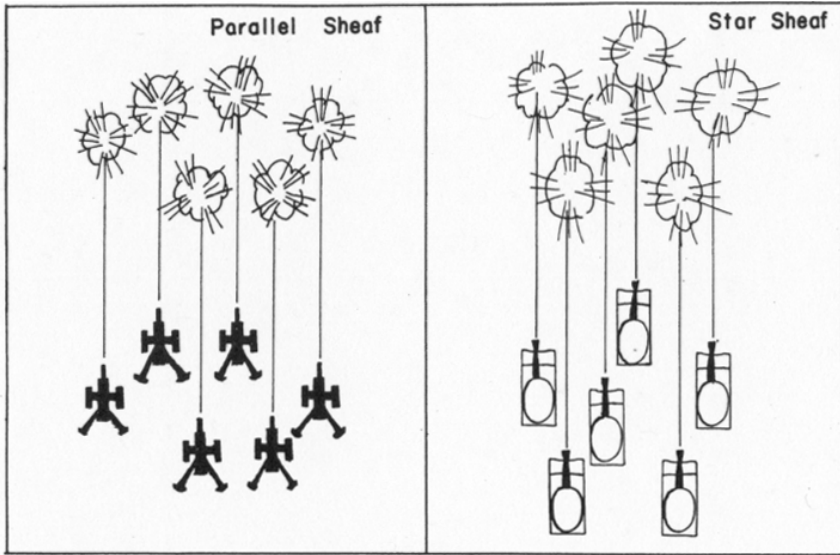


Figure 2. Comparison of parallel and star formations and resulting sheafs.

for comparative VE's can be carried in the form of piece corrections.

The star sheaf, which has deliberate depth as well as width, will provide the desired effect—neutralization of the enemy maneuver elements before they are fully deployed, as in assembly areas. A star sheaf will effectively cover such targets because these targets may have nearly as much depth as they do width.

The five-point star formation, with the 6,400-mil traverse of the M109, permits fires to be shifted to any point in the circle without resorting to individual piece data. However, because of the likely presence of friendly elements within the circle, targets normally will be engaged by using observed fire techniques, usually without benefit of prior registration. Time and situation permitting, registrations around the circle may be accomplished thus permitting unobserved fires.

Although the correction for base piece displacement is a simple computation requiring little time, the correction will be eliminated as the base piece will be over battery center in the approximate geometric center of the star. Also, complete coverage of the target is further insured as the center of the star is closed with the base piece over battery center.

To adjust observed fire, the battery executive officer can select as the adjusting pieces (excluding the base piece) any two howitzers that are relatively opposite each other both laterally and in depth; for example, pieces number 2 and 6 or 1 and 6 are the adjusting pieces if the direction of fire is as indicated in Figure 3. He must, of course, consider the direction of fire when selecting the adjusting pieces. Typically, there would be some lateral distance between the adjusting pieces in relation to the line of fire; the distance in depth between the center of the bursts of the adjusting pieces along the gun-target line will be very significant, approximately 100 meters. Ideally, then, the observer will bracket the adjusting point with the depth as well as the width of the sheaf.

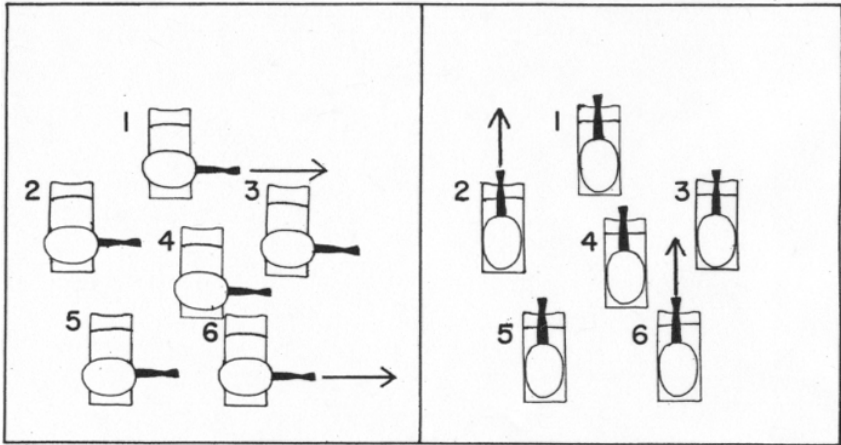


Figure 3. Selection of adjusting pieces.

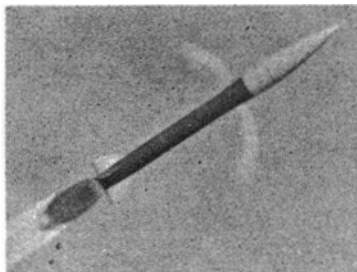
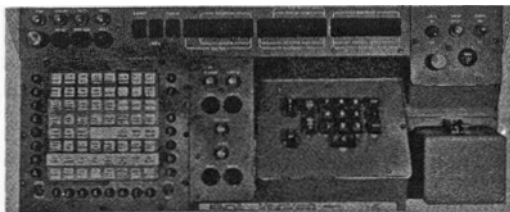
FDC PROCEDURES

In the FDC, a 1:50,000 battle map used as a firing chart for observed fires outside the zone of responsibility of the unit, with new FDC equipment, will facilitate the engagement of targets within the 6,400-mil traverse capability of the M109. The 1:50,000 firing chart (map) would be small enough to handle and permit rapid shifts in any direction to ranges to 18,000 meters. In observed fire, the degree of accuracy obtained with the 1:50,000 chart (map) outside the primary zone of the unit would be acceptable.

From any point of view, the M109, self-propelled 155-mm howitzer is fully capable of satisfying the role for which it is presently programmed, and more. The M109 enhances current tactical employment principles with its capabilities of 6,400-mil traverse, rapid traverse and elevation, increased range, short emplacement time, and accuracy.

Cannon artillery has quite a future in this weapon. It truly has the capability of satisfying all requirements for a general purpose field howitzer in the artillery.

FADAC AND



FREE ROCKETS

Captain Douglas B. Stuart
Gunnery Department

Although the Gun Direction Computer, M18 (FADAC) was originally developed for the computations of artillery cannon programs, two additional uses, which are being tested, are the computation of firing data for the Honest John and Little John free rockets. The ballistic programs for the Honest John and Little John are very similar in operation and capability; however, unlike the cannon programs, the free rocket programs are single-caliber; each is stored on a separate tape. The only difference in the two rockets are those in the materiel; in fact, the same operator's manual, FM 6-3-2, is used for both computer applications.

FIRING DATA COMPUTATION

The most important feature of the free rocket programs is, of course, the computation of firing data for all Honest John and Little John launcher, rocket, and warhead combinations. The computation method used by FADAC for the burning phase of the trajectory is the use of empirical data or "table look-up"; for the free-flight phase, the computation method is simulation of the trajectory by numerical integration of the equations of motion for a projectile in flight. In this latter phase, the FADAC computation method is very similar to that used in the cannon programs.

Although the FADAC solution will be more accurate than that obtained in manual methods, because of the solution of the equations of motion rather than the "table look-up" method currently used, the primary benefit will be reduced computation time; the computation time (from the time the computer operator depresses the COMPUTE button until the time the computer displays a solution) is less than 2 minutes. The actual time is roughly proportional to the time of flight of the rocket. Considering the operator time to enter the ballistic data, the maximum

time to solve a mission is less than 4 minutes.

The FADAC solution to the free rocket problem includes the effects of all materiel conditions and current or standard meteorology (met) data. In addition, the operator, by appropriate selection on the input selection matrix (fig 1, row D-1 to D-3), can cause the computer to display intermediate data necessary to lay the launcher.

After FADAC computes met corrected firing data for a mission, it may be used to compute and apply low-level wind corrections. The ability of the computer to compute and apply these corrections in a matter of seconds at the critical stage of a fire mission is a particularly desirable feature.

CLEARING OF INTERMEDIATE CRESTS

In addition to the computation of firing data, FADAC may be used to compute the probability of clearing intermediate crests both in friendly and enemy territory. FADAC compares the location of the rocket along the trajectory with the crest range and altitude entered by the operator (fig 1, row D-6 to D-8) and displays the probability of clearing the crest and the number of probable errors by which the crest will be cleared. These computations are essentially a mechanization of the procedures currently used to compute minimum quadrant elevation (QE) in manual FDC procedures. The primary difference is that FADAC, instead of computing the minimum QE to clear the crest, computes and indicates the probability of clearing the crest, based on the quadrant elevation computed for the mission. The desired type of crest clearance computation is specified by the operator input data.

MISSIONS

The free rocket programs provide for the storage of a firing point list of up to 16 firing points, to include the easting, northing, altitude, and azimuth of the orienting line for each, and a target list of up to 32 targets, which includes the easting, northing, and altitude of each.

(H)	ORG SAFT	ORG DREXN	ORG ALT	ORG LOC STORE	ORG LOC RECALL	CLEAR MEMORY	NET FTD	NET THROW	(I)
(G)	ORG AS	ORG DREXN DIST	ORG SLANT DIST	ORG TRGT ANGLE	SURVEY		LAT	GRID DECL	(2)
(F)	TRGT LIST ASSOC	FP LIST ASSOC	LOCN TYPE	NET TYPE	WIND TYPE	YIELD	NO	OPTIM	
(E)	WIND SPEED WT	WIND WT	PROP WT CORR	FIN WT	PROP WT	CROSS WIND WT	PROP TEMP	FUEL FEEDS	(A)
(D)	CREST RANGE	AS FIRE	CREST ANGLE			CREST RANGE	CREST ALT	CREST CLEAR	(B)
(C)	FIRING MODE RECALL	LLF MS	LLF CROSS	WIND WT MULT	FINAL LLF CORR	FINAL DATA	PRINT MISSION	CLEAR DATA	(C)
(B)	FP SAFT	FP DREXN	FP ALT	AS SL	FP DATA STORE	RECALL FP OR LIST	PRINT FP	FP DELETE	(D)
(A)	TRGT SAFT	TRGT DREXN	TRGT ALT		TRGT DATA STORE	RECALL TRGT OR LIST	PRINT TARGET	TRGT DELETE	(E)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	

Figure 1. Free rocket input selection matrix.

In addition, the program can store 10 precomputed missions by using the alphanumeric switches to the right of the input selection matrix on the operator's panel (fig 1) which, in the cannon programs, designate the battery caliber (1 and 2 buttons) and the battery to fire (A, B, C, D, E buttons). Each alphanumeric combination (e.g., A-1, B-1, E-2) represents a mission which can be computed and fired immediately or stored for later use. If it is stored for later use, it may be updated by reentering the parameters that have changed, such as a new met message or propellant temperature, and recomputing the mission. The ease with which FADAC can do this is a marked improvement over manual methods, especially if several missions are to be updated.

TELETYPEWRITER

A feature of the free rocket programs not shared by the cannon programs is a print-out capability. The teletypewriter planned for use with the computer is the AN/TGC-14, better known as the MITE (fig 2). This teletypewriter connects directly to the computer. The program provides for a typeout of the target list, firing point list, and mission; the mission typeout records all the parameters used, in addition to the firing data computed for a designated mission. The operator controls each typeout by using the input selection matrix. If desired, the computer may be used without the teletypewriter.

The rocket programs also have a survey capability similar to that of the cannon programs. However, this capability is limited to the traverse and intersection functions, which the survey officer may use to check his survey computations.

TYPICAL FIRE MISSION

Upon occupation of position, the Honest John or Little John unit FDC normally will store known firing points and targets in the computer



Figure 2. The MITE teletypewriter.

for use by the S3 in analyzing the battalion's ability to attack targets in its zone of responsibility. Upon receipt of a fire mission, the S3 can make an alphanumeric selection for the mission. The computer can then associate this particular mission with the target and firing point from their respective lists (fig 1, F-1 and F-2) and enter the type of launcher, rocket, and warhead and other ballistic parameters pertaining to the mission (E-1 to E-8, F-3 to F-8). If it is necessary to provide data to lay the launcher, the operator will cause the computer to display the orienting angle and azimuth of fire before proceeding with the ballistic computation. After the met message (current or standard met) to be used for the mission is selected, the computer is ready for a ballistic computation.

After the ballistic data have been computed, the probability of clearing intermediate crests may be checked in the light of current data by selecting the proper crest clearance function in the matrix.

If the mission is not to be fired until later, no further action by the operator is necessary at this time. (He must, of course, change the alphanumeric mission select buttons if another mission is to be fired in the meantime.) As new data becomes available, this station may be updated by reselecting the alphanumeric buttons for the previously computed mission, entering the new data, and recomputing.

Upon receipt of the low-level wind readings from the windset, the computer is used to compute low-level wind corrections and incorporate them into the final deflection and quadrant elevation.

After the mission is completed, the MITE may be used to print out a hard copy record of the firing data and all parameters used to compute the data. The mission inside the computer may then be destroyed by depressing the CLEAR DATA button (C-8 on matrix), and that alphanumeric designation can then be used for another mission. Of course, any mission may be killed at any stage of the computation procedure.

In conclusion, the free rocket program for FADAC will improve the capability of rocket units by providing more accurate and more rapid solutions to their gunnery problems and by doing much of the book-keeping and analysis which must be performed prior to and during firing.

●

FIRING CHART ALTITUDES

All tick marks on firing charts are to be identified with an altitude measured in meters. Altitudes measured in feet will be converted to meters—multiply feet by 0.3048 to obtain meters. Unit fire direction centers using maps with altitudes in feet should construct a small conversion chart for the vertical control operator (VCO) covering the altitudes of interest in increments of one-half contour interval.

This conversion procedure and the use of only the meter (M) gage-point of the graphical site table are being taught at the USAAMS and will be embodied in Change 2 to FM 6-40 which is being processed for publication.

artillery fire planning . . .

The Responsibility Is Yours

Lieutenant Colonel Charles W. Montgomery
Tactics/Combined Arms Department

IN THE DEFENSE

Private Joe Fuller, Company A, 1st Battalion, 10th Infantry, (note), stepped into the cellar which served as the company command post, unfastened the portable radio he was carrying, removed it from his back, and placed it on the floor. Alfa Company has orders to defend in place and hold Hill 503. Bravo Company is also on line to defend the terrain to the east, and Charlie Company is in reserve. Fuller moved to the table where Captain Jinks, the company commander, had placed his map board when he returned from the battalion briefing. As Private Fuller scanned the map (fig 1), Lieutenant Moritzer, the artillery forward observer, entered the cellar, removed his field jacket, took a seat at the table, and started inspecting the situation map. Captain Jinks had sent for Lieutenant Moritzer and the mortar forward observers to brief them on the defensive situation and the fire support that would be required to support the defense of Hill 503.

During the attack, Private Fuller had been impressed by the preparation delivered by the artillery. Now he wondered how the artillery, which always seemed to be there when the company needed them, would assist in the defense.

When Lieutenant Moritzer looked up from the map, Fuller took the opportunity to start a conversation.

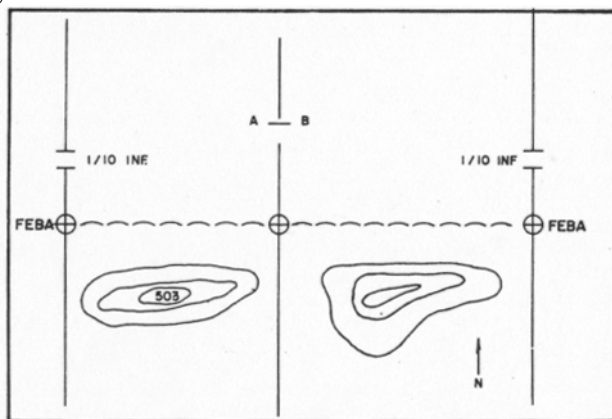


Figure 1. Defensive situation of the 1st Battalion, 10th Infantry.

Note: This article is part two of a two-part article on artillery fire planning. Part one, entitled "The Responsibility Is Yours—In the Attack," appeared in the February 1964 issue of ARTILLERY TRENDS.

- Pfc Fuller:** **"What can artillery do for is in the defensive?"**
- Lt Moritzer:** "Plenty. Properly employed artillery fires are often a deciding factor in the success or failure of the defense. We can support all phases of a defensive action. We can provide massed fires well beyond the range of your infantry weapons. If the enemy succeeds in penetrating your defensive positions, we can fire within the penetrated area. If you have to withdraw, we will have fires planned to the rear to help during your withdrawal. We can rapidly shift fires from one target to another, or we can attack several targets concurrently. Sometimes we have to occupy alternate or supplementary positions to get the job done."
- Pfc Fuller:** **"How do you know where to plan these artillery fires? Who gives you the targets?"**
- Lt Moritzer:** "Planning artillery fires to support the defense is a lot tougher than planning fires for the offense. In the attack, we know the answers to **who, what, when,** and **where.** In the defense, we know only the answers to **who** and **what.** The enemy determines **when** he will attack and **where.** We have to second-guess him and plan fires based on this guess. After the enemy launches his attack, it is too late to make a fire plan."
- Pfc Fuller:** **"What do you mean by 'second-guess' the enemy?"**
- Lt Moritzer:** "From the map we try to determine where the enemy will attack and in what formations (fig 2). We try to determine the most likely places for his artillery, mortars and OP's. Considering the weather and terrain and knowing the ranges of his weapons, we can usually eliminate some areas. However, it's still a tough job. Captain Jinks asked me and the mortar FO's to come here so that he can brief us on his plans and point out targets for our fires. We observers will then prepare our target lists. Working together, we do not duplicate targets. If the company has been allocated barrages to fit into the final protective fires, Captain Jinks will show us where he wants them. My battalion can provide three barrages, each approximately 200 meters wide. Because barrages are priority missions, a battery usually keeps its weapons laid on the barrage data when it is not firing another mission. When we fire a barrage, we use the maximum rate of fire for a given length of time or until the fires are lifted on order. The infantry mortars also fire barrages. My job as an FO requires me to insure the accuracy of

the location of the artillery barrages in the company's area of defense."

Pfc Fuller: "After you prepare the target list for defensive fires, what do you do with it?"

Lt Moritzer: "I send my list to Captain Brown, the artillery liaison officer at the infantry battalion CP. He plots the targets and assigns a concentration number to each so that later, when I need fires, I merely call for a concentration by number. In addition to my target list, Captain Brown receives target lists from the artillery FO's with other companies of the infantry battalion. He plots these targets to determine their adequacy and assigns concentration numbers. He may add targets based on the requirements of the infantry battalion staff. When the consolidated target list has been approved, Captain Brown sends the list to my battalion FDC. The other artillery liaison officers also send their target lists to the FDC. At the FDC, the S3 eliminates duplication and consolidates the requests for fire, insuring adequate coverage all across the brigade sector. He keeps all artillery liaison officers informed of the status of their requests for fire."

Pfc Fuller: "When you need fires on a concentration, do you call the liaison officer?"

Lt Moritzer: "No. When my target list, consolidated with those of the other companies, reaches the artillery battalion

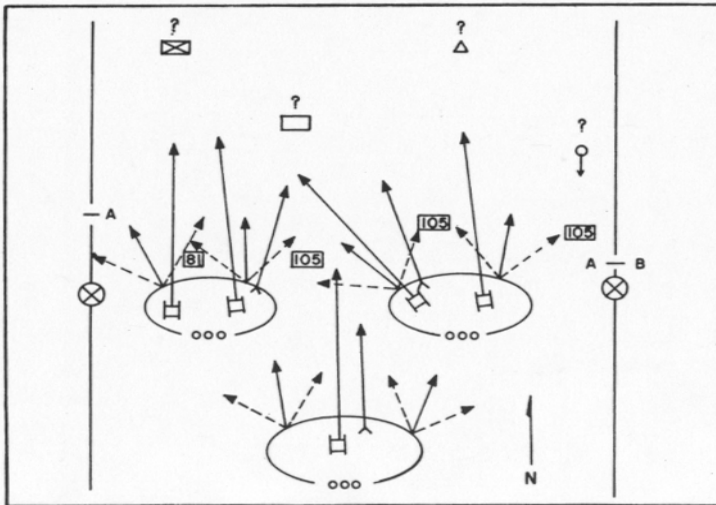


Figure 2. Defensive situation depicting Alfa company's protective fires and barrages and suspected enemy targets.

FDC, the S3 and his operations personnel plot the targets and determine which batteries will fire on each target (fig 3). Firing data is prepared, and each battery keeps data sheets for its assigned targets. When I need fire on a concentration, I call directly to the FDC for these fires. Captain Brown, the liaison officer, is on the same radio frequency as I and hears my request for fires. By calling the FDC directly, I save time. Firing data is kept current with the most recent registration and weather changes so that the fires will be accurate."

Pfc Fuller: **"Speaking of accuracy, how about the short rounds that I hear the platoon leaders kidding you about? How does the artillery make sure that our own supporting fires don't fall in our position?"**

Lt Moritzer: "I am glad you said 'kidding' for that is what they are doing. Lieutenant Colonel Banks, who is the artillery battalion commander, is responsible for establishing a no-fire line and for getting brigade approval of the no-fire line (fig 3). The line extends all across the brigade front and is sent to all artillery units. Each unit, in turn, plots the no-fire line on its firing charts. No artillery unit can fire short of this line without first clearing with my battalion. By handling artillery fires in this way, we are aware of all close-in fires in our sector and thus, can insure the safety of the infantry."

Pfc Fuller: **"You said the artillery battalion S3 determines which batteries will fire on each target. Let's suppose the S3 receives requests for fire on targets which are out of range of the battalion weapons. What happens then?"**

Lt Moritzer: "In those cases, the S3 sends the requests to the division artillery FDC. Division artillery usually has longer range weapons available. If the targets cannot be fired on by division artillery, the requests may be sent to corps artillery. Thus, a rifle company actually has much more artillery support available than is realized. Just last week when the company was attacking, I spotted several targets which needed more fires than my battalion could provide. I called for all available artillery fire. On one occasion, the fires of my own battalion, a general support battalion, and a corps artillery battalion were used on the target."

Pfc Fuller: **"Let's suppose that you plan all these fires for the defense but the enemy doesn't attack in the areas in which you planned your fires? How do you handle this?"**

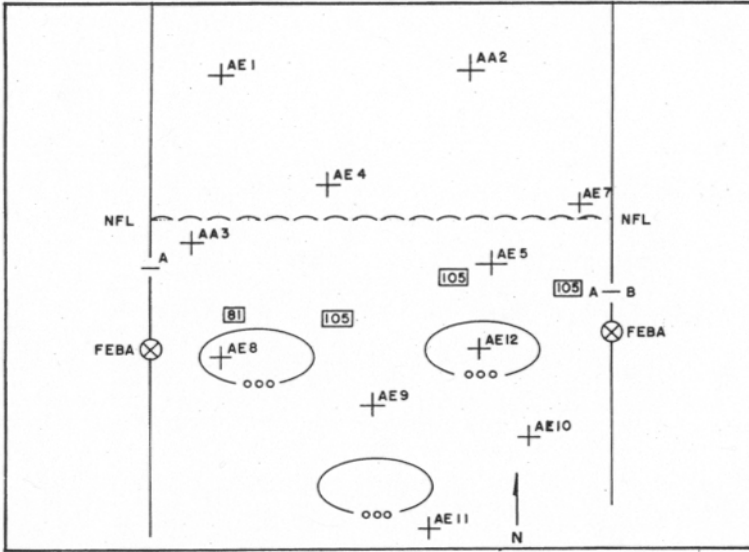


Figure 3. Defense situation of Alfa company depicting artillery concentrations and no-fire line.

Lt Moritzer: "We call any new targets which develop during the action targets of opportunity. These targets usually require immediate fires. I could send the FDC a complete new fire request. However, it will save time if I shift from one of the targets I planned earlier. These targets have already been plotted on the firing chart in the FDC."

Pfc Fuller: "**How do you know what distance to shift?**"

Lt Moritzer: "In many cases I have reference points which can be identified on both the map and the ground. This makes it easy. If I cannot specifically pinpoint the location of a target on the map, I estimate the distance. Having played football and knowing that a football field from goal line to goal line is 100 yards long, I estimate how many football fields would fit in the area of shift. In this way, I usually can come up with a pretty good estimate. A more accurate method of estimating the distance is to measure the gap with field glasses and use a formula to compute the distance."

Pfc Fuller: "**Did I understand you to say that all fires planned to support the defense are on-call fires?**"

Lt Moritzer: "No. Not all fires are on-call. Let's assume a situation where Captain Jinks wants several suspected enemy locations fired on throughout the period of darkness. I send a request to the FDC, through Captain

Brown, that these targets be included in the harassing and interdiction fires (H&I) planned for that night. If the request is approved, the FDC computes the data for these targets and gives it to the firing batteries, stating the number of rounds of ammunition to be expended and the period of firing. This is usually stated as so many rounds per hour for a period of so many hours. Harassing and interdiction fires are placed on an area to deny the enemy unrestricted use of the area or to keep the enemy awake, thus reducing his combat efficiency. In some instances, one artillery piece will fire on one target, while another piece fires on a different target. The chief of section of each weapon insures that the rounds are fired at irregular intervals so that the enemy is unable to determine or predict when the next rounds will come in."

Pfc Fuller: **"How is the artillery support for a counterattack planned?"**

Lt Moritzer: "The procedures for planning fires to support a counterattack are similar to those for planning fires to support the offense. However, there are two major differences. First, we cannot plan fires for delivery at a specific time, and secondly, we cannot plan fires on specific targets. As in the defense, we must visualize the situation and the targets and plan fires based on this visualization. The S3 of the force may make several counterattack plans, and the artillery fire planner must prepare a fire plan for each."

Pfc Fuller: **"Thanks very much, Lieutenant Moritzer. I can see that a lot of planning is necessary to insure adequate artillery support. I now have a greater understanding of the coordination within the combined arms."**

THE GREAT CHALLENGE

Planning fires to support a defensive operation is a greater challenge to the artilleryman than planning fires to support an attack. He must use his knowledge of enemy tactics and weapons and prepare a fire plan which will assist in repelling enemy attacks. The artilleryman must know the complete scheme of defense of the supported unit in order to insure that the fires planned are integrated into this scheme. Whenever possible, firing data should be prepared and available at the guns which are scheduled to fire on the targets. This will insure responsive fires. When batteries are not firing, they should keep their weapons laid on assigned barrages to insure responsiveness. Fires are planned to support each counterattack plan developed. The firing data for all defensive fires planned must be kept current with prevailing weather effects and latest registrations. Illuminating fires should be planned to support the defensive force during the hours of darkness.

As Lieutenant Moritzer said, "Properly employed artillery fires are often the deciding factor in the success or failure of the defense." The plans developed are no better than the ingenuity and offensive spirit of the planners. They must know the capabilities of their own artillery and of the enemy artillery and prepare fire plans accordingly.

●

GEM FOR THE FIRE DIRECTION CENTER

A simple device to help eliminate errors in the FDC and to increase speed may be constructed at battery level by individuals.

The device is a simple template (fig 1) that allows the computer to quickly and easily find the correct line in the ballistic table of either the cannon or rocket tabular firing table. It is especially useful in the larger rocket firing table when the numbers are small and may be some distance from the heading of the table. Since each firing table differs in dimension, the template should be produced **for each type firing table**.

The materials needed are:

1. A piece of heavy, stiff, preferably white paper about 2" by 8" (the back of a grid sheet is excellent for this use).
2. A razor blade or knife.
3. A straight edge and a sharp pencil.

The following steps are followed to produce the template:

1. Cut the paper to a convenient size, large enough to cover several lines of the table, 2" by 7 1/2" approximately.
2. With the straight edge, mark off a slit just wide enough to allow reading of one table line. Cut out the slit.
3. With the slit over a table line, mark off the vertical lines.
4. The table heading can now be placed on the template.

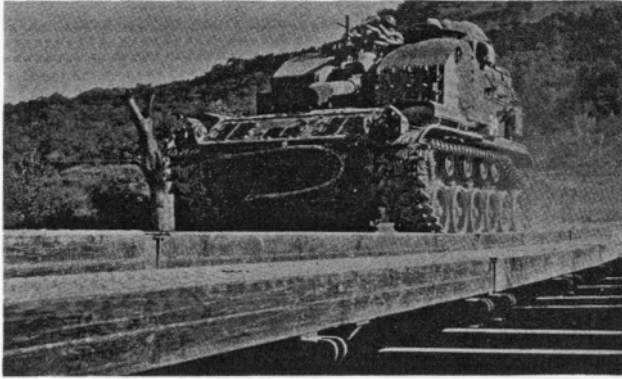
The template thus produced enables the computer to isolate the desired line and to easily read each ballistic value.

HEIGHT	ELEVATION or TIME OF FLIGHT	PROPELLANT TEMPERATURE				PROP WEIGHT	SURFACE AIR PRESSURE	BALLISTIC AIR DENSITY	BALLISTIC AIR TEMP	EMPTY WEIGHT	BALLISTIC RANGE WIND		
		C	or	I									
		77	77	20	77	1 LB.	1%	1%	1%	1 LB.	1 KNOT		
		20	20	30	120								
		1°F	57°F	1°F	1°F								
		DEC	DEC	DEC	INC	DEC	INC	DEC	INC	DEC	INC	H	T

Figure 1. Template for tabular firing table (example).

—by Lieutenant Carl F. Mills

Engineer/Artillery . . .



An Unbeatable Team

Lieutenant Colonel Frank M. Edgar

Major William N. Millward, Jr.

Tactics/Combined Arms Department

In common with many features of our everyday life, we find that the origins of the various military arms and services are somewhat hazy and filled with intermingled facts, legends, and myths to the point that differentiation is difficult. It has been said that the first people to be known as "engineers" were those working with the ancient "engines of war." Since these engines were primarily designed to assault fortified areas, we think first of the scaling towers, often mounted on wheeled platforms, and the various throwing devices commonly called catapults. At this point, then, we have established the earliest presumed link between engineers and artillerymen.

Down through the ages one civilization has been judged by comparison with another. The civilization of ancient Greece with all of its culture and science has been cited thousands of times as a model. Here, also, the influence of people with ingenuity and a zest for challenge is apparent. The appearance of the wooden horse before the "walls of Troy" leads us to presume that an engineer was involved.

It may also be stated that these engineers were able to develop various skills and capabilities useful during times of peace as well as times of war. Diversion of streams to supply water requirements for civil communities, livestock, and field irrigation; construction of stronger, larger, and more beautiful buildings; and creation of bridges, roadways, and canals for transportation of men, foodstuffs, and general supplies soon demonstrated that these skills, initially acquired in the military, fulfilled a peacetime need, and the term "civil engineer" was applied to this new group of people.

Both civil and military applications of engineering have continued throughout recorded history. The very early history of North America

contains references to a few military and civil engineers who came to the New World, with the colonists and the military forces accompanying the colonists to insure their safety. Extraordinary feats of engineering were accomplished by these colonists in their efforts to carve a new life out of the wilderness.

The early wars between the French and English—the battles of Louisburg, Lake George, Ticonderoga, Crown Point, and Quebec—became a training ground for troops and military engineers who would soon see service in our Revolutionary War. A Lieutenant Colonel Richard Gridley, who was the commander of the artillery train of the expedition that was to invest Louisburg, was charged with the supervision of the construction of British batteries surrounding the fortress in his capacity as chief bombardier. Colonel Gridley's experience in the sieges of Louisburg in 1745 and again in 1758 led to his being placed in command of the Provincial Artillery in 1759, and in this capacity he participated in the Battle of the Plains of Abraham and the capture of Quebec.

On the day before the Battle of Bunker Hill, the Continental Congress authorized a colonel as Chief Engineer "in a separate department." Colonel Gridley was appointed to the position by General Washington in July 1775. During the Battle of Bunker Hill, Colonel Gridley was engaged in the construction of breastworks and field fortifications, having been commissioned as Chief Engineer and Colonel of Artillery by the Massachusetts Provincial Congress. Here, again, we see the early ties between engineers and artillerymen in their common support of the infantry. Although the Battle of Bunker Hill took place 13 months before the signing of the Declaration of Independence, General Washington did not actually receive authorization to create a separate Corps of Engineers until December 1776.

Almost 7 years later, in November 1783, the entire Corps of Engineers was mustered out of the service. There were no military engineers until early in 1794 when President Washington temporarily appointed several foreign-born engineers to direct the work of fortifying some coastal harbors due to unsettled European conditions. In May of the same year, Congress passed an act establishing a Corp of Artillerists and Engineers—the organization to be a regiment of four battalions of four companies each. Four years later, in April of 1798, Congress authorized a second regiment of three battalions.

The new military establishment, created by the Congressional Act of 16 March 1802, provided for the separation of the Corps of Artillerists and Engineers by authorizing the President to organize a Corps of Engineers and a Regiment of Artillerists. The following remarks pertinent to this separation are extracted from a report made by the Secretary of War to the President on 5 January 1800:

"It is conceived that the entire union of the officers of artillerists and engineers in one corps, as in our present establishment, is not advisable. The art of fortification and the service of artillery, though touching each other in many points, are in the main distinct branches,

and each so comprehensive that their separation is essential to perfection in either. This has been ascertained by long experience. Among the powers of Europe there is not one recollected, which at the present day, is not conscious of this truth."

Today, engineer troops continue to operate in close coordination with the artillery and other combat arms. Successful accomplishment of the missions of the combat elements, both infantry and armor, greatly depends on firepower and maneuver. As joint members of the combined arms team, the artillery provides the firepower while the engineers provide the facilities for mobility. Responsibility of the Corps of Engineers falls into four general operational areas—military construction, civil works, combat support (fig 1), and the role of the engineers as a combat arm. This article will be limited to the discussion of engineer operations in the combat arm role.

COMBAT ARM ROLE

The ultimate objective of our land forces in time of general war is

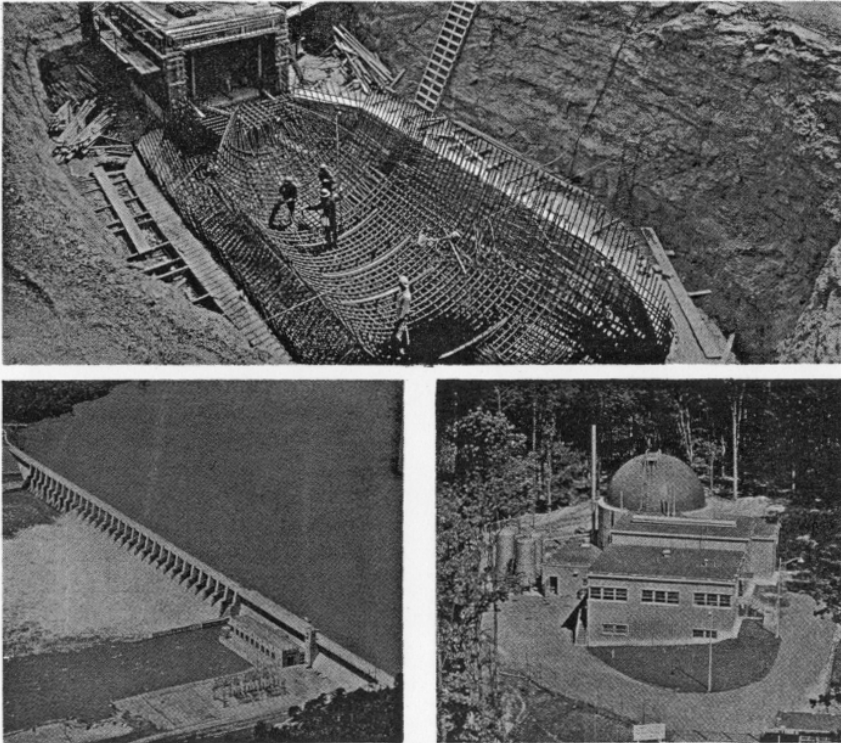


Figure 1. Depicted are examples of three areas of responsibility: military construction (top)—missile installations; civil works (bottom left)—Fort Gibson Dam on the Grand River; and combat support (bottom right)—construction of nuclear power plants for nuclear research for the Armed Services.

to close with the enemy, to destroy his capability to wage land war, and to occupy his territory. Success of our land forces in this ultimate objective is dependent on the effectiveness of our combined arms team. The principle of "fire and maneuver" is applied through the formation of the infantry and armor as the ground gaining elements, supported by the artillery (firepower) and engineers (mobility). The great captains of history—Alexander, Hannibal, Caesar, Gustavus Adolphus, Frederick, and Napoleon—employed this principle to the maximum and thereby gained fame in the art of warfare.

As a combat arm, the Corps of Engineers provides troops to join the other combat arms—infantry, armor, and artillery—in frontline battle. What began in early history as the construction of breastworks and field fortifications has since expanded into all areas concerned with the mobility of our own forces and the denying of mobility to the enemy. On landing beaches, at river crossings, or over mountains, avenues of approach must be built or blasted into enemy defenses. The expanded areas of the nuclear battlefield, together with the complexities and mass destruction capabilities of modern weapons, have placed an even greater demand and emphasis on combat engineers.

Organic to each type division—infantry, armored, mechanized infantry, and airborne—is an engineer combat battalion. These self-contained units are designed to provide a maximum combination of equipment and skills for forward combat engineer tasks. Division combat engineer battalions have the capability and responsibility for supporting hasty and expedient river and stream crossings (limited capability for the airborne combat engineer battalion) (fig 2); constructing, repairing, and maintaining roads, bridges, ferries, fords, culverts, and landing strips (fig 3); providing fixed bridges for crossing short gaps; preparing and executing demolitions, to include the employment of atomic demolition munitions (ADM); assisting in emplacing and removing obstacles, to include minefields and boobytraps; performing engineer

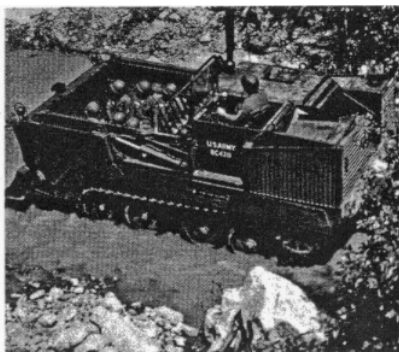
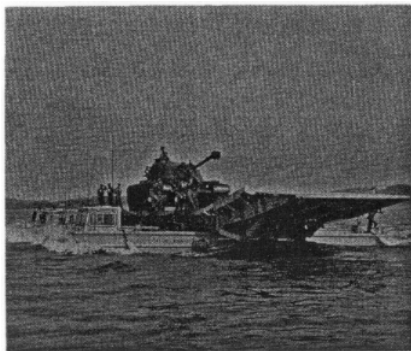


Figure 2. (Left) Continuous research provides new equipment for the Engineers' mission. River crossings are enhanced by a new mobile assault ferry.

Figure 3. (Right) A new universal engineer tractor provides a vehicle that can excavate an area or tow a howitzer.

reconnaissance and intelligence; providing technical assistance to other troops in the construction of obstacles, field fortifications, emplacements, camouflage, and deceptive devices (fig 4); supplying water and means for water purification; and fighting as infantry when required.

Artillery units of the division share the benefits of these tasks performed by the combat engineers. Bridging and rafting operations across water obstacles are essential to the artillery in all types of combat (fig 5). Road networks within the combat area are the primary means of communication used by the artillery for displacement and for the replenishment of ammunition, POL, rations, water, and other essential supplies. Assistance to artillery units in off-road movement into firing positions, preparation of gun emplacements, and clearing fields of fire is of primary importance to combat engineers.

NONDIVISIONAL COMBAT ENGINEER UNITS AND FUNCTIONS IN THE ATTACK

Working closely with, and in support of, the division engineer battalions

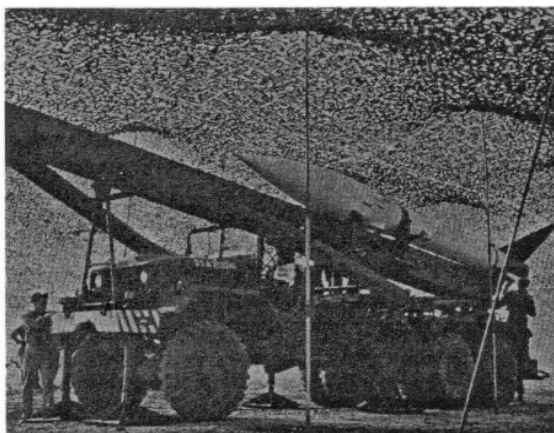


Figure 4. Camouflage is important to all artillery units.



Figure 5. Self-propelled howitzer using M4T6 bridge.

are certain combat engineer units within the corps; they are further supported by combat engineer units at the field army level. Normally three combat engineer groups are assigned to the corps. Each group contains a minimum of three combat engineer battalions. Lack of organic bridging within these combat engineer battalions is offset by the assignment of separate bridge companies to the same combat engineer group. Assignment of separate panel and float bridge companies provides the group with the capability to replace emplaced division tactical bridging vitally needed for displacement forward in the combat area. Additionally, this fixed and float bridging provides support for deliberate river-crossing operations and is executed at the corps level. An engineer dump truck company and an engineer light equipment company are also assigned to the combat engineer group. These two units give the group a greater capability for combat construction of roads, fords, culverts, and landing strips. Combat engineer battalions at the corps level, with reinforcement from the separate bridge companies, are essentially equipped to perform the same engineer tasks as those performed by the frontline division engineer battalion. Their areas of responsibility are normally from the division rear to the corps rear boundary. However, many times these corps combat engineer units are displaced forward to reinforce the combat engineer battalion of the divisions. In such situations, the division engineer, who is also the commander of the division engineer battalion, is responsible for the recommended employment and assignment of engineer units within the division area. To facilitate assignment of engineer sectors of responsibility within the division, an engineer work line (EWL) is established. Responsibility for the engineer work from this line rearward to the division rear boundary is transferred to the supporting engineer unit. This engineer work line is usually established along easily identifiable terrain, such as a river, and roughly parallels the forward edge of the battle area (FEBA). The EWL is not permanently established but is shifted, as required, according to the progress of the action or changing requirements.

To provide operational planning and command and staff supervision, and to coordinate activities of engineer groups and other assigned or attached engineer units for large-scale operations in the combat zone an engineer brigade is formed. This normally is accomplished when two or more engineer groups are assigned within the corps or field army. Such additional units as engineer camouflage companies (CORPS) or battalions (ARMY) and engineer topographic companies (CORPS) or battalions (ARMY) are attached as required. It is from this latter unit within the corps that survey control is passed from the engineer to the artilleryman at the target acquisition level.

COMBAT ENGINEERS IN THE DEFENSE

General Karl von Clausewitz in **Principles of War** explained the use of terrain as follows: "All other obstacles to approach, such as small rivers, brooks, ravines, etc., serve to break the enemy's front. He will

have to reform his lines after passing them and this will be delayed. These obstacles must, therefore, be placed under our most effective fire, which is grapeshot (400 to 600 paces), if we have a great deal of artillery or musketshot (150 to 200 paces), if we have little artillery at this point. Another method of using these obstacles to protect our front is to leave them a short distance ahead. They are thus within the effective range of our cannon (1000 to 2000 paces) and we can attack the enemy's column from all sides as they emerge."

Of course, the time and weapons have changed, but the basic principle concerning the use of natural and artificial obstacles and their protection by fire still applies today as it did for von Clausewitz and the Prussians of another era. Employment of barriers, as a coordinated system of natural and artificial obstacles, is adaptable to both nuclear and nonnuclear warfare.

Defensive actions are assisted by dispersion, concealment, and protection of men and materiel from enemy weapons. Barriers contribute materially to the accomplishment of the purpose of defensive combat, to gain time and to economize forces. Neutralization of the enemy's effort requires creation of artificial obstacles and barriers to hamper his mobility. There is no positive method that can be employed to deny the enemy approaches into our defensive positions when he is willing to "pay the price." Combat engineer troops have the necessary skills and equipment to create obstacles and barriers to assist our forces in delaying, diverting, and canalizing the enemy into areas where mass fire can be brought to bear on them. The distinct advantage in defensive operations is that the defensive force can choose the ground for the battle. By making full use of the terrain and the natural obstacles, such as rivers, dense forests, ravines, steep slopes, and swamps to the front as well as to the flanks, and supplementing these with artificial obstacles, such as demolished bridges, road craters, log cribs, antitank ditches, and minefields (fig 6) the defensive area can be strengthened. During the planning and execution of the barrier plan, very close coordination is

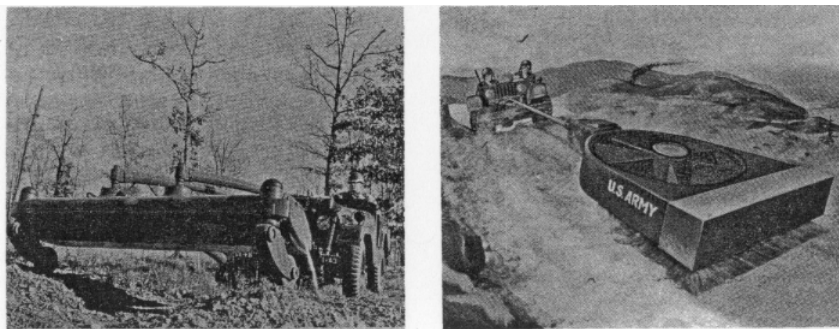


Figure 6. The engineer's job is made easier with mobile mine detectors (left). A future mine detector is to be developed (right).

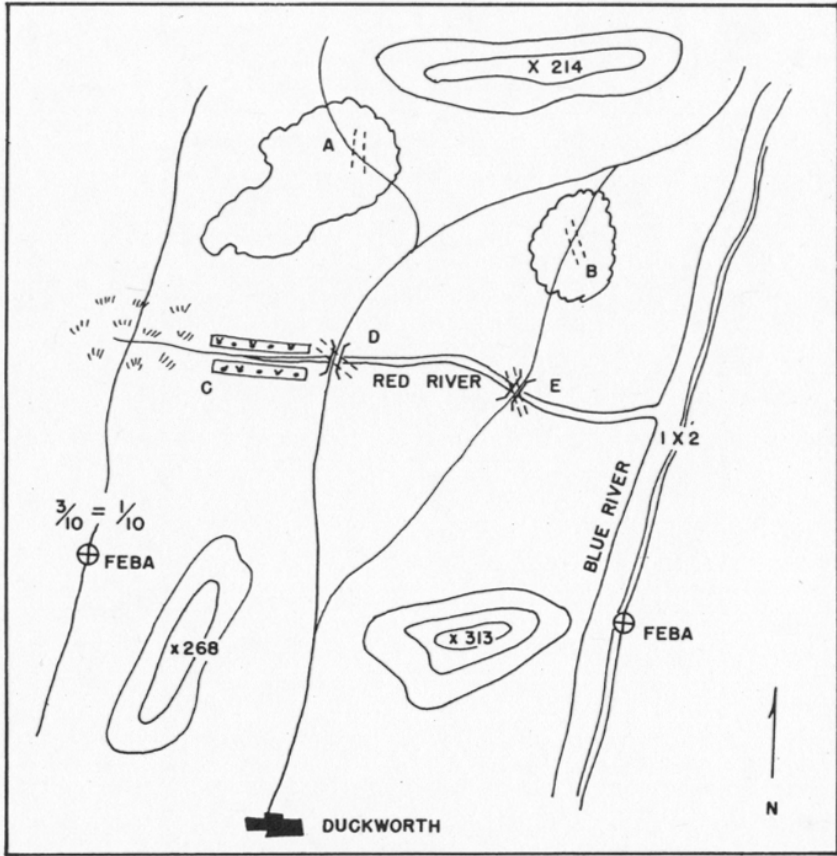


Figure 7. Barrier schematic (area defense).

conducted between the engineers and the artillery. Fire planning should be coordinated with the barrier plan in order to increase its effectiveness by covering fire. The schematic in figure 7 illustrates how a portion of a well planned barrier might appear when the terrain has been used to full advantage and has been supplemented with additional obstacles.

INFORMATION FOR SCHEMATIC

The barrier schematic provides a situation in which the 1st Battalion, 10th Infantry, is engaged in an area defense to the west of the BLUE River and across the high ground south of the RED River. An enemy mechanized battalion (reir forced) is attacking southward toward the RED River. The COP forces are in contact with the advance guard of the enemy and are withdrawing toward the bridges crossing the RED River.

The barrier plan shows the BLUE and RED Rivers used as natural obstacles along with wooded areas A and B and the swamp area on

the west end of the RED River. That section of the Red River between bridge D and the swamp is fordable. Employ prepared demolitions for road craters or for tree blowdown (abatis) in woods A and B and on bridges D and E across the RED River. All demolitions are to be executed on order after all COP forces are withdrawn. Employ defensive minefield C (mixed AT and APers) will cover fordable portion of the RED River.

Fire planning for schematic situation is executed by the artillery liaison officer supporting the 1/10 Inf who works closely with the engineer to provide maximum fire cover for the barrier. Concentrations across the north side of the minefield and on the roadways leading to bridges D and E, where the enemy will stop and "stack-up," are primary targets for the artillery. Additional targets are planned in woods A and B. The enemy will be engaged in repairing the road and clearing obstacles in these woods, and further, he will probably want to use these woods as assembly areas for river-crossing operations.

COMBAT ENGINEERS IN WITHDRAWAL ACTIONS

Withdrawal operations require a high degree of control and coordination of the engineer effort in the combat zone. In addition to the covering fire the artillery provides withdrawal actions, engineers assisting in the closing of lanes and gaps in previously emplaced minefields, blowing bridges, cratering roads, and similar works create obstacles in the face of an advancing enemy which are of paramount importance to withdrawal and delaying tactics. In operations of this type, combat engineer units will be placed along the tail end of retiring columns to maintain withdrawal routes for our covering and screening forces which requires a maximum degree of coordination between the engineer and all echelons of command within the zone and to both flanks. Although barrier operations become more extensive and elaborate during a withdrawal or delaying action, many times they must be hastily executed. In economy of force operations, the enemy usually has the advantage of numerical superiority in forces and weapons, but this imbalance can be substantially improved by the employment of a well planned barrier utilizing both natural and artificial obstacles.

MOBILITY—THE MISSION

The Corps of Engineers—in its role as a combat arm—plays a key part in the success of the combined arms team. Although emphasis on particular types of work may vary, tasks for combat engineer units are similar whether our forces are engaged in offensive or defensive combat. The primary mission of the combat engineer is still centered on mobility—providing it to our own forces and denying it to the enemy. Methods of execution and priorities will vary and will be greatly influenced by the commander's estimate of the situation. Cooperation and coordination with other members of the combined arms team toward the common goal of victory over the enemy, by destroying him or rendering him incapable of waging land war, is essential.

Division artillery . . .



The Airborne Division Artillery organizations have undergone some major changes since the draft TOE's were published in the July 1963 issue of ARTILLERY TRENDS. To keep all artillerymen up-to-date with division artillery organizational changes, ARTILLERY TRENDS has provided the following block diagrams and strength figures (fig 1 through 6) which are the final TOE's for the Airborne Division Artillery.

A broken line (- - - -) in a block diagram represents an augmentation to a unit. The strength figures in the augmentations are not counted in the unit strength figures.

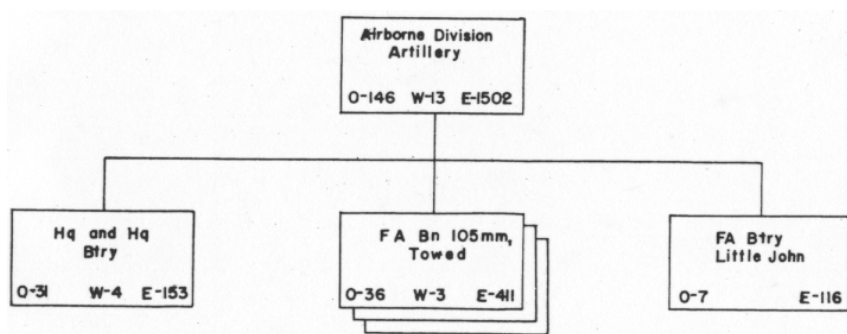


Figure 1. Airborne Division Artillery (TOE 6-200E).

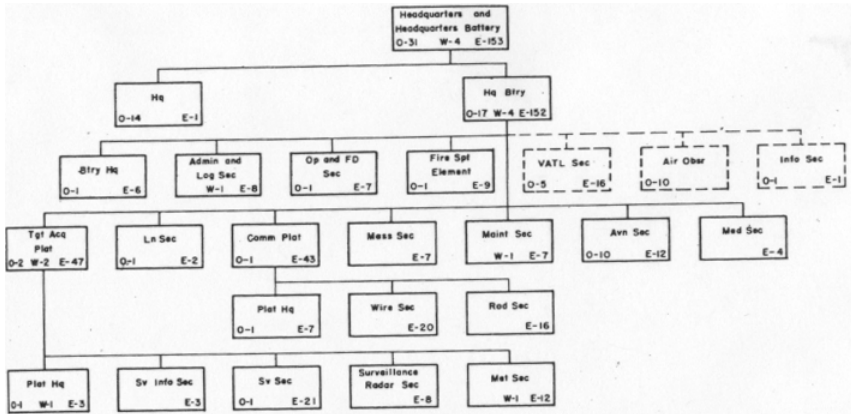


Figure 2. Headquarters and Headquarters Battery, Airborne Division Artillery (TOE 6-201E).

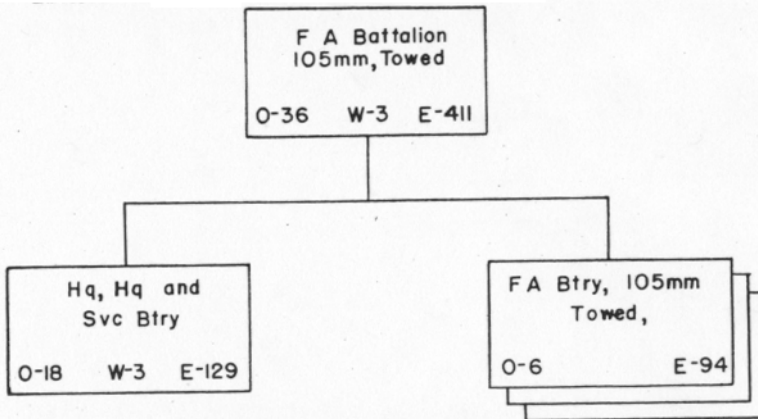


Figure 3. Field Artillery Battalion 105-mm, Towed, Airborne Division (TOE 6-215E).

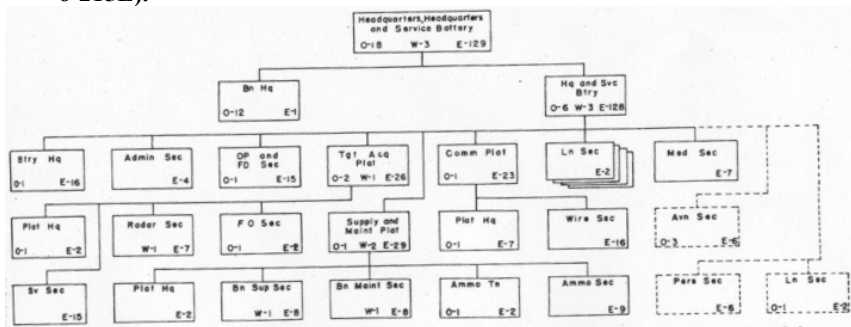


Figure 4. Headquarters, Headquarters and Service Battery Field Artillery Battalion 105-mm, Towed, Airborne Division (TOE 6-216E).

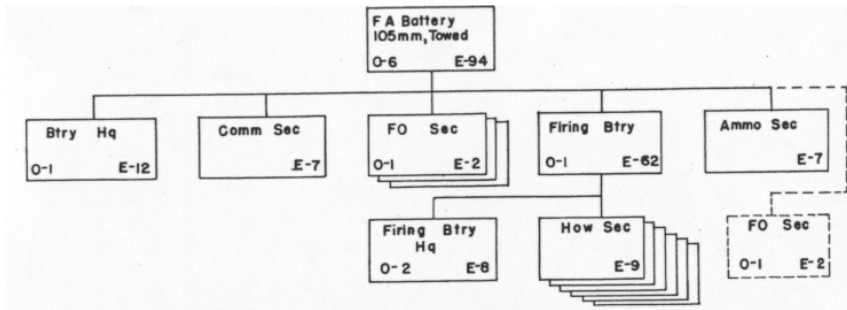


Figure 5. Field Artillery Battery 105-mm, Towed, Field Artillery Battalion, Airborne Division (TOE 6-217E).

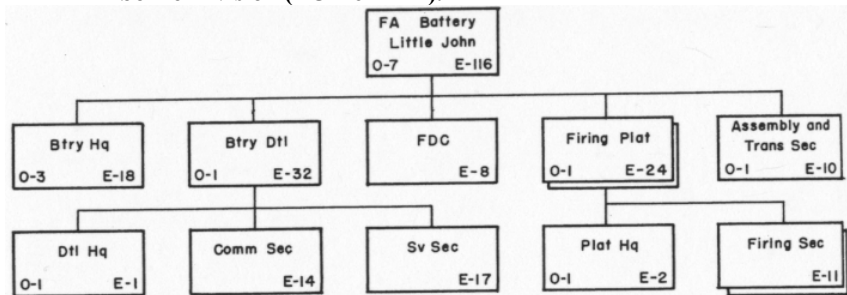


Figure 6. Field Artillery Battery, Little John, Airborne Division (TOE 6-228E).

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GEM FOR THE BATTERY COMMANDER

Quite often during his career an artilleryman can expect to be called on to fire a salute. Proper execution of a salute necessitates quite a lot of practice to achieve the required split second timing. Blank rounds are expensive and usually not available for as many practices as the salute battery commander may feel his unit needs.

The following procedure can be used to add realism to salute practices. Obtain the required number of empty blank 105mm canisters. Have the expended primer punched out and insert a M-14 blank cartridge in the primer cavity. The M14 blank rounds can be wrapped with adhesive cloth tape, FSN 8135-266-5006, to build up their diameter sufficiently to allow them to be wedged securely in the cavity. During practices the modified canisters are loaded and fired as normal 105mm blank rounds. The M-14 blank reports add realism to salute drills and allow more effective practice in report counting and misfire procedures.

—by Captain Frank J. Wasko, Jr.

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The mailing address for ARTILLERY TRENDS is: Commandant, US Army Artillery and Missile School, ATTN: AKPSIPL-ARTILLERY TRENDS, Fort Sill, Oklahoma 73504.

low-cost training aid . . .

Observer Pegboard Trainer

Warrant Officer William L. Lyon
3rd Battalion, 157th Artillery
Colorado Army National Guard

One of the problems of Reserve and National Guard units is the lack of space for student instruction in National Guard armories and Reserve centers. An artillery unit of the Colorado Army National Guard has solved its space problem by devising a low-cost, easily fabricated, and effective trainer for instructing forward observers. The pegboard trainer (fig 1), which can be erected indoors or outdoors, is used for teaching artillery terminology and procedures and to provide practical work for the forward observer section, fire direction center, gun sections, and wire section.



Figure 1. Pegboard trainer.

This trainer, which can be built locally for less than \$20.00, consists of one 4 by 8 foot sheet of Masonite pegboard, one or two 12 by 36-inch sheets of styrofoam cut to simulate terrain (fig 1), a few pieces of standup cardboard to represent grid lines, a few small pieces of red and yellow cardboard to represent shellbursts, one piece of 1/4-inch dowling to peg in holes and hold the red and yellow cardboard shell-bursts, and one roll of masking tape to mark areas on the drill floor.

The personnel required to operate the trainer includes the instructor, an observer (student), a radio-telephone operator (student), and a pegboard plotter, who operates the trainer and plots bursts from data given by the observer.

TRAINER PREPARATION

To prepare the training aid for operation, use the following procedures:

- Choose any military map with known observation posts and impact areas, and select the grid square(s) in which to simulate fire.
- Place the pegboard flat on the floor or on a table and count two lines of 40 holes in the form of a right angle. The distance between two adjacent holes represents 25 meters, thus 40 holes equal 1,000 meters, or one grid square (fig 2).
- Place cardboard cutouts of the terrain and targets on the pegboard. Any small objects may be used for targets. The terrain on the trainer does not necessarily have to match the terrain on the military map. Mark the cardboard grid markers with the grid square numbers selected from the military map (fig 1), and stand the markers on the pegboard.
- Pace off approximately 30 feet from the pegboard, and mark observation post positions on the floor (fig 3). The azimuths from the observation posts to the pegboard should correspond to the azimuths from the OP to the impact area on the military map. If the azimuth on the map measures 3,600 mils from the OP to the impact area, then the azimuth from the OP marked on the floor to the trainer must be 3,600 mils.

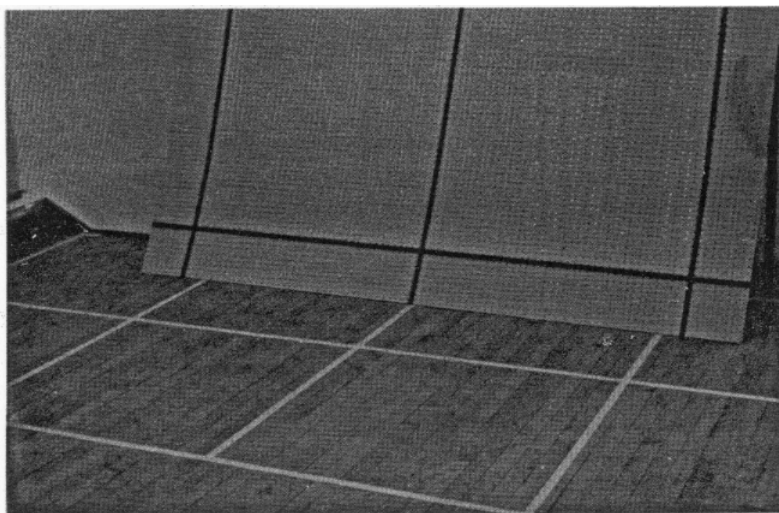


Figure 2. Grid squares are marked on floor with masking tape. Grid squares on pegboard are used to aid the pegboard plotter.

METHOD OF OPERATION

The use of the pegboard trainer permits simulation of all firing battery functions with one exception—no rounds are fired. After a target is selected for or by the student, the approximate grid coordinates are estimated by using the stand-up grid markers. The student observer uses a compass to determine the azimuth to the target, and then transmits his initial fire request to the FDC.

The FDC computes the firing data, transmits the necessary information

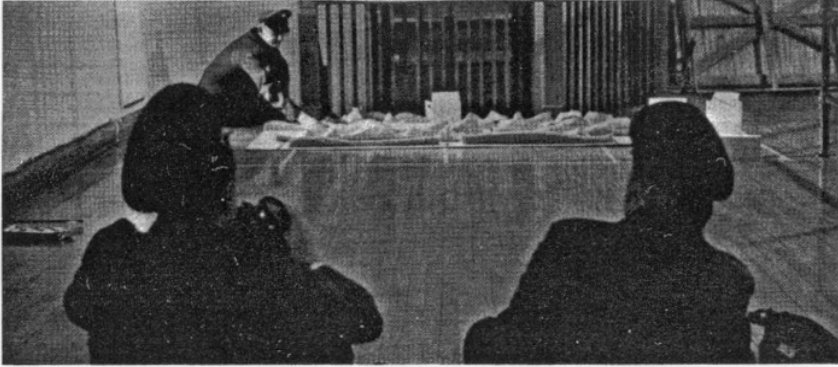


Figure 3. Relationship of observation post and pegboard.

to the firing battery, which, when ready, simulates firing. When "on the way" is transmitted to the observer, the pegboard plotter raises a flag or marker indicating the first burst. The pegboard plotter determines the location of the burst from the grid coordinates given in the fire request. If the student observer's coordinates are too accurate, the plotter may introduce an error with the first burst in order to give the student training in sensing, making corrections, and bracketing (fig 4).

All types of missions can be fired with the trainer with a few modifications in procedures. To fire area missions, the observer can shift from a known point (flags or markers representing a previous mission). This is also true when firing destruction missions.

If the observer uses polar plot, he estimates the scaled distance in meters from his position to the trainer. The actual distance is measured with a tape or simulated by the instructor.

When firing fuze time or fuze VT, the plotter uses red flags to represent graze bursts and yellow flags to indicate air bursts.

OT FACTORS

The observer-target (OT) factor is determined from the distance between the OP and trainer (fig 5). Various distances provide the student observer practical work in the use of the mil relation formula.

The advantage of the 30-foot distance is fewer holes for the plotter to count and a smaller grid square. The greater distances (45 or 60 feet) permit more distinct focus of the reticle in the binoculars. When using the greater distances, the instructor has to simulate only a portion of the grid square and change the stand-up grid square markers accordingly.

The pegboard trainer for student observers provides instruction for all personnel in nearly all the stages of observed fire training. In addition, many types of problems are practicable on this low-cost training aid. If more information concerning the observer pegboard trainer is desired, write to: WO William L. Lyon, Battery A, 3d Howitzer Battalion, 157th Artillery, 590 Yampa Avenue, Craig, Colorado.

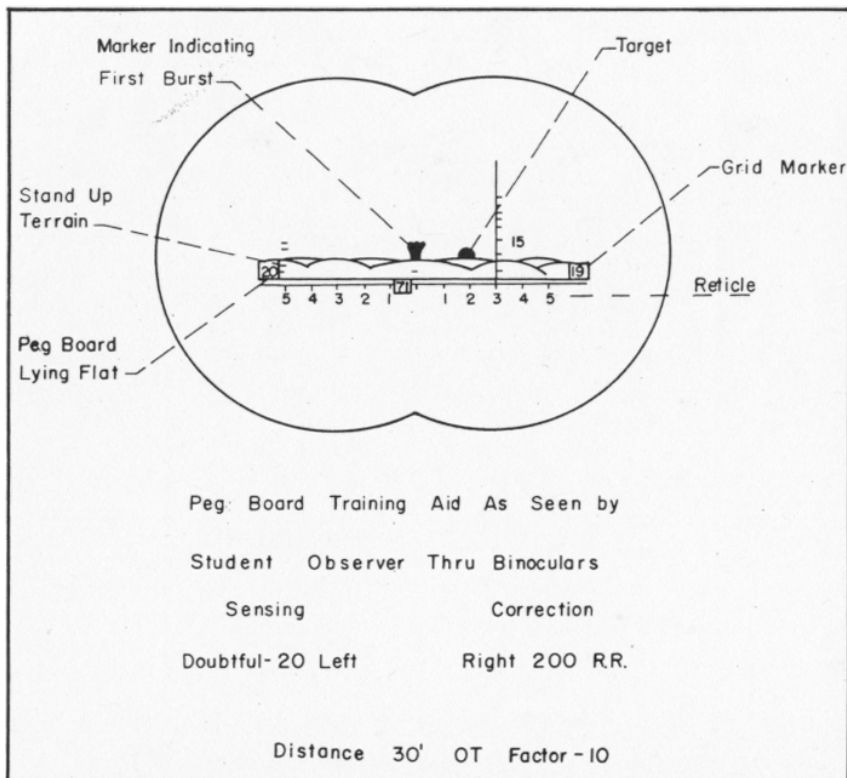


Figure 4. The observer, using the mil reticle in the binoculars, makes sensings and corrections.

Distance in Feet Observer to Trainer	OT Factor	Meters per inch between holes in board.
30	5	12 ½
30	10	25
45	3	4
45	6	10
60	2	2 ½
60	4	5

Figure 5. OT factor and distance table.

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The US Army Artillery and Missile School crest may be worn on the pocket of the red artillery blazer by all personnel who are or who have been assigned to the USAAMS either as staff and faculty or as a student.

A COLLECTION OF GEMS

GEMS in ARTILLERY TRENDS provide a vehicle for one artilleryman to share with thousands of other artillerymen suggestions, ideas, or helpful hints concerning field expedients.

In order for units to benefit from the numerous suggestions, ideas, and hints which have been published in ARTILLERY TRENDS during the last six years, the following pages which contain a collection of GEMS are provided for use of the battery commander, battery executive, and communication, survey, and fire direction center personnel as well as the forward observer and safety officer.

GEMS FOR THE BATTERY COMMANDER

Starting truck engines with radio switches in the "on" position often results in future radio troubles. Due to rear-mounted radios in the 3/4- and 2 1/2-ton trucks, it is difficult for the driver to determine whether or not the switches are on when the vehicle is started.

A Battery, 1st Battalion, 49th Artillery, has designed a switch and light arrangement so the driver can turn the radio "on" or "off" from the cab (fig 1). The light indicates when the equipment is on. Existing bolts or brackets on the dash board of the vehicle should be utilized for mounting the switch and light, since modification of the vehicle is not permitted under Ordnance regulations.

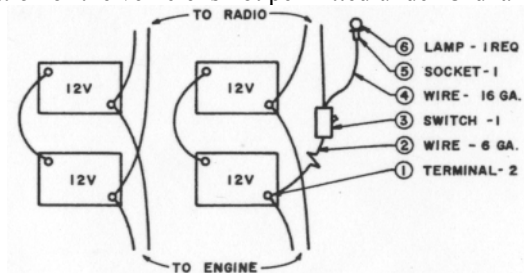


Figure 1. Radio switch.

The phrase "divide and conquer" can readily be applied to the problem of checking individual equipment prior to a command inspection. According to an announced schedule, have each man in the battery

place one or two items on his bunk each day. While the battery is training, the first sergeant and supply personnel can quickly check the equipment for serviceability and proper marking. Deficiencies should be posted on the bulletin board. Unsatisfactory items would be displayed again on subsequent days.

GEMS FOR THE BATTERY EXECUTIVE

A new "do-it-yourself" lighting device can eliminate delays caused by unmarked sights during night occupation of positions with M52 self-propelled howitzers. A red warning light from the driver's panel of a M113 personnel carrier can be taped to the top of the M100 sight and wired to a battery powered flashlight which the gunner can turn on and off as needed. The orienting of flashlights, previously used for marking sights, was difficult because the light beam could not be reflected properly from the first prism to the last. Usually, the light beam was diffused on the walls of the panoramic telescope, and only a faint light was reflected from the last prism into the darkness.

Previously, time was needed for the gunner to direct his sight toward the aiming circle before he could receive an initial deflection. With the new device, each piece is given an initial deflection as quickly as the howitzer stops and a deflection can be read on the aiming circle.

The XM53 Instrument Light Kit used with the M115 panoramic telescope mounted on the M107, 175-mm self-propelled gun and the M110, 8-inch self-propelled howitzer, operates and is used in essentially the same manner as the "do-it-yourself" system. A similar light projecting system, the XM52 Instrument Light, is used with later models of the T177 panoramic telescope mounted in the M108, 105-mm and M109, 155-mm self-propelled howitzers.

Here is a way you can help gunners to reduce the possibility of using the wrong aiming posts.

Make up small markers (about 6" by 8") of sheet metal, masonite, or similar sturdy material. These markers should be painted red and white in a series of distinctive patterns, one pattern for each section. Place a clamp or spring clip on the back of each marker so that the markers can be attached to the near aiming posts. The clamps will permit the marker to be mounted high enough to be seen above any high

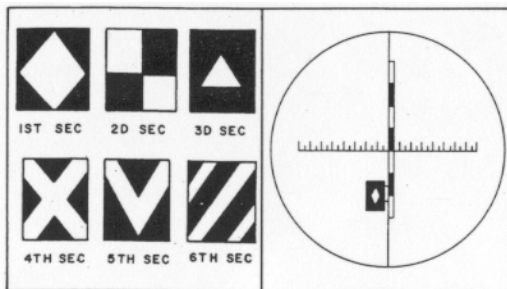


Figure 2. One example of marker patterns.

grass which might be in the way.

When these markers are in use, all cannoneers should know their own section marker. These markers may also speed up checks made by the chief of section and safety officer.

Figure 2 is a suggested set of marker patterns. Do not use regular numbers; they might cause confusion if the 4th section, for example, were to occupy a position as Number 5 piece.

* * * * *

Figure 3 shows an emplacement rod that is easily fabricated and can be attached to an aiming stake to speed up their placement, especially in hard ground. The rod is two and one-half feet in length and is pointed at the bottom. The bottom handle is located at the middle of the rod and is used for applying foot pressure. The upper handle is used when the ground is soft enough to give beneath hand pressure. The emplacement rod is attached to the stake with a "U" clamp at the top and a ring at the bottom for the tapered point of the stake.

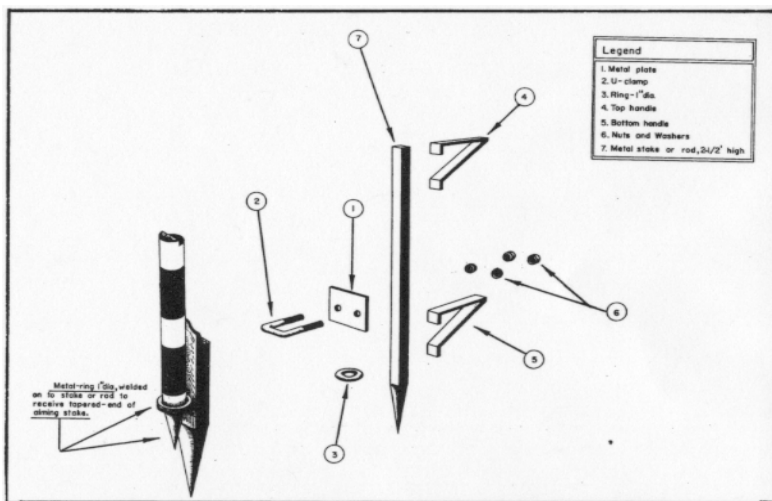


Figure 3. Emplacement rod for aiming stake.

* * * * *

If you've had problems laying out the necessary holes for your 155-mm howitzer before it comes into position, try the following method for quick, accurate orientation of high angle pit, trail holes, etc.

First prepare a board as in figure 4. Then place marks on a length of nylon cord at 30 inches from the end, 53 inches from the end, 78 inches from the end, and 14 feet, 6 inches from the end.

Place the board on the ground in the general direction of fire, and, using line "d" and a compass, orient the board on the azimuth of fire. Stake the board to the ground (a wooden, brass, or aluminum stake is preferable, since the compass is being used) through the stake hole at

A suggested standing operating procedure is to have the first dismounting cannoneer carry the rack with him to a spot not far from the howitzer and plant it firmly in the ground. The other cannoneers then have a readily accessible place to dispose of their unwieldy weapons while they emplace the howitzer.

When a field artillery battery goes into position, it must get the first round on the way as quickly as possible. The laying time can be reduced by using an arrow-shaped marker (fig 6). The marker is easy to make and is mounted on a rod. The top portion (both sides) should be painted with the section color to aid in identification, and both sides of the bottom portion should be painted with blackboard paint. The reconnaissance party can use the markers to indicate the position of each weapon. The arrow is pointed in the direction of fire, which can be determined with an M2 compass. Another shortcut is that the aiming circle operator can read the initial deflection to each piece before the battery arrives. This initial deflection should be recorded on the bottom part of the marker with chalk. When the battery arrives, each gunner can set off the initial deflection on the panoramic telescope.

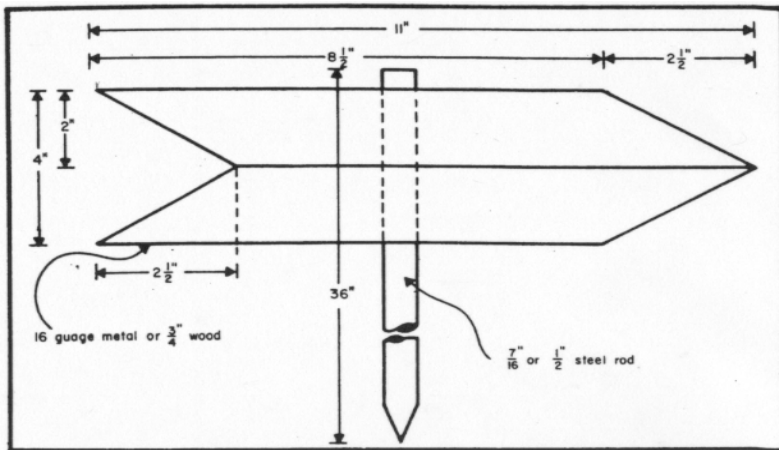


Figure 6. Dimensions of the arrow-shaped marker.

Don't let a hard surface in your gun park limit cannoneer training. You can overcome the problem of emplacing aiming stakes by filling two five-gallon buckets with sand and emplacing the stakes in the buckets. Thus, cannoneer training is not restricted.

Field artillery units can occupy a position much faster if each cannoneer acting as a gun marker is equipped with a large colored board (2' by 2'). Each gun section has its own color or distinctive design. The gun marker, who is standing over the assigned gun position, simply holds the board over his head as the battery occupies position, and the

chief of section directs his weapon to the appropriate colored board. By looking at the board, the gun crew can tell as soon as they reach the position where their weapon belongs.

GEMS FOR COMMUNICATION PERSONNEL

To prevent accidental signaling of the Manual Telephone Switchboard (SB-86/P) while the wire line is being laid, and to prevent possible damage to the switchboard during the initial line check, all line selector switches should be placed in the "M" position and should remain in this position until each wire line has been connected and tested using local battery operation. After each line is connected, the installer should then indicate to the switchboard operator which type of operation is required for the particular instrument. The line selector switch on the switchboard and the circuit selector switch on the telephone should then be placed in the desired position.

* * * * *

Protecting the radio mounts of your vehicles against weather is as important to the proper maintenance of communications equipment as the protection of the radios themselves. All of the radios of a field artillery battalion have canvas covers—why not the mounts too? Covers can easily be fabricated to protect the mount. Scrap canvas, old shelter halves, or discarded tarpaulins can be cut and sewn to fit the mounts snugly enough that they will sit tightly over the mount and not necessitate tiedowns or buckles. The result of this minimum expenditure of time and effort will be easier maintenance and assured fitting of the radio into its mount.

* * * * *

A very common problem with wire is its susceptibility to the short circuit. An expedient way to overcome a short circuit until permanent repair can be accomplished is with a ground return.

The operator on the receiving end of the line is notified, by an alternate means of communications, to ground return the shorted circuit. He does this by placing both ends of the pair of wires in one terminal of the switchboard or telephone and by placing a wire to ground in the other terminal. This procedure, when performed on both ends of the line, should allow normal operations again.

Remember, however, that to accomplish troubleshooting and repair of the shorted wire line, ground return must be eliminated.

To stimulate enemy jamming during field exercises, a standard FM radio will make an acceptable jammer. To use an FM radio as an expedient jammer, connect a loudspeaker to one of the audio receptacles on control box C-375/VRC. If a control box is not being used with the set, connect the loudspeaker to the audio receptacle on the receiver-transmitter. Connect a handset to the other audio receptacle. Turn the set on to maximum volume and tune to the frequency you wish to jam. Press the PUSH-TO-TALK switch on the handset and hold the microphone an inch or two from the speaker. Feedback will cause a whistle or

squeal which will change tone as you move the handset. With a little practice, you can produce a jamming signal similar to the stepped-tone or "bagpipes" sometimes used by jamming stations. You might have to try several combinations of receiver-transmitter, loudspeaker, and handset for best effect.

A sound similar to modulated continuous wave (CW) can be produced by using the RING switch on the receiver-transmitter. Voice jamming is produced by chattering into the microphone. In each case, the vehicle can be moved about to provide the desired signal strength and degree of interference. The strength of the jamming signal should allow receiving operators to work through the jamming by using proper procedures.

Although these jamming methods should be continued only for relatively short periods, such procedures will make operators conscious of jamming and afford training in anti-jamming techniques and reporting procedures.

A handy tool for use by the radio or radar repairman in those "hard to get at places" is the hemostatic forceps, a surgical instrument. This instrument usually can be obtained from an aid station or hospital when it is discarded as unserviceable because of minor stains, rust, or wear. This versatile tool, which looks like a combination of scissors and long nose pliers, provides a means of reaching into small places that are inaccessible to the repairman using standard tools. The locking grip of the forceps makes it valuable as an aid in assembling small components or as a holding tool when soldering.

A handy field expedient for overhauling field wire or cable in wooded areas can be made by using a lance pole (PO2) with a slingshot stock taped to one end (fig 7). This aids in lifting a line to a limb or overhang.

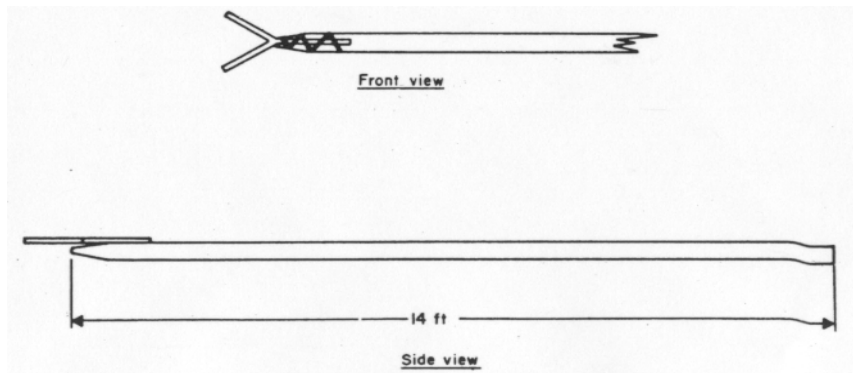


Figure 7. Lance pole.

The lance pole has several advantages over the pike pole. The lance pole is five feet longer than the pike poles and is in one section;

the pike pole is in two sections and requires assembly. Also, the lance pole can withstand more pressure.

If you have experienced difficulty with broken wire lines in the ground, start collecting slingshot stocks and lay the wire overhead.

To prevent entry of foreign matter and moisture into the receptacles on AN/VRC-12 radios when the radio is removed from the mount, the U. S. Army Electronics Materiel Supply Agency suggests that the receptacles be protected by use of self-sealing plastic tape FSN 5970-296-1175 or an equal type tape. Action has been initiated to provide discardable plastic covers FSN 5935-958-4869 to protect unused round type receptacles, such as J-11, J-12, and J-13 or J-21, J-22, and J-23, located underneath the mountings. The availability of this item will be announced in appropriate supply bulletins.

Users of the AN/VRC-12 radios should tape up connectors of temporarily disconnected cables and secure these cables to the mountings with tape, if necessary, to keep them out of the way.

GEMS FOR SURVEY PERSONNEL

A handy carrier for taping pins used by the survey party's front and rear tapemen permits free use of both hands. The carrier (fig 8) is simple in design and is constructed using an old taping pin mounted on a board. The reverse of the board has a loop of sufficient width to allow it to be attached to the pistol cartridge belt. A coat hanger or wire of sufficient strength may be used in place of the old taping pin.

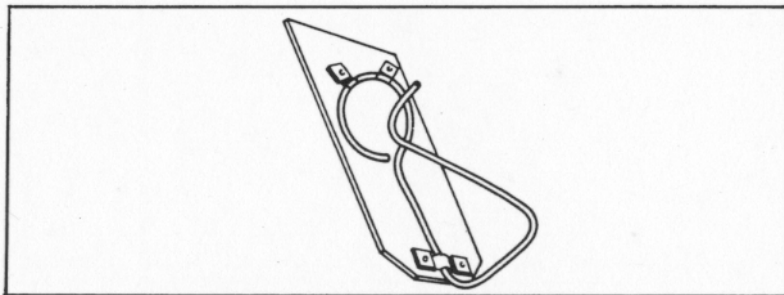


Figure 8. Taping pin carrier.

A system of rapid position area survey has been developed which will greatly facilitate the massing of a light artillery battalion from unprepared positions. This type of survey may be used when an entire battalion is in a march column and fire mission is received. The lead battery will leave the road and prepare to fire the mission. When the two other batteries arrive, they will take positions flanking the lead battery.

After the executive officer of the lead battery has laid his pieces, a survey instrument (theodolite or aiming circle) is set up at battery center. Survey personnel sight on the instrument with the recording motion

of the executive officer's aiming circle, being careful not to disturb the lower motion. The azimuth of fire is added to this reading and the result is the azimuth from the executive officer's aiming circle to the survey instrument at battery center. The addition or subtraction of 3,200 mils then gives the azimuth from the survey instrument to the executive officer's aiming circle.

Using the executive officer's aiming circle as a rear station, the azimuth to which is known, and the battery center of the center battery as the starting point, all the prerequisites for initiating a survey exist. The coordinates of the battery center are determined by map inspection. Survey is then simultaneously extended to the two flank batteries, which will be relayed by orienting angle. Thus, all batteries are on common coordinates and a common direction within a very short time. The registration of the center battery may be accurately applied to the flank batteries and the battalion may be effectively massed. As more time passes, the survey will be improved and true control will be established.

Does the battery cable's rubber molding on your unit's Gyro-Azimuth Survey Instrument-C2A ABLE split when subjected to acute bending near the battery clip (fig 9; (1)).

Repositioning the cable adapter adjoining the alligator clip can prevent the split in the rubber molding. Turning the cable adapter 90° eliminates the loop above the battery and any stresses occurring at or near the clip (fig 9; (2)).

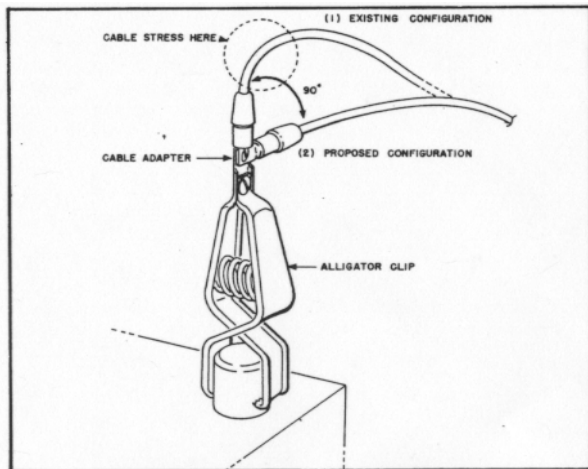


Figure 9. Battery clip and cable.

One unit has solved the problem of making sightings on range poles over 800 meters distant by fabricating panels of 1/4-inch plywood in the shape of an equilateral triangle with 16-inch sides (fig 10). One side of the panel is painted white and the other is covered with red or orange material from an airplane marking panel. A bracket mounted

on one point of the triangle facilitates attachment to the range pole. The point of the triangle then marks the exact center of the range pole.

The red (orange) side of the panel is used when surveying in snow or when the range pole is silhouetted against the sky line. The white side is used when the terrain background is green or brown. In addition to helping the instrument operator, the tapemen also have an easier time seeing the forward station to which they are taping.



Figure 10. Front and back of panel (left). Visibility of panel against background of trees (right).

GEMS FOR FIRE DIRECTION CENTER PERSONNEL

How many times have pencils rolling around on the chart gotten in your way when you wanted to use the GFT fan? You can end this problem by placing a piece of masking tape on the end of the pencil and then sticking the tape to the right edge of the table (for right handers). A color scheme on the masking tape will help to identify the desired pencil. A gum eraser similarly attached to the table makes an excellent holder for plotting pins.

The many computations required for ideal height of burst above target, range spread, and deflection spread during an illumination mission are time-consuming and error-prone. A common error in computing an illumination mission is applying the correction for change in elevation for a 50-meter increase in altitude (height of burst) to the fuze setting and vice versa. To decrease the possibility of this occurring in your unit, "color code" the illuminating shell section of your TFT's. One method of doing this is to lightly color the elevation column and its corresponding correction column with a red pencil; the fuze setting and correction column may be colored blue. Try this with your firing tables FT 105-H-6, C2, and FT 155-Q-3.

GEM FOR THE FORWARD OBSERVER

The rifle company in the Infantry Division has two 106-mm recoilless rifles. The M92D sight on the 105-mm recoilless rifle permits the

determination of the range to targets hit by the rifle or the spotting rifle that is a component of the weapon. Range may be determined from firing the recoilless rifle up to 2,200 yards and from firing the spotting rifle up to 1,200 yards. The forward observer should seek range data from any 106-mm recoilless rifle squad near his observation post. This range data can be a great aid in determining observer-target distance.

GEM FOR THE SAFETY OFFICER

Before leaving for the field, the firing battery safety officer can reduce his safety diagram information to a handy 3" by 5" card. This card (fig 11) will lessen the chance of error in verifying safety information since each charge to be fired is listed on a separate card. When the charge is announced to the guns, the safety officer selects the card to correspond to the charge to be fired. When the deflection is announced, he refers to the card and insures if the announced deflection is within the safety deflection bracket. When this has been established, all required safety information is available.

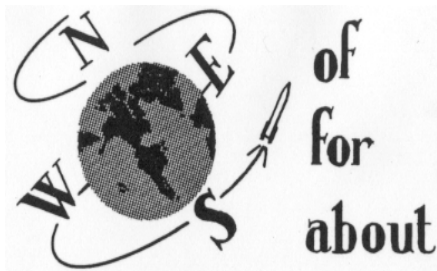
<u>CHARGE 5</u>			
Deflection	2018	2400	2765
Max Quad Elev	475	596	
Min Quad Elev	133	115	
Min Time Setting (Sec)	10.6	9.4	

Figure 11. Safety officer information card.

FADAC INTERFERENCE WITH FM RADIOS

Tests conducted by the USAAMS indicate that when the Gun Direction Computer, M18 (FADAC) is operated in close proximity to the antenna associated with receiver-transmitter RT-67 (component of radio sets AN/VRC-9, and 17 and AN/VRQ-2, there is sufficient interference to preclude effective voice communications under certain circumstances. Pending results of further testing, the following interim measures of reducing the interference are offered:

1. Normal remoting techniques should provide sufficient separation between the FADAC and RT-67 to eliminate most of the interference. This interference was not present when using the AM radio, man-pack radio, or FM radio sets in the AN/VRC-12 family.
2. Position the antenna associated with the RT-67 on either a higher or lower plane than the FADAC. When using a remoted antenna (RC-292) with the RT-67 the FADAC should be on a higher or lower plane than the remoted antenna and a separation of 3-5 meters should be maintained between the FADAC and the RT-67.



THE ARTILLERY WORLD

USAAMS HISTORY

A history of the US Army Artillery and Missile School is being prepared to cover the period from 1945 to the present. The history will consist of a narrative which will include humorous and entertaining items in conjunction with historical facts.

Artillerymen, who have been assigned to the school or to Fort Sill, Oklahoma during any of the years to be covered by the history, may have interesting items which would be appropriate for inclusion in this history. Anyone with memories, exciting experiences, or anecdotes concerning their tours at the school could be very helpful in the compilation of this history.

Appropriate information, whether it be of a serious or humorous nature, should be forwarded to: Commandant, U. S. Army Artillery and Missile School, ATTN: AKPSIPL-ARTILLERY TRENDS, Fort Sill, Oklahoma 73504.

CHANGE FOR THE ORIENTING ANGLE

The present procedure of restricting the orienting angle to never greater than 3,200 mils (FM 6-40, paragraph 43f) is no longer required. According to FM 6-40, the azimuth of the orienting line is expressed as the direction from the orienting station to a designated end of the orienting line; therefore, the orienting angle is the true horizontal clockwise angle from the line of fire to the orienting line regardless of the size of the angle, and it can exceed 3,200 mils.

When Change 2 to FM 6-40 is published, the definition of the orienting angle will be changed to read: "An orienting angle is the horizontal clockwise angle from the line of fire to the orienting line." Change 2 is being processed for publication.

CONSOLIDATION OF COMMUNICATIONS COURSES

By direction of CONARC, the Communications Officer Courses and the Communication Supervisors Courses concurrently taught at the Armor, Infantry, and Artillery Schools have been consolidated into one Communications Officer Course and one Communications Chief Course which will be taught at the USAAMS starting 1 July 1964. The Communications Officer Course will be 10 weeks, 5 days in length. Eight classes with a total input of 282 have been programmed for fiscal year 1964.

The Communications Chief Course will be 12 weeks in length, and four classes with a total input of 158 have been programmed for fiscal year 1965.

TELEPHONE SETS TA-312/PT

All telephone sets TA-1/PT authorized in ROAD artillery battery TOE's for use in the howitzer sections will be replaced by the telephone sets TA-312/PT (fig 1). This change will be accomplished when the applicable TOE's are changed.

Limited tests conducted by the Communication/Electronics Department, USAAMS, indicate that it is impossible for a howitzer section equipped with the TA-1/PT to signal the executive officer's post or any other howitzer section when more than three telephones are used with the Connecting and Switching Group MX-155/GT or in a hot-loop type installation. Also, the Headset Microphone H-144/U cannot be connected to the telephone set TA-1/PT.

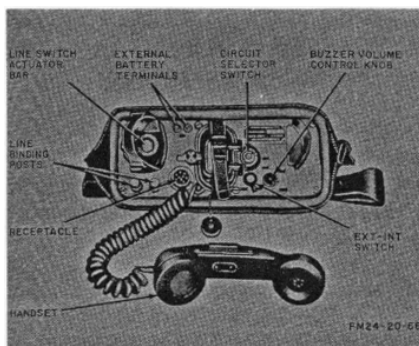


Figure 1. Telephone set TA-312/PT.

Pending documentation of TOE changes the following methods for effecting immediate remedial action by local commanders can be initiated. In addition to the telephone sets TA-1/PT each battery has authorized a quantity (13 to 19) of the standard field telephone sets TA-312/PT for use as determined by the battery commander. The TA-1/PT is a sound powered telephone that can be used in conjunction with any field telephone or switchboard within a working limit of five miles. Therefore, the allocation of telephones could be adjusted by local command action to effect a more satisfactory usage of all authorized telephones.

TM 38-750, AER PROCEDURES, REVISED

Effective 1 July 1964, the Army will implement an improved system for recording essential data concerning equipment operation and maintenance with the following changes in the newly revised TM 38-750 (January 1964), Army Equipment Record (AER) Procedures:

- The revised manual covers all Army equipment to include ammunition, materiel, calibration equipment, rail and marine (floating) equipment, and administrative vehicles.
- Equipment will now be grouped into primary categories instead of the technical service groups as was the case in the original TM 38-750. The categories are weapons, combat vehicles, tactical vehicles, electronics and communications, aircraft, missiles, special purpose equipment, and ammunition.
- Additional items have been included in the "mission essential-maintenance

significant" list. This list specifies the forms which are forwarded to the various commodity commands of the Army maintenance data processing center.

- All operational records are required for self-propelled and towed-type equipment. Use of operational records for other types of equipment is optional with the commander.

There are some changes in the forms:

- DA Form 2404, Equipment Inspection and Maintenance Worksheet, is no longer authorized for use in reporting command maintenance management inspections (CMMI). It is used as a worksheet, but the final reporting must be done on the DA Form 2408-3, Equipment Maintenance Record (Organizational).

- DA Form 2406, Materiel Readiness Report, has been combined with the old DA Form 2411 and is for all practical purposes, a completely new form. The new 2406 is designed to provide the Department of the Army and commanders at all levels, information as to the readiness status of equipment in the hands of using organizations. The Department of the Army will use this report for collection of materiel readiness data on those items of equipment which are considered essential for combat operations and which require a significant amount of maintenance to insure operational reliability. A list of these items is in appendix III of TM 38-750. Commanders below DA level may use DA Form 2406 for the collections of materiel readiness data on **any** items of equipment which they designate to insure the materiel readiness of the command.

- DA Form 2410, Component Removal and Repair/Overhaul Record, was revised and is used to provide a record and report for the control of all aircraft engines, specific aircraft components; recoverable combat vehicle engines, and selected recoverable missile components. The form is initiated each time a recoverable component is removed from an end item, a component is returned to the supply system, the Federal stock number of a component is redesignated, or when an uninstalled serviceable component becomes unserviceable. The procedures applying to DA Form 2410 must be implemented by 30 April 1964.

Many of these changes were introduced because of suggestions made by equipment operators. Information provided by the equipment operator at the troop level is still the basis for the entire system.

REVISED ORGANIZATIONAL MAINTENANCE TRAINING

CONARC has directed that a revised career training pattern for organizational level automotive maintenance personnel be implemented on 1 July 1964

The new system for providing maintenance training will be as follows:

- a. Army Training Centers at Forts Dix, Knox, Leonard Wood, Ord, Jackson, and Polk will train wheeled vehicle mechanics using a common Army subject schedule. This course will be seven weeks duration.

- b. Selected graduates of the wheeled vehicle mechanic course will be chosen to attend a tracked vehicle mechanic course at Fort Sill, Fort

Knox, or Fort Benning. This course will be seven weeks duration with a common Program of Instruction.

c. A master mechanic course of approximately nine weeks duration will be available to the mechanics who reenlist. This course will fill the present gap in formal schooling between the mechanic and the maintenance sergeant.

d. A maintenance sergeants course of approximately four weeks is programmed for maintenance personnel later in their career and aimed primarily at maintenance administration and supervision at the E-6 to E-9 levels.

These courses will provide better trained maintenance personnel at all levels as well as incentives for reenlistment.

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GEM FOR THE FIRE DIRECTION CENTER

Corrections obtained from a high angle registration with a given charge provide acceptable corrections for higher and lower charges, thus the elevation gageline is constructed through the entire face of the cursor. Errors introduced by the elevation gageline not being constructed parallel to the cursor hairline can be eliminated by placing the cursor hairline over the adjusted elevation and drawing a range gageline through the GFT range and 100/R scales of the GFT.

The computer can then set the range gageline over the range announced by the horizontal control operator and determine elevation, 10mils site factor, drift, and time of flight under the cursor hairline; for example see Figure 1. Be sure to label the range gageline; its use is unique to this solution.

This method is presented as an alternate solution to the method taught by the US Army Artillery and Missile School.

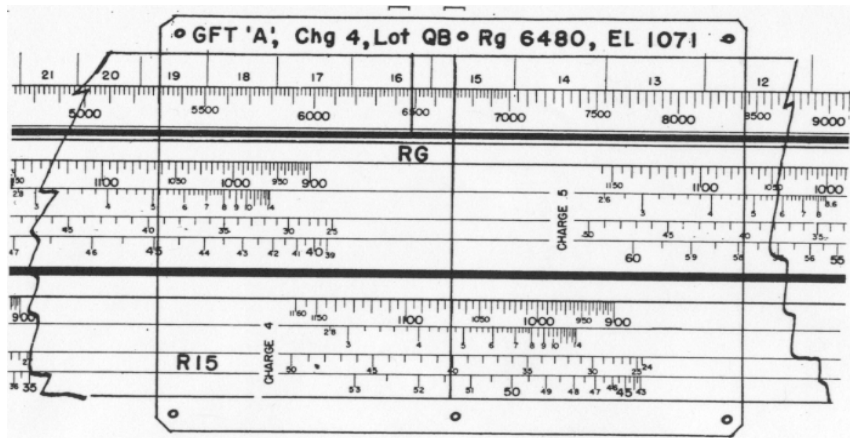


Figure 1. Example: GFT "A", Chg 4, Lot QB, Range 6480, El 1071, Df Corr: R15.

—by Lieutenant J. W. Hood

Readers' Comments

ARTILLERY TRENDS welcomes all comments from readers concerning any information published in ARTILLERY TRENDS that would be beneficial, instructional, or informative to all artillerymen. Comments should be forwarded to: Commandant, US Army Artillery and Missile School, ATTN: AKPSIPL-ARTILLERY TRENDS, Fort Sill, Oklahoma 73504.

A Book of GEMS.

ARTILLERY TRENDS has furnished me with many helpful ideas in the form of the GEMS submitted by artillerymen in the field.

In my job as Vietnamese division artillery advisor, I have proposed to the Vietnamese artillery officers many of the GEMS which they have used to good advantage. Is there a compilation book of these GEMS published by your office?

—Captain B. J. Thaxton
23rd Infantry Division
Vietnam

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Captain Thaxton's question concerning a compilation book of GEMS prompted ARTILLERY TRENDS to publish the article entitled "A COLLECTION OF GEMS" which appears on page 39.

GEM FOR THE COMMUNICATION OFFICER

Radio-telephone training, especially for Reserve units, presents a real headache for the Communication Officer. Using field radios, vehicles and a considerable amount of preparation are involved and the classes must be small and decentralized. With a field telephone "hot loop" system, only the operators can hear the transmission. In either arrangement, class participation is limited and the instructor finds it nearly impossible to interject comments or corrections.

The 94th Division Artillery Headquarters has developed and tested a system using field telephones and a standard civilian AM receiver, which combines the convenience of the telephone hot loop and the realism of the radio net.

The impedance match between a Telephone TA-312/PT and a radio having a carbon mike receptacle is ideal. Connect any number of telephones in a loop or series to the "phono" or "mike" receptacle of a small home radio. The radio amplifier which serves as a loudspeaker can then be used and traffic over the net can be heard by the entire class. All typical reactions, nervousness, mistakes, and mike fright, are evident as in an actual net. Class interest is high, and participation is 100 percent since each member of the class can hear and profit by the mistakes of the operators. The instructor, by using an additional telephone, can make comments or function as net control.

To prevent damage to the civilian radio by inadvertent operation of the ringing circuit of the telephones, all phones should be set on common battery or "CBS."

—by Major John J. Heffernan, Jr.

Resident Courses

U.S. Army Artillery and Missile School

Mr. Harold E. Earley
Office of Director of Instruction

More than 10,000 students are currently scheduled for resident courses at the US Army Artillery and Missile School (USAAMS) for fiscal year 1965. The USAAMS schedule of classes includes 35 courses of instruction with a total of 244 classes. Course lengths with a few exceptions are approximately the same as in fiscal year 1964.

The USAAMS FY 1965 schedule of classes has been forwarded to United States Continental Army Command (CONARC) for approval. Based upon this schedule and those from other agencies, CONARC annually publishes a "Detailed Schedule of Classes, Army Service Schools." This schedule, which is distributed throughout the army, provides course titles and numbers, class numbers, reporting dates, close dates, and class capacities.

Career active duty artillery officers are selected to attend the officer career courses by the Artillery Section, Officers Assignment Division, DCSPGRS, Department of the Army. Applications for admission to resident courses should not be sent to the School. Officers of the active army who desire to attend specialist (MOS) resident courses at the USAAMS may apply through channels. Army Reserve officers **not** on active duty may make application for attendance for any course (providing they meet all prerequisites) in accordance with the provisions of AR 135-200. Only active status members of the Army Reserve are eligible for selection. National Guard officers **not** on active duty should make application on National Guard Bureau Form 64 for admission to

<p>LETTER INDICATES CATEGORY OF STUDENTS</p> <p style="margin-left: 40px;">A—commissioned officers</p> <p style="margin-left: 40px;">B—commissioned and warrant officers</p> <p style="margin-left: 40px;">D—commissioned and enlisted</p> <p style="margin-left: 40px;">N—warrant officers and enlisted</p> <p style="margin-left: 40px;">R—enlisted</p>	
<div style="display: flex; justify-content: space-around; align-items: center;"> 6 A C-23 </div>	
<p>Digit indicates branch:</p> <p style="margin-left: 20px;">6—FA course</p> <p style="margin-left: 20px;">5—engineer course</p> <p style="margin-left: 20px;">7—infantry course</p>	<p>Courses within a school:</p> <p style="margin-left: 20px;">C—officer career course</p> <p style="margin-left: 20px;">23—associate career course</p>

Figure 1. Explanation of the digits and letters comprising a typical course number. The example shown is the Associate Field Artillery Officer Career Course.

USAAMS resident courses to the Chief, Army National Guard Bureau, ATTN: Schools Division, Washington 25, D. C.

CURRENT RESIDENT COURSE SCHEDULE

A completed summary of the purposes and prerequisites for all courses conducted at the USAAMS is published in DA Pam 20-21, "Army School Catalog." All courses which exceed 20 weeks are attended in a permanent change of station (PCS) status and those 20 weeks or less in length are attended in temporary duty (TDY) status.

Listed are the officer and enlisted resident courses scheduled to be taught at the USAAMS during fiscal year 1965, starting 1 July 1964.

Course	Class No.	Report	Start	Close	Input
FA Officer Basic (9 Weeks) (6-A-C20)	1-65	22 Jul 64	27 Jul 64	24 Sep 64	91
	2-65	19 Aug 64	24 Aug 64	22 Oct 64	97
	3-65	16 Sep 64	21 Sep 64	19 Nov 64	91
	4-65	29 Sep 64	2 Oct 64	3 Dec 64	91
	5-65	13 Oct 64	16 Oct 64	17 Dec 64	91
	6-65	24 Nov 64	30 Nov 64	11 Feb 65	91
	7-65	6 Jan 65	11 Jan 65	11 Mar 65	91
	8-65	3 Feb 65	8 Feb 65	8 Apr 65	91
	9-65	17 Feb 65	23 Feb 65	22 Apr 65	91
	10-65	17 Mar 65	22 Mar 65	20 May 65	91
	11-65	28 Apr 65	3 May 65	1 Jul 65	90
	12-65	9 Jun 65	14 Jun 65	12 Aug 65	90
Artillery Officer Career (32 weeks) (6-A-C22)	1-65	1 Jul 64	6 Jul 64	26 Feb 65	120
	2-65	5 Oct 64	7 Oct 64	4 Jun 65	171
	3-65	25 Jan 65	27 Jan 65	10 Sep 65	120
	4-65	3 May 65	5 May 65	17 Dec 65	120
Associate Field Artillery Officer Career (19 Weeks) (6-A-C23)	1-65	5 Jul 64	7 Jul 64	17 Nov 64	101
	2-65	28 Sep 64	30 Sep 64	25 Feb 65	101
	3-65	19 Jan 65	21 Jan 65	3 Jun 65	101
	4-65	26 Apr 65	28 Apr 65	9 Sep 65	101
FA Officer Refresher (2 Weeks) (6-A-C6)	*1-65	2 Aug 64	3 Aug 64	14 Aug 64	40
	2-65	13 Sep 64	14 Sep 64	25 Sep 64	39
	3-65	31 Jan 65	1 Feb 65	12 Feb 65	39
	4-65	25 Apr 65	26 Apr 65	7 May 65	39
Senior Field Artillery Officer (2 Weeks) (6-A-F6)	1-65	19 Jul 64	20 Jul 64	31 Jul 64	24
	2-65	3 Jan 65	4 Jan 65	15 Jan 65	24
	3-65	11 Apr 65	12 Apr 65	23 Apr 65	25
** Nuclear Weapons Employment (3 Weeks) (6-A-F19)	1-65	11 Sep 64	14 Sep 64	2 Oct 64	25
	2-65	17 Nov 64	18 Nov 64	11 Dec 64	25
	3-65	25 Feb 65	26 Feb 65	19 Mar 65	25
	4-65	3 Jun 65	4 Jun 65	25 Jun 65	15
Nuclear Weapons Employment (Res Comp) (2 Weeks) (6-A-F20)	1-65	27 Sep 64	28 Sep 64	9 Oct 64	16
	2-65	17 Jan 65	18 Jan 65	29 Jan 65	17
	3-65	25 Apr 65	26 Apr 65	7 May 65	17
Nuclear Weapons Employment (4 Weeks, 3 Days) (6-A-F26)	1-65	9 Aug 64	10 Aug 64	10 Sep 64	21
	2-65	15 Nov 64	16 Nov 64	17 Dec 64	21
	3-65	7 Mar 65	8 Mar 65	7 Apr 65	21
Communications Officer (10 Weeks, 5 Days) (6-A-0200)	1-65	1 Jun 64	2 Jul 64	18 Sep 64	35
	2-65	3 Aug 64	4 Aug 64	20 Oct 64	35
	3-65	29 Sep 64	30 Sep 64	17 Dec 64	35
	4-65	2 Nov 64	3 Nov 64	4 Feb 65	35
	5-65	4 Jan 65	5 Jan 65	23 Mar 65	35
	6-65	1 Feb 65	2 Feb 65	20 Apr 65	35

*For US Marine Corps Personnel Only.

**The course 6-A-F19 is conducted for selected graduates of each Associate Field Artillery Officer Career class.

Course	Class No.	Report	Start	Close	Input
	7-65	1 Apr 65	2 Apr 65	18 Jun 65	36
	8-65	3 May 65	4 May 65	21 Jul 65	36
Artillery Target Acquisition Officer (11 Weeks) (6-A-1154)	1-65	8 Sep 64	10 Sep 64	25 Nov 64	16
	2-65	11 Jan 65	13 Jan 65	30 Mar 65	16
Artillery Survey Officer (8 Weeks) (6-A-1183)	1-65	8 Jul 64	9 Jul 64	2 Sep 64	34
	2-65	14 Oct 64	15 Oct 64	11 Dec 64	33
	3-65	14 Apr 65	15 Apr 65	10 Jun 65	33
Sergeant Officer (5 Weeks, 4 Days) (6-A-1190D)	***OA-65	19 Jul 64	20 Jul 64	28 Aug 64	25
	1-65	9 Sep 64	10 Sep 64	20 Oct 64	24
	2-65	13 Jan 65	14 Jan 65	24 Feb 65	24
	3-65	1 Mar 65	2 Mar 65	9 Apr 65	23
	4-65	11 Apr 65	12 Apr 65	20 May 65	23
	5-65	23 May 65	24 May 65	2 Jul 65	23
Sergeant Officer (NON-US) (7 Weeks) (6-A-1190DX)	1-65	12 Jul 64	13 Jul 64	28 Aug 64	20
	2-65	26 Oct 64	27 Oct 64	16 Dec 64	20
Pershing Officer (8 Weeks) (6-A-1190E)	1-65	12 Aug 64	13 Aug 64	8 Oct 64	25
	2-65	20 Oct 64	21 Oct 64	17 Dec 64	25
	3-65	14 Jan 65	15 Jan 65	12 Mar 65	25
	5-65	2 Jun 65	4 Jun 65	30 Jul 65	25
FA Officer Candidate (23 Weeks) (6-N-F1)	1-65	26 Jul 64	3 Aug 64	19 Jan 65	85
	2-65	23 Aug 64	31 Aug 64	16 Feb 65	85
	3-65	20 Sep 64	28 Sep 64	16 Mar 65	85
	4-65	18 Oct 64	26 Oct 64	13 Apr 65	84
	5-65	15 Nov 64	23 Nov 64	11 May 65	84
	6-65	13 Dec 64	4 Jan 65	8 Jun 65	84
	7-65	24 Jan 65	1 Feb 65	6 Jul 65	84
	8-65	21 Feb 65	1 Mar 65	3 Aug 65	84
	9-65	21 Mar 65	29 Mar 65	31 Aug 65	84
	10-65	18 Apr 65	26 Apr 65	28 Sep 65	84
	11-65	16 May 65	24 May 65	26 Oct 65	84
	12-65	13 Jun 65	21 Jun 65	23 Nov 65	84
FA Off Candidate (RC) (11 Weeks) (6-N-F2)	1-65	11 Jun 65	16 Jun 65	28 Aug 65	120
FADAC Operator (1 Week) (6-D-F28)	1-65	26 Jul 64	27 Jul 64	31 Jul 64	15
	2-65	30 Aug 64	31 Aug 64	4 Sep 64	15
	3-65	20 Sep 64	21 Sep 64	25 Sep 64	15
	4-65	18 Oct 64	19 Oct 64	23 Oct 64	15
	5-65	15 Nov 64	16 Nov 64	20 Nov 64	15
	6-65	31 Jan 65	1 Feb 65	5 Feb 65	15
	7-65	14 Feb 65	15 Feb 65	19 Feb 65	15
	8-65	21 Mar 65	22 Mar 65	26 Mar 65	15
	9-65	9 May 65	10 May 65	14 May 65	15
	10-65	27 Jun 65	28 Jun 65	2 Jul 65	15
FADAC Maintenance (2 Weeks, 1 Day) (6-D-F29)	1-65	9 Jul 64	10 Jul 64	24 Jul 64	14
	2-65	13 Aug 64	14 Oct 64	28 Aug 64	14
	3-65	1 Oct 64	2 Oct 64	16 Oct 64	14
	4-65	2 Dec 64	3 Dec 64	17 Dec 64	14
	5-65	14 Jan 65	15 Jan 65	29 Jan 65	14
	6-65	4 Mar 65	5 Mar 65	19 Mar 65	14
	7-65	22 Apr 65	23 Apr 65	7 May 65	14
	8-65	10 Jun 65	11 Jun 65	25 Jun 65	15
Nuclear Projectile Assembly (1 Week) (6-D-F——) (Formerly 142.1)	1-65	5 Jul 64	6 Jul 64	10 Jul 64	30
	2-65	19 Jul 64	20 Jul 64	24 Jul 64	30
	3-65	2 Aug 64	3 Aug 64	7 Aug 64	30
	4-65	16 Aug 64	17 Aug 64	21 Aug 64	30
	5-65	30 Aug 64	31 Aug 64	4 Sep 64	30
	6-65	20 Sep 64	21 Sep 64	25 Sep 64	30
	7-65	27 Sep 64	28 Sep 64	2 Oct 64	30
	8-65	11 Oct 64	12 Oct 64	16 Oct 64	30
	9-65	25 Oct 64	26 Oct 64	30 Oct 64	30
	10-65	15 Nov 64	16 Nov 64	20 Nov 64	30

***Input includes: 19 US, 6 Non-US.

Course	Class No.	Report	Start	Close	Input
	11-65	29 Nov 64	30 Nov 64	4 Dec 64	30
	12-65	6 Dec 64	7 Dec 64	11 Dec 64	30
	13-65	3 Jan 65	4 Jan 65	8 Jan 65	30
	14-65	17 Jan 65	18 Jan 65	22 Jan 65	30
	15-65	31 Jan 65	1 Feb 65	5 Feb 65	30
	16-65	14 Feb 65	15 Feb 65	19 Feb 65	30
	17-65	28 Feb 65	1 Mar 65	5 Mar 65	30
	18-65	14 Mar 65	15 Mar 65	19 Mar 65	30
	19-65	28 Mar 65	29 Mar 65	2 Apr 65	30
	20-65	4 Apr 65	5 Apr 65	9 Apr 65	30
	21-65	18 Apr 65	19 Apr 65	23 Apr 65	30
	22-65	2 May 65	3 May 65	7 May 65	30
	23-65	16 May 65	17 May 65	21 May 65	30
	24-65	13 Jun 65	14 Jun 65	18 Jun 65	30
Artillery Ballistic Meteorology (9 Weeks, 4 Days) (6-H-103.1)	1-65	10 Jul 64	13 Jul 64	18 Sep 64	37
	2-65	7 Aug 64	10 Aug 64	16 Oct 64	37
	3-65	11 Sep 64	14 Sep 64	20 Nov 64	37
	4-65	9 Oct 64	12 Oct 64	17 Dec 64	37
	5-65	20 Nov 64	23 Nov 64	15 Feb 65	37
	6-65	8 Jan 65	11 Jan 65	19 Mar 65	37
	7-65	12 Feb 65	15 Feb 65	23 Apr 65	37
	8-65	19 Mar 65	22 Mar 65	27 May 65	37
	9-65	23 Apr 65	26 Apr 65	2 Jul 65	37
	10-65	14 May 65	17 May 65	26 Jul 65	37
Weather Equipment Maintenance (13 Weeks, 4 Days) (6-N-201A/6-N-205.1)	1-65	24 Jul 64	27 Jul 64	30 Oct 64	8
	2-65	25 Sep 64	28 Sep 64	19 Jan 65	8
	3-65	27 Nov 64	30 Nov 64	22 Mar 65	8
	4-65	12 Feb 65	15 Feb 65	21 May 65	8
	5-65	16 Apr 65	19 Apr 65	26 Jul 65	8
Field Artillery Radar Maintenance (26 Weeks) (6-N-211A/211.3)	1-65	10 Jul 64	15 Jul 64	28 Jan 65	25
	2-65	18 Sep 64	23 Sep 64	8 Apr 65	25
	3-65	8 Jan 65	13 Jan 65	14 Jul 65	25
	4-65	19 Mar 65	24 Mar 65	22 Sep 65	25
	5-65	28 May 65	3 Jun 65	3 Dec 65	26
Sergeant Missile Battery (6 Weeks, 2 Days) (6-N-161.2)	1-65	25 Aug 64	26 Aug 64	9 Oct 64	30
	3-65	17 Feb 65	18 Feb 65	2 Apr 65	30
Sergeant Missile Battery (NON-US) (7 Weeks) (6-N-161.2X)	1-65	13 Oct 64	14 Oct 64	3 Dec 64	32
Pershing Specialist (17 Weeks) (6-N-214E/163.2)	1-65	8 Jul 64	9 Jul 64	5 Nov 64	32
	2-65	15 Sep 64	16 Sep 64	29 Jan 65	32
	3-65	29 Nov 64	30 Nov 64	13 Apr 65	32
	4-65	16 Feb 65	18 Feb 65	18 Jun 65	32
	5-65	27 Apr 65	29 Apr 65	27 Aug 65	32
Artillery Survey Specialist (5 Weeks, 2 Days) (6-R-153.1)	1-65	7 Jul 64	8 Jul 64	13 Aug 64	63
	2-65	28 Jul 64	29 Jul 64	3 Sep 64	63
	3-65	25 Aug 64	26 Aug 64	2 Oct 64	63
	4-65	15 Sep 64	16 Sep 64	22 Oct 64	63
	5-65	3 Nov 64	4 Nov 64	14 Dec 64	63
	6-65	5 Jan 65	6 Jan 65	11 Feb 65	63
	7-65	26 Jan 65	27 Jan 65	5 Mar 65	63
	8-65	16 Mar 65	17 Mar 65	22 Apr 65	63
	9-65	30 Mar 65	31 Mar 65	6 May 65	63
	10-65	11 May 65	12 May 65	18 Jun 65	63
Artillery Sound Ranging (Advanced) (8 Weeks) (6-R-155.2)	1-65	7 Jul 64	9 Jul 64	1 Sep 64	16
	2-65	20 Oct 64	22 Oct 64	17 Dec 64	16
	3-65	2 Mar 65	4 Mar 65	27 Apr 65	16
	4-65	4 May 65	6 May 65	30 Jun 65	17
FA Radar Operations (10 Weeks) (6-R-156.1)	1-65	24 Jul 64	28 Jul 64	5 Oct 64	35
	2-65	28 Aug 64	1 Sep 64	9 Nov 64	35
	3-65	2 Oct 64	6 Oct 64	15 Dec 64	35
	4-65	6 Nov 64	10 Nov 64	3 Feb 65	35

Course	Class No.	Report	Start	Close	Input
	5-65	8 Jan 65	12 Jan 65	22 Mar 65	35
	6-65	5 Feb 65	9 Feb 65	19 Apr 65	35
	7-65	19 Mar 65	23 Mar 65	28 May 65	35
	8-65	23 Apr 65	27 Apr 65	6 Jul 65	35
	9-65	25 Jun 65	29 Jun 65	7 Sep 65	35
Pershing Missile Battery (8 Weeks, 4 Days) (6-R-163.6)	1-65	6 Aug 64	7 Aug 64	8 Oct 64	30
	2-65	14 Oct 64	15 Oct 64	17 Dec 64	31
	3-65	10 Jan 65	11 Jan 65	12 Mar 65	62
	4-65	21 Mar 65	23 Mar 65	21 May 65	62
	5-65	26 May 65	28 May 65	30 Jul 65	30
Artillery Radio Maintenance (13 Weeks) (6-R-313.1)	1-65	3 Jul 64	6 Jul 64	5 Oct 64	40
	2-65	17 Jul 64	20 Jul 64	19 Oct 64	40
	3-65	14 Aug 64	3 Aug 64	2 Nov 64	40
	4-65	31 Jul 64	17 Aug 64	17 Nov 64	40
	5-65	28 Aug 64	31 Aug 64	2 Dec 64	40
	6-65	11 Sep 64	14 Sep 64	15 Dec 64	40
	7-65	25 Sep 64	28 Sep 64	13 Jan 65	40
	8-65	9 Oct 64	12 Oct 64	27 Jan 65	40
	9-65	23 Oct 64	26 Oct 64	10 Feb 65	40
	10-65	6 Nov 64	9 Nov 64	25 Feb 65	40
	11-65	20 Nov 64	23 Nov 64	10 Mar 65	40
	12-65	4 Dec 64	17 Dec 64	23 Mar 65	40
	13-65	8 Jan 65	11 Jan 65	12 Apr 65	40
	14-65	22 Jan 65	25 Jan 65	26 Apr 65	40
	15-65	5 Feb 65	8 Feb 65	10 May 65	40
	16-65	19 Feb 65	23 Feb 65	24 May 65	40
	17-65	19 Mar 65	22 Mar 65	21 Jun 65	40
	18-65	2 Apr 65	5 Apr 65	6 Jul 65	40
	19-65	16 Apr 65	19 Apr 65	20 Jul 65	40
	20-65	30 Apr 65	3 May 65	3 Aug 65	40
	21-65	14 May 65	17 May 65	17 Aug 65	40
	22-65	28 May 65	1 Jun 65	31 Aug 65	40
	23-65	11 Jun 65	14 Jun 65	14 Sep 65	40
	24-65	25 Jun 65	28 Jun 65	28 Sep 65	40
Track Vehicle Maintenance (7 Weeks) (6-R-632.1)	1-65	3 Jul 64	7 Jul 64	21 Aug 64	33
	2-65	10 Jul 64	14 Jul 64	28 Aug 64	33
	3-65	17 Jul 64	21 Jul 64	4 Sep 64	26
	4-65	24 Jul 64	28 Jul 64	11 Sep 64	26
	5-65	31 Jul 64	4 Aug 64	18 Sep 64	26
	6-65	7 Aug 64	1 Aug 64	25 Sep 64	26
	7-65	14 Aug 64	8 Aug 64	2 Oct 64	26
	8-65	21 Aug 64	25 Aug 64	9 Oct 64	26
	9-65	28 Aug 64	1 Sep 64	16 Oct 64	26
	10-65	4 Sep 64	8 Sep 64	23 Oct 64	26
	11-65	11 Sep 64	15 Sep 64	30 Oct 64	26
	12-65	18 Sep 64	22 Sep 64	6 Nov 64	26
	13-65	25 Sep 64	29 Sep 64	13 Nov 64	26
	14-65	2 Oct 64	6 Oct 64	20 Nov 64	26
	15-65	9 Oct 64	13 Oct 64	27 Nov 64	26
	16-65	16 Oct 64	20 Oct 64	4 Dec 64	26
	17-65	23 Oct 64	27 Oct 64	11 Dec 64	26
	18-65	30 Oct 64	3 Nov 64	18 Dec 64	26
	19-65	20 Nov 64	24 Nov 64	22 Jan 65	26
	20-65	27 Nov 64	1 Dec 64	29 Jan 65	27
	21-65	2 Jan 65	5 Jan 65	19 Feb 65	27
	22-65	8 Jan 65	12 Jan 65	26 Feb 65	27
	23-65	15 Jan 65	19 Jan 65	5 Mar 65	27
	24-65	22 Jan 65	26 Jan 65	12 Mar 65	27
	25-65	29 Jan 65	2 Feb 65	19 Mar 65	27
	26-65	5 Feb 65	9 Feb 65	26 Mar 65	27
	27-65	12 Feb 65	16 Feb 65	2 Apr 65	27
	28-65	19 Feb 65	23 Feb 65	9 Apr 65	27
	29-65	26 Feb 65	2 Mar 65	16 Apr 65	27
	30-65	5 Mar 65	9 Mar 65	23 Apr 65	27
	31-65	12 Mar 65	16 Mar 65	30 Apr 65	27

Course	Class No.	Report	Start	Close	Input
	32-65	19 Mar 65	23 Mar 65	7 May 65	27
	33-65	26 Mar 65	30 Mar 65	14 May 65	27
	34-65	2 Apr 65	6 Apr 65	21 May 65	27
	35-65	9 Apr 65	13 Apr 65	28 May 65	27
	36-65	16 Apr 65	20 Apr 65	4 Jun 65	27
	37-65	23 Apr 65	27 Apr 65	11 Jun 65	27
	38-65	30 Apr 65	4 May 65	18 Jun 65	27
	39-65	7 May 65	11 May 65	25 Jun 65	27
	40-65	14 May 65	18 May 65	2 Jul 65	27
	41-65	21 May 65	25 May 65	9 Jul 65	27
	42-65	28 May 65	1 Jun 65	16 Jul 65	27
	43-65	4 Jun 65	8 Jun 65	23 Jul 65	27
	44-65	11 Jun 65	15 Jun 65	30 Jul 65	27
	45-65	18 Jun 65	22 Jun 65	6 Aug 65	27
	46-65	25 Jun 65	29 Jun 65	13 Aug 65	27
AN/TRC-80 Operations (Pershing) (9 Weeks) (6-R-F24)	1-65	12 Jul 64	13 Jul 64	15 Sep 64	15
Communication Supervisors (12 Weeks) (6-R-F31)	1-65	1 Sep 64	2 Sep 64	27 Nov 64	39
	2-65	1 Dec 64	2 Dec 64	11 Mar 65	39
	3-65	1 Mar 65	2 Mar 65	24 May 65	40
	4-65	1 Jun 65	2 Jun 65	25 Aug 65	40
FA Operations and Intelligence Assistant (11 Weeks, 1 Day) (6-R-F——) (Formerly 152.6)	1-65	6 Jul 64	7 Jul 64	23 Sep 64	25
	2-65	28 Sep 64	29 Sep 64	17 Dec 64	25
	3-65	4 Jan 65	5 Jan 65	24 Mar 65	25
	4-65	29 Mar 65	30 Mar 65	16 Jun 65	25
****Refresher Training in the Tactical Employment of Nuclear Wpns (1 Week)	1-65	9 Aug 64	10 Aug 64	14 Aug 64	30
	2-65	23 Aug 64	24 Aug 64	28 Aug 64	30
	3-65	30 Aug 64	31 Aug 64	4 Sep 64	30
	4-65	4 Oct 64	5 Oct 64	9 Oct 64	30
	5-65	6 Dec 64	7 Dec 64	11 Dec 64	30
	6-65	3 Jan 65	4 Jan 65	8 Jan 65	30
	7-65	28 Mar 65	29 Mar 65	2 Apr 65	30
	8-65	2 May 65	3 May 65	7 May 65	30
	9-65	13 Jun 65	14 Jun 65	18 Jun 65	30

****The course is conducted for local input and instructor personnel from those installations conducting a Nuclear Weapons Refresher Course:

INTERIM FADAC PROGRAMS FOR M109

Although the 155-mm howitzer, M109, has already been issued to the field, the Gun Direction Computer, M18 (FADAC) ballistic programs for the M109 are still under development and will probably be ready for issue during the late summer of 1964. In the interim, the FADAC programs for the old series 155-mm howitzer with newly developed procedures have been approved for issue with the computers to M109 units until the new programs are available. These procedures will be provided to M109 units as part of a FADAC Information Letter.

GEM FOR THE BATTERY EXECUTIVE

The man-handling of 8-inch howitzer projectiles is a dangerous job. This hazard can be eliminated with the aid of a few simple items—a projectile sling and carrying handle and a loading ramp (fig 1)—which can be easily fabricated by a battalion maintenance section.

The 10-foot length of the loading ramp is designed for the height of a 5-ton truck. However, this length can be adjusted for other vehicles; the only requirement is that the angle of the ramp should remain

approximately 25°. This will prevent the acceleration of the projectile during unloading.

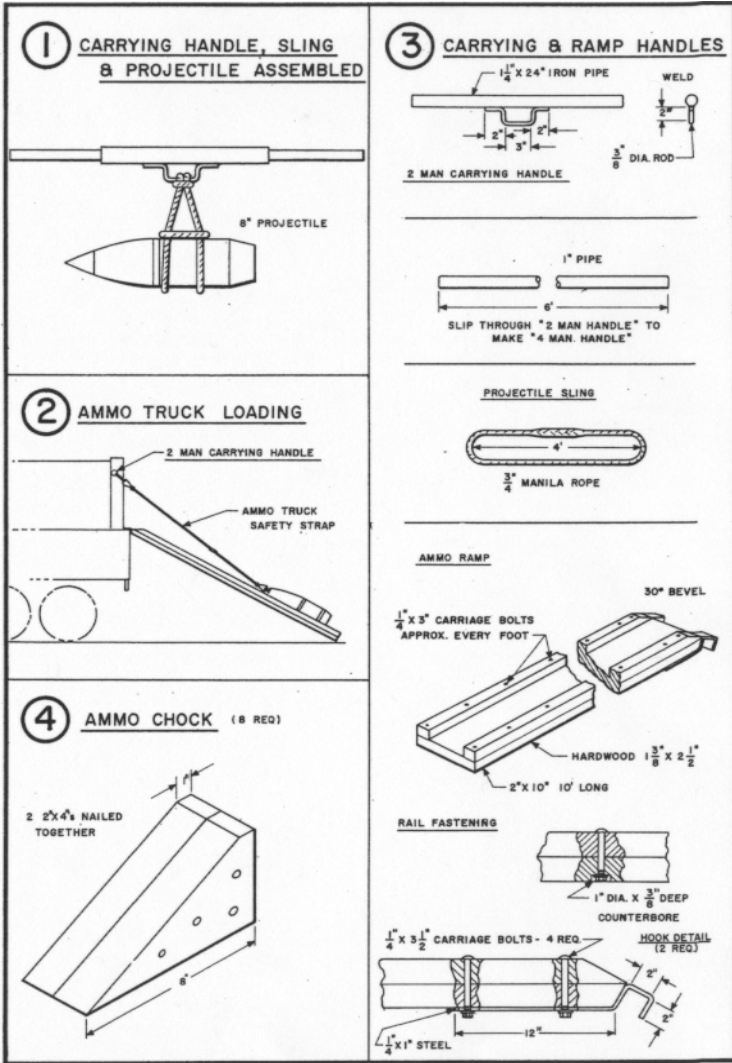


Figure 1. ① The assembly used when carrying the projectile. The men walk alternately on each side. ② The method for loading the projectile onto the ammunition truck. Unloading is accomplished without the strap. The projectiles are simply allowed to slide free. ③ Specifications for fabricating the component parts. ④ Specification for wooden chocks to prevent rolling of loose rounds on the bed of the ammunition truck.

—by Captain Otto A. Schaedlich

STATUS OF TRAINING LITERATURE AND FILMS

TRAINING LITERATURE

1. The following training literature is under preparation or revision by the US Army Artillery and Missile School or the US Army Combat Developments Command, Artillery Agency:

- A. FIELD MANUALS (FM):
- FM 6-3-2 Operations of Gun Direction Computer M18 (FADAC), Free Rocket Application.
 - FM 6-3-2A(S) Gun Direction Computer M18, Cannon Application with Selected Ammunition.
 - FM 6-3-2B (C) Gun Direction Computer M18, Free Rocket Application with Selected Ammunition.
 - FM 6-10 Field Artillery Communications.
 - FM 6-40 Field Artillery Cannon Gunnery.
(Changes 2)
 - FM 6-40-1 Field Artillery Rocket Gunnery.
 - FM 6-40-1A (S) Field Artillery Rocket Gunnery.
 - FM 6-40-2 (C) Field Artillery Missile Gunnery.
 - FM 6-40-3 Field Artillery M18 Computer Gunnery.
 - FM 6-77 105-mm M52, Self Propelled.
(Changes 1)
 - FM 6-93 8-inch Howitzer, M55, Self-Propelled.
 - FM 6-122 Artillery Sound and Flash Ranging.
 - FM 21-13 The Soldier's Guide.
- B. TECHNICAL MANUALS (TM):
- TM 6-300-65 Army Ephemeris.
- C. ARMY SUBJECT SCHEDULES (ASUBJSCD):
- ASubjScd 6-5 Communications Training for Sections and Platoons.
 - ASubjScd 6-6 Communications Exercises for Artillery Units.
 - ASubjScd 6-32 Field Artillery Command Post Exercises.
 - ASubjScd 6-42 Difficult Traction and Field Expedients.
 - ASubjScd 6-154 Flash Ranging Crewman, MOS 154.0.
 - ASubjScd 6-155 Sound Ranging Crewman, MOS 155.0.
- 2. Training literature submitted for publication:**
- FM 6-3-1 Operations of Gun Direction Computer M18 (FADAC), Cannon Application.
 - FM 6-3-1A (C) Gun Direction Computer M18, Cannon Application with Selected Ammunition.
 - FM 6-70 105-mm Howitzer, M102.
 - FM 105-6-1 (C) U. S. Nuclear Play Calculator.
 - FM 105-6-2 U. S. Nuclear Play Calculator.
 - FM 105-6-3 Aggressor Nuclear Play Calculator.
 - ASubjScd 6-29 Artillery Survey.
 - ASubjScd 6-147 Field Artillery Rocket Crewman, MOS 147.1.

- ASubjScd 6-152 Field Artillery Operations and Intelligence Assistant, MOS 152.1.
- ASubjScd 6-153 Artillery Surveyor, MOS 153.0.
- ASubjScd 6-163 Field Artillery Missile Crewman (Pershing), MOS 163.0/1.

3. Training literature recently printed:

- FM 6-37 Field Artillery Battalion, Sergeant.
- FM 6-38 Field Artillery Battery, Sergeant.
- *FM 6-50 (C) Field Artillery Missile Gunnery.
- FM 6-54 Area Toxic Rocket.
- FM 6-61 Field Artillery Battalion Honest John Rocket, SP.
(Changes 3)
- FM 6-99 Employment of Selected Ammunition.
- ASubjScd 6-16 Field Artillery Instruments and Duties of Instrument Operators.
- ASubjScd 6-161 Field Artillery Missile Crewman (Sergeant), MOS 161.0/1.

*FM 6-50 to be superseded by FM 6-40-2.

TRAINING FILMS

1. The following training films are currently under production and scheduled for release during calendar year 1964:

Fire Direction Procedures—Part I. Precision Fire (TF 6-3448)—Part II. Area Fire (TF 6-3449)—Part III. Observed Fire (TF 6-3450).

The Honest John Battalion—Part I. Organization and Operations (TF 6-3436)—Part II. RSOP (TF 6-3451).

Field Artillery Target Acquisition Battalion.

Operation of the Surveying Instrument Azimuth Gyro Artillery.

Active and Passive Defense of the Field Artillery Battery.

The Pershing Missile System—Air Transported and Track Mounted Operations.

2. Training films scheduled for production and release during calendar year 1964:

Fire Support Coordination, Infantry Division.

Pershing Missile Azimuth Laying Procedures.

The Sergeant Artillery Guided Missile System.

3. Training films scheduled for production and release during calendar year 1965:

Helicopter Artillery RSOP.

(others not yet approved for calendar year 1965).

4. Training films recently released to Audio Visual Communications Center:

TF 6-3385. Artillery Forward Observer—Part I. In the Defense.

TF 6-3386. Artillery Forward Observer—Part II. In the Attack.



Direct communication between major commands and the US Army Artillery and Missile School is authorized in matters pertaining to Nuclear Weapons Employment Training.

GEM FOR THE SUPPLY SECTION

The air assault concept of mobile artillery fire support demands rapid movement of guns, men, and ammunition. In the initial assault these essentials to fire power are delivered in a single load by the CH-47 Chinook helicopters. However, resupply of 105mm ammunition to forward positions, which used to be a problem, has been solved by the Supply Section, 6th Battalion, 81st Artillery, 11th Air Assault Division.

By utilizing an empty 55 gallon chemical drum and a bit of ingenuity that has characterized the development of the new division, the problem was met head on with the development of a simple, highly mobile ammunition container; thus, the air assault artillery ammunition drum (fig 1).

To accommodate the fiber containers containing the rounds, plywood inserts are fitted to the drum and drilled out which gives the appearance of a revolver cylinder. Into each of the "chambers" a round is fitted and held secure. To refine the drum for ease of movement a pivot arm is attached to a 1/2-inch steel axle welded to a steel plate which in turn is placed over the drum lid. The lid and plate are secured by wing nuts, enabling disassembly without special tools. A nylon sling is fixed to the pivot arms with snap links, and serves the dual role of a helicopter sling and ground tow line. In this configuration, the drum, fully loaded with nine rounds, weighs approximately 450 pounds and can easily be pulled by two men or towed by a 1/4-ton truck with the sling loop in the trailer hitch.

The drum can also be used without the inserts giving a capacity of 14 rounds at an approximate weight of 675 pounds.

The development of this container results in continuous resupply of ammunition by assault-type helicopters, such as the UH-1B and frees larger craft for large scale operations. The container has been tested under field conditions.

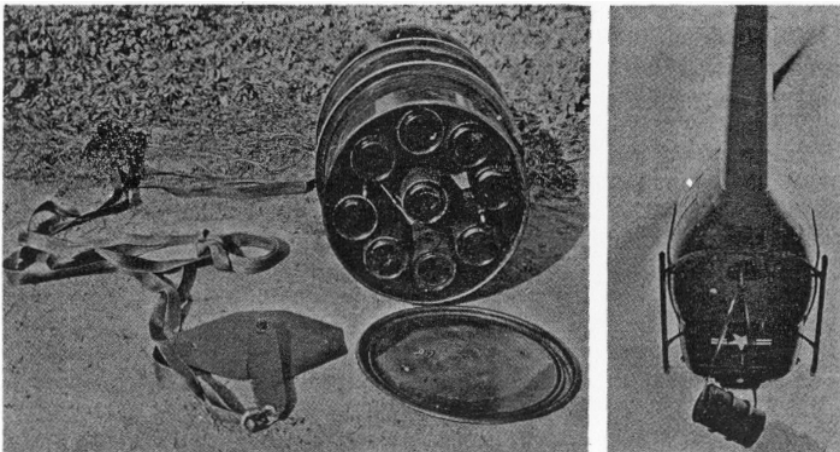


Figure 1. Ammunition drum sling loaded under helicopter (right). Drum showing nine fiber canisters set in plywood inserts (left).