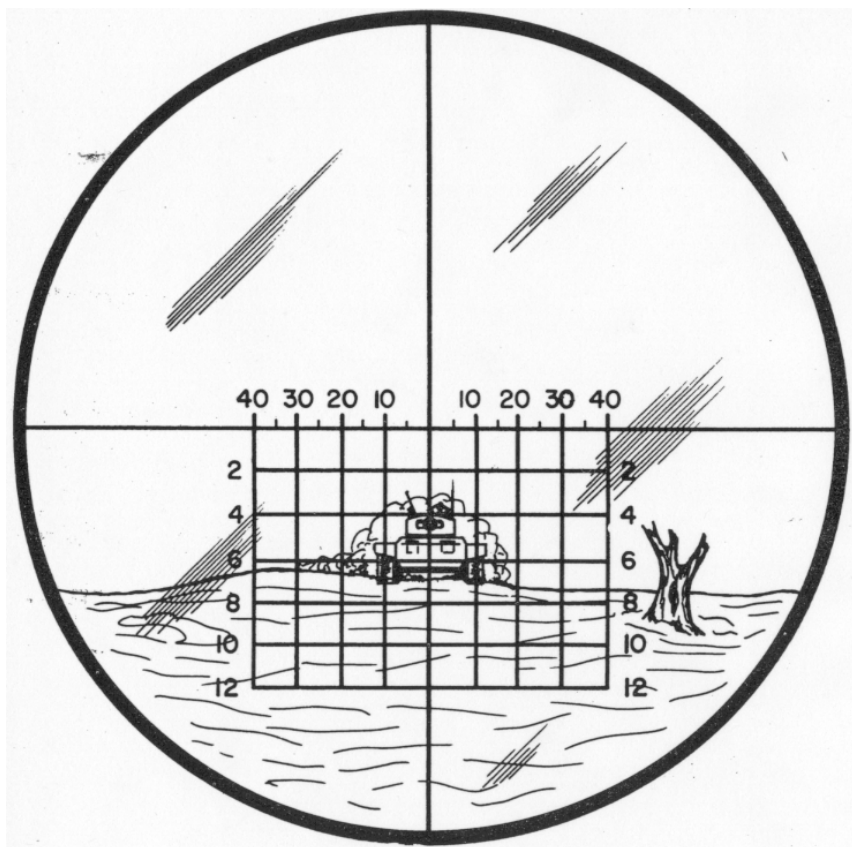


ARTILLERY TRENDS



U S Army Artillery and Missile School



June 1961

ARTILLERY

TRENDS

June 1961

Instructional Aid Number 18

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● COVER

"The frontal attack upon a battery in action can never succeed, if only the gunners stand firm and keep cool."

The Gunner, 1949.

The sight picture portrayed on the cover shows an enemy tank bearing down on an artillery gun position. The short 600 yard range demands that the first round be the "killer" round. See "Direct Fire," beginning page 17.

WANTED—ARTILLERYMEN

For Extension Course Program.

Any member of any Army component. Extension course program for artillery officers for promotional purposes (National Guard) or retirement points (USAR). Courses offered are comparable to resident Courses. Applicants fill out DA Form 145 and submit through channels (USAR through unit commander, unit advisor and Reserve Corps HQ — Regular Army direct to School) to Commandant, US Army Artillery and Missile School, Nonresident Instructional Department, ATTN: Extension Course Division, Fort Sill, Okla. Counseling for students available from same address as above. For complete details consult Extension Course catalog FY 62.

For Reserve Component Program.

Infantry, Armored Division, Corps Artillery, Division Artillery, Field Artillery Battalion Commanders who need material for staff and unit training. Available to USAR units on nonreimbursable basis; to National Guard units on reimbursable basis. Present catalog (FY62) contains updated instructional material. Requests should be addressed to: Commandant, US Army Artillery and Missile School, Nonresident Instructional Department, ATTN: Reserve Components. Division, Fort Sill, Oklahoma. For complete details, consult catalog of Instructional Material FY 62.

theory and practice . . .

Safety Officer Training

The artilleryman cannot afford to make a mistake during "live" firing. When a round is fired outside prescribed safety limits, the reason for this dangerous occurrence can be traced to one or both of two types of errors—mechanical or human. When a mechanical error occurs, despite proper maintenance, little can be done. But the human mechanism needs proper "maintenance" also, to avoid human error. This article will discuss the maintenance necessary to decrease human error. Recommended courses of action will be presented to assist the commander in lessening this dangerous problem.

Commanders in the field have recently expressed concern about the ability of newly reporting 2d Lieutenants to function as safety officers. Many of these Lieutenants have received their reserve commissions through the ROTC after graduating from a university which provides only branch immaterial military training and then reported to the United States Army Artillery and Missile School for a very brief 8-week orientation course. The purpose of this course as stated in Department of the Army Pamphlet 20-21, entitled "The Army School Catalog" is, "to provide basic branch training and orientation in Field Artillery for newly commissioned artillery officers."

The 8-week Field Artillery Officer Orientation Course consists of 373 hours. Forty-two of these hours are spent in firing battery instruction and are intended to provide the student with a working knowledge of the procedures for laying the battery and measuring azimuths and orienting angles. Five of these 42 hours are devoted to instruction in the duties of the safety officer, and include safety precautions and regulations, safety cards and safety diagrams, and safety stakes. An additional 3 hours of safety training are integrated into certain of the practical exercises in the firing battery block of instruction. This amount of training will not make a young officer a battery executive or a safety officer. It does give him basic training and orientation.

To supplement this limited training, Commanders in the field will have to provide for additional instruction prior to full utilization of the young 2d Lieutenant. The US Army Artillery and Missile School can provide help in this training.

One of the recommended courses of action is for Commanders to encourage the officers subject to safety officer duty to enroll in the Army Extension Course Program administered by the US Army Artillery and Missile School. Artillery Subcourse 60, "Service Practice Procedures," includes instruction for the safety officer. The materials and equipment necessary for solving the exercises are furnished with the

subcourse. The procedures for enrolling in the Army Extension Course Program are described on page two.

Another course of action for unit Commanders who desire further training for their officers is to apply for the *Catalog of Instructional Material for Staff, Unit and Section Training*, prepared by the US Army Artillery and Missile School. The instructional material is prepared in packets which contain instructional notes, instructor's outline, illustrative problems, and transparencies. The materials are provided upon request to USAR and active Army units on a nonreimbursable basis. National Guard units may obtain the material on a reimbursable basis. See back cover for details.

The handy pocket-size reference "Notes for the Battery Executive" also contains information for the safety officer. This booklet is published by the US Army Artillery and Missile School and sells for 35c at the Book Store.

The use of the Army Extension Course Program and the unit training materials is urged, and Commanders are again cautioned that the young graduate of the Field Artillery Officer Orientation Course, while having made real progress in his 8 weeks of study is still not an accomplished artilleryman, and does require additional training in his new unit.

●

NEW SAFETY OFFICER CLASS

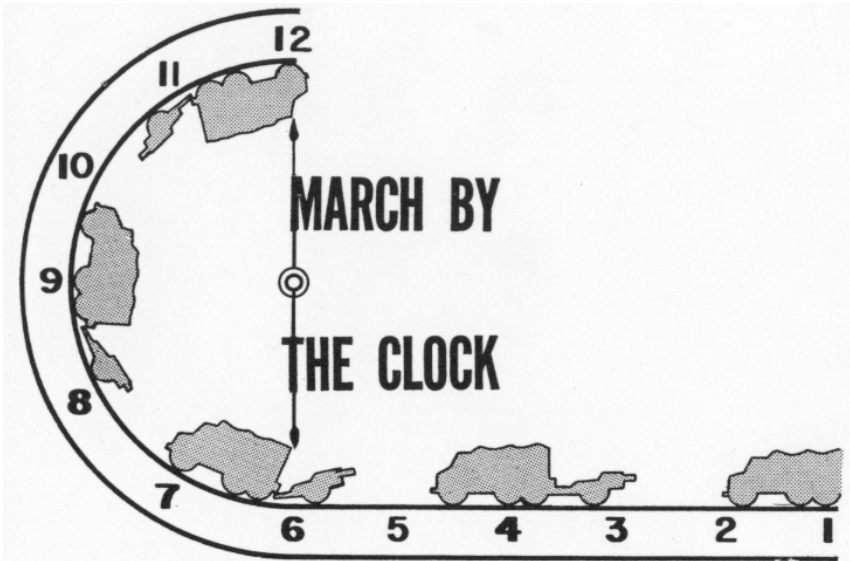
The Safety Officer Class listed in the catalog mentioned in the above article has recently been revised and contains the latest safety instruction. The packet contains all the necessary elements for the presentation of the class—instructor's manuscript, instructional notes and writs, illustrative problems, transparencies, diagrams, and models. See back cover for instructions concerning the ordering of this class or any of the other instructional packets listed in the catalog.

●

"Form the crossed cannons
They never will run—
The limber and rolling caisson,
The trace and the collar
The rumble of gun
As we follow the Red Guidon."

Gerald E. Griffin
Chorus, "The Red Guidon"

a time-interval technique . . .



Lieutenant Colonel Donald B. Stewart
Army Advisor, 36th Infantry Division Artillery
Army National Guard
San Antonio 5, Texas

Are you having trouble maintaining a uniform interval between vehicles in your march unit? Do your vehicles bunch up or spread out even though you prescribe the rate of march, apply the speedometer multiplier, and set a minimum gap between vehicles? Do your drivers have difficulty determining the desired distances? Here is a suggestion which may be the answer to your march column interval problem—march by the clock instead of by guess.

You and your drivers have probably been thinking and talking of the distance between vehicles in terms of yards. Yet few people can accurately estimate 50, 100, or 200 yards, whether it be on a parade ground or on a highway or road. Though your drivers know what to do and do it to the best of their ability, they may not be able to maintain the prescribed interval. The distance between vehicles cannot be measured, but the *time interval* can. When a time interval has been determined, the driver can hold, increase, or decrease his speed as necessary to maintain or achieve the proper interval.

The driver does not attempt to guess or to measure yards. He measures seconds. The time in seconds between vehicles is a function

of the distance interval between vehicles and the speed of the vehicles. By staying a certain number of seconds behind the vehicle ahead, the driver automatically maintains the distance interval fixed for the prescribed rate of march. In other words, if the driver keeps his vehicle 10 seconds behind the one ahead when the rate of march is 20 miles per hour (mph), his road interval is 100 yards. If he measures his time interval to be 12 seconds, his road interval is 120 yards and he should close up. If his time interval measures 8 seconds, his road interval is 80 yards and he should drop back.

DETERMINING TIME INTERVAL IN SECONDS

A vehicle moving 20 mph travels 100 yards in 10 seconds (10.27 exactly). This ratio applies at all speeds. It is not necessary to perform involved computations to determine the various time intervals. A simple empirical formula may be used as a rule to obtain the time interval in seconds (to the nearest whole second) for any feasible combination of road interval and military vehicle speed (fig 1). The formula is—

$$\text{Number of seconds between vehicles} = \frac{\text{twice the interval in yards}}{\text{rate of march in mph}}$$

Examples:

1. Rate of march 20 mph, interval 100 yards

$$\text{Time} = \frac{2 \times 100}{20} = \frac{200}{20} = 10 \text{ seconds}$$

2. Rate of march 30 mph, interval 200 yards

$$\text{Time} = \frac{2 \times 200}{30} = \frac{400}{30} = 13 \text{ seconds}$$

3. Rate of march 15 mph, interval 50 yards

$$\text{Time} = \frac{2 \times 50}{15} = \frac{100}{15} = 7 \text{ seconds}$$

<u>MILES PER HOUR</u>		<u>INTERVAL</u>			
		50 yards	100 yards	200 yards	
		seconds	seconds	seconds	seconds
5	20	40	80	160	"
10	10	20	40	80	"
15	7	13	27	54	"
20	5	10	20	40	"
25	—	8	16	32	"
30	—	7	13	27	"
35	—	—	11	22	"
40	—	—	10	20	"
45	—	—	9	18	"

Figure 1. Table of time intervals.

The time interval is better measured by the assistant driver than by the driver. Using his watch, the assistant driver simply notes when the vehicle ahead passes any recognizable point, such as a culvert, a tree, or a pole; then he determines the number of seconds that elapse until his vehicle passes the same point. Knowing the proper time interval, he can tell the driver to hold his speed or to change it as necessary.

A march unit commander can easily check the intervals throughout a column merely by measuring the number of seconds between vehicles as they pass the designated check point. Undoubtedly, measuring the time between vehicles, instead of guessing the distance, improves the regularity of a march column for two reasons:

- (1) "Guess-timates," which vary with the individual, can be eliminated.
- (2) Drivers can constantly check and maintain a consistent interval.

The commander who takes the short time required to teach this easy method to his drivers will be taking a giant step towards alleviating the headache he acquires concerning vehicle intervals on a march.



METRO CHANGES

The conversion to NATO metro messages based on the ICAO atmosphere takes another step toward completion when the Army Field Manual, FM 6-16 (*Tables for Artillery Meteorology*), is published on or about 1 July 1961. The following equipment, used with the manual will be published on the same date:

1. new adiabatic chart, ML-574/UM
2. new zone height scale, ML-573/UM
3. new plotting fan, ML-577/UM
4. new DA Forms and charts.

Army Field Manual, FM 6-15 (*Artillery Meteorology*), which is used in conjunction with FM 6-16, will be published on or about 1 October 1961.

Until a definite date has been announced for converting to the NATO message, artillery metro sections should continue to produce the present types of metro message. New firing tables based on the NATO message and the ICAO atmosphere are being prepared for dissemination to all artillery units. New firing tables for the 155-mm and 8-inch howitzers have been distributed with the 105-mm howitzer tables scheduled to follow in September 1961 (see ARTILLERY TRENDS, March 1961, page 51). The new tables are accompanied by a change (supplement) which allows their use in conjunction with the present ballistic (Ordnance Standard Atmosphere) message. When conversion to the NATO message occurs, many units will not have received new firing tables. These units will be provided changes to the old firing tables which will contain the necessary conversion factors to allow their use with the new NATO message.

CANNON CORRELATION

Lieutenant Colonel Carl C. Simpson
Gunnery/Cannon/Rocket Department

The necessity for registration has always been a problem; and now under the present division artillery organization, with battalions equipped with mixed calibers, the registration requirement is greater than ever. This problem can be alleviated by a technique which has been devised to convert the registration corrections determined from one registration into corrections for different charges *and* for different caliber cannon. It will save time and money, ease the ammunition supply problem, and deny the enemy information of friendly gun positions. This technique is called *Cannon Correlation*.

CANNON CORRELATION DEFINED

Cannon Correlation is defined as a means for converting a range correction determined by registration with a given cannon-ammunition-charge combination to a range correction for adjacent charges of the same cannon-ammunition combination and for a different caliber cannon-ammunition-charge with equivalent muzzle velocity combination. Examples are: 105-mm-HE-Charge 4 to 105-mm-HE-Charges 3 and 5; 105-mm-HE-Charge 6 to 155-mm-HE-Charge 5. Cannon Correlation is an extension of the registration and K-transfer technique.

In Cannon Correlation, Velocity Errors (VE's) are assumed to be known. When the total range correction is found by registration, the correction for VE is subtracted to find the meteorological (met) correction; this is called the net range correction. The met correction for a particular cannon, charge, and elevation is thus found without using a met message. This procedure is equivalent to "shooting in" a met message.

The total met corrections for different charges of the same cannon and for cannon of different caliber are similar under certain conditions. If two projectiles encounter the same weather conditions for equal amounts of time, the total met effects will be similar even though the projectiles describe different trajectories. These conditions—the same weather for equal periods of time—can be met by selecting trajectories which have similar maximum ordinates and azimuths of fire. Projectiles describing trajectories with similar maximum ordinates will encounter the same atmospheric conditions and will also have approximately

equal times of flight. Therefore, similar times of flight can be used to select trajectories with similar maximum ordinates.

When the net range correction is determined, it can be used for other charges and other cannon at certain ranges, those ranges the corresponding time of flight of which are similar to the registration time of flight.

Projectiles with subsonic or supersonic velocities are affected differently by the same weather conditions. Therefore, correlation cannot be performed between two charges producing muzzle velocities which bracket the velocity of sound (fig 2). Also, since projectiles of different caliber have different characteristics, charges which produce similar muzzle velocities must be used in correlating corrections for cannon of different caliber.

CANNON CORRELATION PROCEDURE

The sequence for the determination and application of corrections using Cannon Correlation is as follows:

1. *Registration Point Selection and Registration.* The area to be covered by adjacent charges and cannon of other caliber should be considered in selecting the registration point. Cannon Correlation corrections are applied at the azimuth of fire of the registering piece and may be applied to other cannon the positions of which are well removed from that of the registering piece. The registration procedures outlined in FM 6-40, *Field Artillery Cannon Gunnery*, are followed for precision, center-of-impact, and high-burst registration.
2. *Computation of Net Range Correction and Total Range Correction.* The total registration correction may be converted to a total correction for another charge or to another cannon by replacing the registration VE correction with the VE correction of the selected charge or cannon. An example of the computational formula is: *Total Range Correction* (registering charge) minus *Velocity Error Correction* (registering charge) equals *Net Range Correction*. Therefore, *Net Range Correction* plus *Velocity Error Correction* (adjacent charge or charge of another caliber having equivalent muzzle velocity) equals *Total Range Correction* (adjacent charge or charge of another caliber having equivalent muzzle velocity). The elements needed by adjacent units to compute their corrections are the net range corrections, the nearest listed time of flight (corresponding to adjusted elevation), the azimuth of fire, and the deflection correction.
3. *Determination of Firing Tables Range to Which Corrections Are to be Applied.* The firing tables range is that range the time of flight of which most closely matches the time of flight corresponding to the adjusted elevation. No interpolation is necessary.
4. *Application of Corrections.* The net range correction plus the correction for the VE of the selected charge equals the total range

correction for that charge. The total range correction is then *subtracted* from the firing tables range (determined in step 3) to obtain the range for the GFT setting. This range is then placed under the hairline on the GFT. The deflection correction plus the correction for drift is used for the adjacent charges of the same cannon or for charges of equivalent muzzle velocity of different cannon.

HOW TO OBTAIN GOOD CORRELATION

In charge-to-charge correlation, best results are obtained in correlating between adjacent charges or within the subsonic group of charges between charges once removed, for instance, Charge 4 to Charges 3 and 5, 105-mm howitzer. Good correlation is not obtained between a charge producing a subsonic muzzle velocity and a charge producing a supersonic muzzle velocity. Within the subsonic group of charges for the 105-mm howitzer, VE's may be disregarded since the difference in VE's and velocity effects is small.

In cannon-to-cannon correlation, charges which produce similar muzzle velocities *must* be chosen. Good correlation is not obtained between the 105-mm howitzer and the 8-inch howitzer.

A comparison of charges for different caliber cannon which produce similar muzzle velocities is shown in figure

<u>105-mm Howitzer</u>	<u>155-mm Howitzer</u>	<u>8-inch Howitzer</u>
Charge 2	Charge 1	—
Charge 3	Charge 2	Charge 1
Charge 4	Charge 3	Charge 2
(Subsonic)		
Charge 5	Charge 4	Charge 3
Charge 6	Charge 5	Charge 4
(Supersonic)		
Charge 7	Charge 6	Charge 6

Figure 2. Charge Selection Correlation Table.

EXAMPLES OF CANNON CORRELATION

EXAMPLE 1. CORRELATION DATA OBTAINED FROM REGISTRATION WITH CHARGE 3, 155-mm HOWITZER

Registration with Charge 3, 155-mm Howitzer (use FT 155-Q-3).

Data Obtained:

Chart Range = 4,000 meters

Adjusted Elevation = 350 mils

Adjusted Quadrant Elevation = 358 mils

Range corresponding to Adjusted Elevation = 4,162 meters

(Adjusted Range)

Time of Flight (TF) corresponding to Adjusted Elevation 350 mils = 18.2 seconds (Nearest listed TF in the Firing Tables).

Data for Correlation:

- (1) Total Range Correction = +162 meters (Adjusted Range 4,162 meters minus Chart Range, 4,000 meters).
- (2) Velocity Correction = +279 meters [ΔV of —30 ft/sec (see note) for Charge 3, 155-mm times the Unit Correction of +9.3 corresponding to TF 18.2 seconds].
- (3) Net Range Correction = —117 meters (Total Range Correction of +162 meters minus Velocity Correction of +279 meters).

Elements Needed for Correlation:

Net Range Correction	—117 meters
Adjusted Elevation Time of Flight	18.2 seconds
Azimuth of Fire	1,380 mils
Net Deflection Correction	Left 3 mils

Note: ΔV = VE corrected for current propellant temperature.

EXAMPLE 2. CORRELATION FOR SAME CANNON, ADJACENT CHARGE
Correlation to Charge 4, 155-mm Howitzer (use FT 155-Q-3).

Data Obtained from Firing Tables:

- (1) Time of Flight nearest 18.2 seconds = 18.4 seconds
- (2) Range corresponding to 18.4 seconds = 4,900 meters
- (3) Elevation corresponding to 18.4 seconds = 308.3 mils

Data for Correlation:

- (1) Velocity Correction = +252 meters [ΔV of —28 ft/sec (see note) for Charge 4, 155-mm times the Unit Correction of +9.0 corresponding to TF 18.4 seconds].
- (2) Total Range Correction = +135 meters (Net Range Correction of —117 meters plus Velocity Correction of +252 meters).
- (3) GFT Range = 4,765 meters (Firing Tables Range of 4,900 meters minus Total Range Correction of +135 meters).

GFT Setting: Charge 4, Lot X, Range 4760, Elevation 308

Note: ΔV = VE corrected for current propellant temperature.

EXAMPLE 3. CORRELATION OF CANNON-TO-CANNON, CHARGE WITH EQUIVALENT MUZZLE VELOCITY.

Correlation to Charge 2, 8-inch Howitzer (use FT 8-J-3).

Data Obtained from Firing Tables:

- (1) Time of Flight nearest 18.2 seconds = 18.2 seconds
- (2) Range corresponding to 18.2 seconds = 4,400 meters
- (3) Elevation corresponding to 18.2 seconds = 344.7 mils

Data for Correlation:

- (1) Velocity Correction = —227 meters [ΔV of +27 ft/sec (see note) for Charge 2, 8-inch howitzer, times the Unit Correction of —8.4 corresponding to TF 18.2 seconds].
- (2) Total Range Correction = —344 meters (Net Range Correction of —117 meters plus Velocity Correction of —227 meters).
- (3) GFT Range = 4,744 meters (Firing Tables Range of 4,400 meters minus Total Range Correction of —344 meters).

GFT Setting: Charge 2, Lot X, Range 4740, Elevation 345

Note: ΔV = VE corrected for current propellant temperature.

EXAMPLE 4. CORRELATION OF CANNON-TO-CANNON, CHARGE WITH EQUIVALENT MUZZLE VELOCITY.

Correlation to Charge 4, 105-mm Howitzer (use FT 105-H-4 and FT 155-Q-2).

Data Obtained from Firing Tables:

- (1) Nearest listed US Ordnance Atmosphere Time of Flight corresponding to Adjusted Elevation 350 mls = 18.0 seconds
(FT 155-Q-2)
- (2) Time of Flight in FT 105-H-4 nearest 18.0 seconds = 17.9 seconds
- (3) Range corresponding to 17.9 seconds = 4,500 yards
- (4) Elevation corresponding to 17.9 seconds = 351.9 mls

Data for Correlation:

- (1) Velocity Effect = -242 yards [ΔV of -26 ft/sec (see note) for Charge 4, 105-mm howitzer, times the Unit Effect of 9.3 corresponding to TF 17.9 seconds].
- (2) Total Range Correction = +114 yards [Net Range Correction of -128 yards (-117 meters) plus Velocity Correction of +242 yards (-242 yards effect)].
- (3) GFT Range = 4,386 yards (Firing Tables Range of 4,500 yards minus Total Range Correction of +114 yards).

GFT Setting: Charge 4, Lot X, Range 4390 yards, Elevation 352

Note: ΔV = VE corrected for current propellant temperature.

A table of missed distances is shown in figure 3. This is an indication of the accuracy which can be expected in the application of correlation of same cannon, adjacent charge and of cannon-to-cannon, charge with equivalent MV.

<i>Registration of:</i>		<i>Applied to:</i>		<i>Average Missed Distance (Meters)</i>	<i>Number of Missions</i>
<i>Cannon</i>	<i>Charge</i>	<i>Cannon</i>	<i>Charge</i>		
105	3	105	4	20	6
	4		5	55	9
	6		7	33	9
105	5	155	4	47	2
	6		5	91	3
	7		6	32	3
155	4	8-inch	3	2	1
	5		4	38	3
	6		5	50	3

Figure 3. Cannon Correlation Missed Distance Table.

The 105-mm Firing Tables (FT 105-H-4) are based on the US Ordnance Standard Atmosphere, while the 155-mm Firing Tables (FT 155-Q-3) are based on the ICAO Standard Atmosphere. Similar times of flight in these two types of Firing Tables do not indicate similar maximum ordinates, and standard ranges are different; therefore, when correlating

between the 105-mm and the 155-mm, FT 155-Q-2 must be used until the new 105-mm Firing Tables are published.

If the registering piece is a 155-mm howitzer, FT 155-Q-2 is entered at the adjusted elevation to determine the time of flight at which to enter FT 105-H-4.

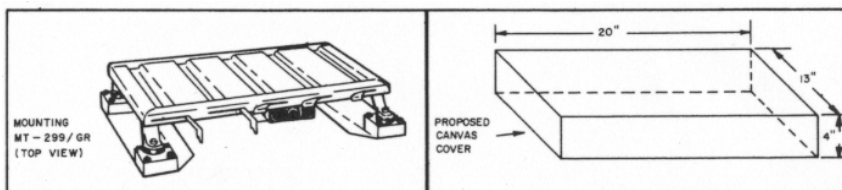
If the registering piece is a 105-mm howitzer, FT 155-Q-2 is entered at the adjusted time of flight to determine the Firing Tables range and elevation for the 155-mm howitzer.

Commanders are encouraged to try the Cannon Correlation technique during the next service practice or rehearsals for Army Training Tests. Informal comments concerning the trial of this technique under field conditions would be of value to the US Army Artillery and Missile School in evaluating field results of this technique. Comments should be addressed to the Assistant Commandant, US Army Artillery and Missile School, ATTN: Director, Gunnery/Cannon/Rocket Department, AKPSIGCR, Fort Sill, Oklahoma.

●

GEM FOR THE COMMUNICATIONS OFFICER

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 tie-downs or buckles. The result of this minimal expenditure of time and effort will be easier maintenance and assured fitting of the radio into its mount.

—Submitted by Lt W. J. Liell
Headquarters Battery, 2nd How.
Battalion, 92nd Artillery
New York, N. Y.

DANGER AHEAD

Summer time-vacation time. But all play and no work and you'll get behind in your Artillery Extension Course Program.



Captain Henry E. Callaghan
Communication/Electronics Department

One sure way to fail a battalion test is to neglect the communication training of the battalion. Communication does not count heavily on the score sheets of most Army Training Tests (ATT). However, without proper communication, other areas of the artillery weapons system will function at a minus value and the consequences will probably be a low score on the Army Training Test.

After having subjected the battalion and battery communication sections to long hours of training, many battalion communication officers have been puzzled upon seeing the battalion communication system fail to operate properly during the battalion test. One cause of this difficulty may be that most of the operators and users of the battalion communication system are not members of the communication sections and have only a secondary interest in communication. An example might be the personnel of the battalion fire direction section, who are normally responsible for installing and operating the internal communication equipment within the battalion fire direction center.

How can this problem be overcome? One method of training such

personnel is to train them within their own section. This method reduces the complexity of assembling the personnel from the various sections for instruction. However, since the best communication instructors are usually found in the battalion communication section, the personnel not assigned to the communication section may not receive the most effective instruction available. Also, this type of training decreases the uniformity of communication procedures throughout the battalion.

Another method of training is to schedule all battalion personnel for standard communication classes conducted by the battalion communication officer and his assistants. This increases the uniformity and quality of the instruction but frequently confines the instruction to subjects that are not of direct interest to sections other than the communication section. Also, the scope of this instruction is too broad and permits too little attention to the specific problems found within the various sections of the battalion.

COUNTY FAIR METHOD IS BEST

The best method of training personnel not assigned to the communication section in communication subjects is the "county fair" method. It doesn't involve midway music, cotton candy, or balloons, as the name might suggest; it is a method which allows the best available instructor to present his material to small groups and enables him to tailor his presentation to meet the needs of any section in the battalion.

First, the items of communication equipment and procedures necessary to complete the mission of the various sections of the battalion are determined; then a county fair station is assigned for items of equipment or procedures. A typical battalion county fair might consist of stations for the AN/PRC-9 radio, the AN/VRC-9 radio, the remote control group AN/GRA-6, the telephone TA-312, the switchboard SB-22, and an additional station for teaching radiotelephone procedure.

The next consideration is timing. The six-station class in the preceding example may be timed so that 40 minutes are spent at each station. This schedule takes 4 hours, plus the necessary breaks. The number of stations or the time allotted to each station can be varied to adjust the length of the class.

The third step in planning a class of this nature is the selection of instructors and rehearsal. The instructors should be the best available; they must be fully experienced on the equipment or techniques to be demonstrated at their individual station. Not only must they be thoroughly familiar with the equipment, but they must also know the communication requirements of all sections of the battalion. Most of these instructors can probably be obtained from the communication sections, but noncommissioned officers with communication background assigned to other sections should not be overlooked.

ASSIGNING PERSONNEL TO CLASS

The final step in planning is the assignment of personnel to class. In the example six-station class, six groups should be formed and each group assigned to start the class at one of the six stations. Groups should be approximately equal in size and, if practicable, each group should be composed of members of the same section to allow the instructor to stress the application of his subject to the mission of that particular section.

In planning the organization of the stations, enough equipment should be made available at each station to give all members of the group an opportunity to apply the techniques taught at the station.

The county fair method is intended to supplement, not replace, other communication training within the battalion. It should be scheduled after training in the basic communication subjects has been completed but before the first command post exercise is scheduled. This will allow the instruction to be confined to the more advanced aspects and will enable the communication officer to bring battalion personnel not assigned to a communication section to a state of training that will result in a better performance on the command post exercise.

The majority of the means of communication are in the hands of personnel not assigned to a communication section; therefore, it is important that these people be as well-trained comparably as the battalion communication sections. The battalion *must* have communication for control on the battlefield. Employment of the county fair method of instruction will permit the battalion to attain a higher degree of skill in communication techniques and will enable the artillery to perform better its mission to move, shoot and communicate.



THE 1961-62 EXTENSION COURSE CATALOG

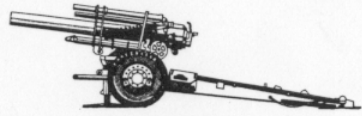
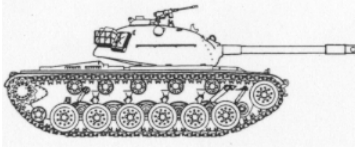
The artillery extension course catalog for the school year 1961-62 is now being distributed. This catalog reflects the new programs of the US Army Artillery and Missile School and the US Army Air Defense School. The primary extension courses of each school have been reorganized into the "Familiarization," "Orientation," and "Career" fields to conform to the new officer education pattern currently in effect at the resident schools. Special extension courses and resident school preparatory extension courses are also offered to complete the program.



DON'T GET DULL

If your summer schedule calls for all work and little play—fine but make sure some of that work is on your Extension Course Program.

point-blank defense . . .



DIRECT

FIRE

2/Lt Howard C. Anawalt
US Army Artillery Board

"Tanks, right front . . . fire at will!"

You had better be ready to fire this mission; if *you* don't end it, the enemy will. No mission takes priority over the direct fire mission; none requires greater speed and accuracy. Field artillery weapons are designed primarily for firing indirect fire, but they *can* and *must* be used for firing by direct laying, principally against moving targets. The speed and accuracy required in indirect laying become even more important for direct laying missions.

In direct fire, the howitzer section becomes the complete fire unit and incorporates the functions of forward observer and fire direction center as well as the firing battery. The chief of section estimates target range and speed and then directs the section to fire at that range with an estimated lead. He senses and adjusts his fire as necessary.

THREE METHODS OF LAYING FOR DIRECT FIRE

There are three methods of laying an artillery weapon for direct fire: *the two-man, two-sight system; the one-man, one-sight system; and the two-man, one-sight system.* The most effective technique is the two-man, two-sight system. In this method, the gunner lays the piece for direction using the panoramic telescope, while the assistant gunner lays for range using the elbow telescope. This system is the fastest, is comparatively easy to teach to cannoneers, and is the most accurate, particularly when the target is moving up or down steep slopes. In addition, in this method, the assistant gunner is able to check the direction of lead which has been set off, thereby increasing the accuracy. However, this check of the lead using the elbow telescope is possible only with those elbow telescopes which can be boresighted for deflection. The M16 telescope on the 105-mm howitzer M2A2 is not capable of deflection boresighting. The two-man, two-sight method should be used when firing direct fire with any weapon equipped with two sights.

The second most effective system is the one-man, one-sight system, in which the gunner lays for both direction and range by using the panoramic telescope. Although effective, it is difficult to train a gunner in this system, since he must adjust simultaneously the lay of the weapon for both elevation and deflection.

The third method is the two-man, one-sight technique, in which the gunner lays for direction by using the panoramic telescope while the assistant gunner lays for range by using the range quadrant (elevation scale). This is an easy system to teach and it produces acceptable results against targets moving on level terrain. However, since it does not offer effective accuracy against targets moving on steep slopes, it is the least desirable technique to use against such targets.

Design limitations in some weapons prevent the use of the two-man, two-sight system of direct laying. If this is the case, the technique most favorable for the weapon and the section personnel should be used.

"LEADING THE TARGET"

A crucial aspect of direct fire is the ability to "lead" the target accurately. Firing at a stationary target simply requires aiming at the center of mass. This is not possible with a moving target. Consider a moving tank; even as the projectile travels toward this target, the tank is moving from its original position. Instead of aiming at the original position of the target, the gun must be laid on a theoretical point at which the target and the projectile should arrive simultaneously. In other words, the weapon must be aimed ahead of the target. This is "leading."

There are two techniques for incorporating the correct lead into the lay of the piece; they are *reticle laying* and *central laying*. In reticle laying, the vertical crosshair of the panoramic telescope is placed a certain number of mils *ahead* of the target (fig 4). The lead is indicated on the *reticle pattern* of the telescope. Central laying involves setting the lead mechanically on the *azimuth scale* and then laying the vertical crosshair *on* the center of mass of the target (fig 4).

The two techniques are equally rapid, but central laying is more accurate. In firing tests conducted by the US Army Artillery Board, Fort Sill, Oklahoma, central laying proved to be about seven percent more accurate than reticle laying.

CENTRAL LAYING AFFORDS CHECKS

When using central laying, the chief of section can correct a lead applied in the wrong direction before the round is fired. He can do this by glancing at the azimuth scale. In reticle laying, he cannot check the direction of lead until he sees the round burst, and then he will not know whether an error is due to the amount or direction of lead. The error may persist for two or three rounds if the gunner continues to apply the corrections in the wrong direction.

A difficulty with central laying is that the gunner may lose the target as he looks at the scale to set off the lead. This is particularly a problem in self-propelled weapons, in which "naked-eye" vision is restricted.

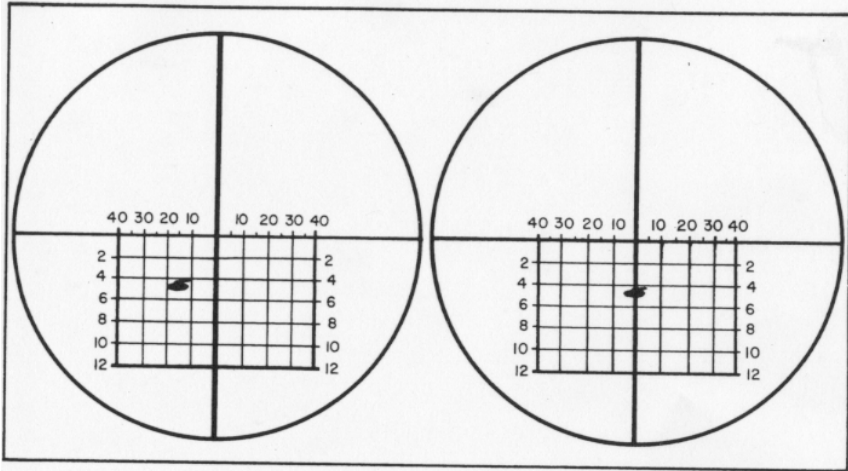


Figure 4. Positions of vertical crosshair in reticle laying (left) and central laying (right).

A device which will reduce this possibility is a mechanism called the "click sight." A click sight makes a perceptible click when a fixed lead is set off, thereby allowing the gunner to set the lead without taking his eye from the eyepiece.

Another partial solution is for the gunner to traverse at a speed which approximates the speed of the target as he glances at the scale to set the lead value. A second assistant gunner can be used to set the lead. Because of these complications in laying enclosed, self-propelled weapons, reticle laying seems to be the best solution when click sights are not available.

A good combination of sighting and laying will increase the percentage of first-round hits. When a tank is barreling down on a gun position, that first round will be critical. If that all-important hit is not made on the first round, adjustment is necessary. Adjustment takes time, which allows the tankers to shoot back. It is best to hold fire until the tank is within the optimum direct fire range (about 500 meters for present weapons). "Don't shoot until you see the whites of their eyes" is a good suggestion to follow. If your gun position is concealed and the tank hasn't spotted it, wait until you have the odds; surprise is a factor in your favor.

CHIEF OF SECTION BECOMES FO, S3

If it is necessary to adjust, it is best for the chief of section to do it; the muzzle blast may obscure the gunner's vision. The chief must stand where he can see the rounds burst and use judgment in sensing them. Direct fire bursts can be deceptive. At close ranges, a round which lands short of the target may bounce over it before exploding

and cause a missensing of OVER. Or the lead may be slightly too wide and cause the round to pass in front of the target. By the time the round bursts, the vehicle has moved in front of the burst. If the chief senses it OVER, he may command a range change which will give him a short on the next round. Time is wasted—and there may be no next round.

Learn these recommended procedures for adjustment.

(1) If the initial range is 600 meters or less, make 100-meter range changes until you get a target hit. Open fire at the estimated range or 400 meters, whichever is greater.

(2) If the initial range is between 600 and 1,400 meters, make 200-meter range changes until you get a bracket.

(3) If the initial range is over 1,400 meters, make 400-meter range changes until a bracket is obtained.

(4) Split brackets until you get a target hit.

When adjusting on a target which is moving toward the gun position, the decreasing range of the target must be considered. For example, if a sensing of OVER is obtained and the target moves 100 meters closer, a 300-meter range change must be applied to establish a 200-meter bracket (fig 5). Similarly, changes in site must be considered as the target moves up or down on slopes.

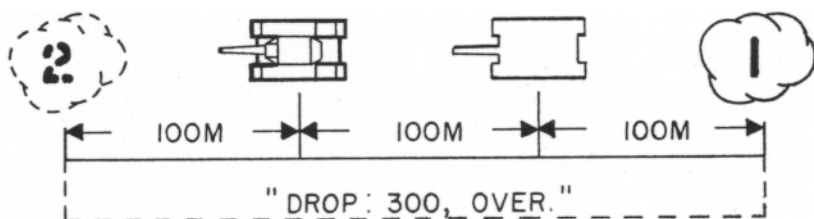


Figure 5. Establishing a bracket on a moving target.

Field glasses can be used to aid in adjustment; however, US Army Artillery Board tests indicate that acceptable adjustment can be made without them at ranges up to 1,200 meters. Because of their narrow field of view, field glasses afford less accuracy than the naked eye at ranges below 500 meters.

TANK VS HOWITZER

On the future battlefield, with units widely dispersed, the artillery battery will have an increased requirement to defend its own position area. Aggressor armor will frequently be used in deep penetrations because it is fast, maneuverable, and offers some protection against the effects of nuclear weapons. Artillery batteries will more than ever be exposed to tank attacks. To provide continuous support, artillery must be able to defend itself.

The tank *is* a direct fire weapon. It is constructed with all the necessary direct fire features. It has an extremely high velocity gun and a direct fire control system which make possible a high percentage of first-round hits at ranges up to 4,000 meters. Its chief weakness is limited "seeing." Compared with a tank, the artillery piece, an indirect fire weapon, has a low muzzle velocity, a low-power direct fire telescope, and no range finder. Artillery, however, is usually concealed and strives for 6,400-mil observation. Although at a disadvantage when face-to-face with the tank, artillerymen can depend on surprise; that is, seeing the tank before the tankers see them, and thereby getting off the first shot.

DIRECT FIRE IMPROVEMENTS

The best range to open fire on a tank is approximately 500 meters with most artillery pieces. At this range, the maximum ordinate for high explosive (HE) and high explosive antitank (HEAT) shells never exceeds eight feet. In other words, at this range the shell never rises above the height of current tanks. If the deflection is correct and the round is not short, a first-round hit is assured. Higher muzzle velocities will extend this effective direct fire range. The HEP-T shell M327 extends the flat trajectory range of the 105-mm howitzer to approximately 700 meters; as shells with even higher muzzle velocities become available, this range will be further extended.

Improving the optical characteristics of telescopes is another development in artillery direct fire capability. Increasing the power of the elbow telescope contributes to more accurate and consistent laying for range and better target detection and recognition. Atmospheric turbulence limits the useful magnification of direct fire telescopes to 10 power or less. Future elbow telescopes will be 7 or 8 power—or more than twice the power of present models.

Another development in direct fire optics is increased exit pupil diameter—the diameter of the beam of light leaving the telescope and entering the eye. The average eye can accommodate a 7-mm beam of light. A 7-mm exit pupil diameter allows the maximum amount of light to enter the eye and therefore permits more effective fire under poor light conditions. At present, the panoramic telescope has an exit pupil diameter of only 4.1-mm. The increase to 7-mm will be a significant aid in twilight and moonlight situations.

As mentioned previously, click sights will aid the central laying of self-propelled weapons, and they will be provided on all future artillery weapons. The newest self-propelled weapons, the T195 (105-mm) and T196 (155-mm) are equipped with a click sight.

Improved optical characteristics for telescopes, click sights, high velocity rounds, and better training will increase the artillery's capacity to deal with tanks without complicating or decreasing the indirect fire capability. But with these developments must come an improvement in the ability to determine ranges accurately—and thereby increase the first- or second-round hit capability. The immediate goal should be to develop

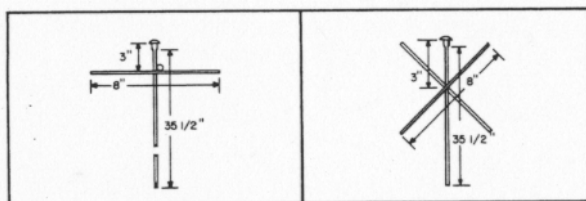
a simple means to determine ranges accurately to 2,500 meters. The feasibility of an optical range finder and a spotting rifle system are being investigated; when developed, these and the other improvements mentioned will give the direct fire capability needed for survival on the modern battlefield. Artillery *can* and *must* be used for firing by direct laying, principally against moving targets. The artilleryman must be ready when he hears the command . . .

"TANKS!"

●

A GEM FOR THE BATTERY EXECUTIVE

If you've had trouble in the past with gun section individual weapons lying on the ground or leaning carelessly against trees, here is a suggestion. Manufacture for yourself a portable rifle rack. The rack is easily made by welding together 105-mm howitzer ammunition rods (see figure).



A suggested standing operating procedure is to have the first dismantling 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.

—Submitted by Capt B. L. Walton
Battery "B," 1st How. Battalion (105-mm/155-mm)
7th Artillery
Fort Riley, Kansas

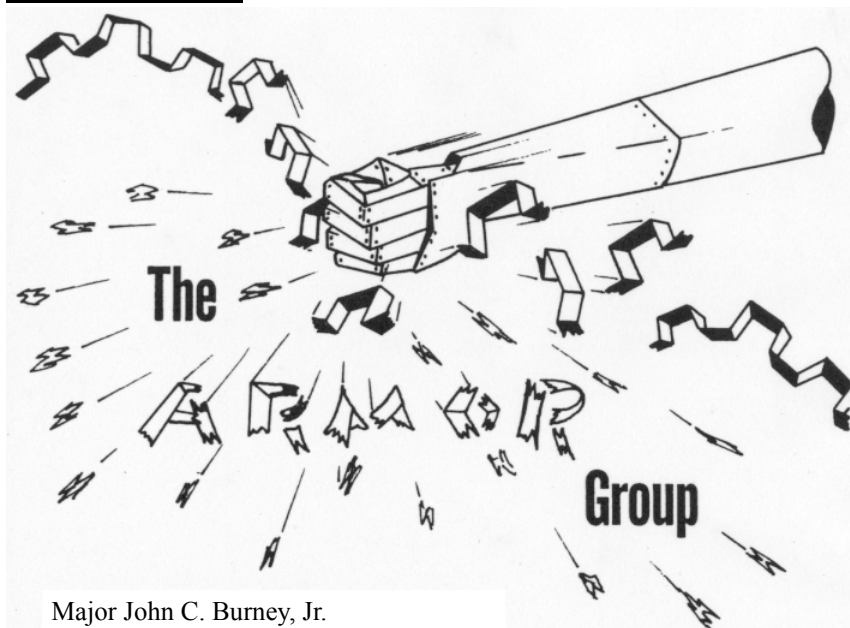
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"They ate their horses!
But saved their Guns."

"A Trumpeter in Ladysmith"
The Gunner, May 1950

"Nothing is more destructive than the charge of artillery on a crowd."
Napoleon

your sunday punch . . .



Major John C. Burney, Jr.
Tactics/Combined Arms Department

An armored division was speeding through enemy-held territory. Its objectives were to seize bridges spanning a wide, unfordable river. If the mission was accomplished, the other divisions of the corps could cross the river swiftly and avoid a costly deliberate crossing.

Suddenly, a strong enemy tank force struck the division; prospects of taking the bridges dimmed. But the division commander had something extra up his sleeve—something that enabled him to block the enemy attack and still keep his armor rolling toward the bridges. Because of the possibility of an enemy tank attack, the corps commander had given the armored division additional armor—a tank battalion from the corps' armor group.

A puzzled artilleryman on the division staff queried, "The armor group? What's that?" Fortunately, he was a member of a "student staff," the armored division was the "Hell on Paper" division from the US Army Artillery and Missile School "troop list," and the enemy was the dreaded aggressor.

The student's question was certainly logical; a crowded Artillery School curriculum may not permit detailed instruction on the armor group. To fill this void, this article will acquaint you with the mission, organization, equipment, and employment of the armor group.

As an artilleryman, you must acquire this knowledge if you are to

fulfill your mission of supporting the ground-gaining arms—armor and infantry. As a corps artilleryman, an armored division artilleryman, or an infantry division artilleryman, you will frequently be required to provide fire support for an armor group or elements of the group.

ARMOR GROUP IS VERSATILE

Each type corps has one armor group. The mission of this group is to command, control, and supervise one or more separate tank battalions. The group, properly reinforced, may be used intact as a potent combat force; however, the battalions of the group are normally used to augment the tank strength of infantry or armored divisions.

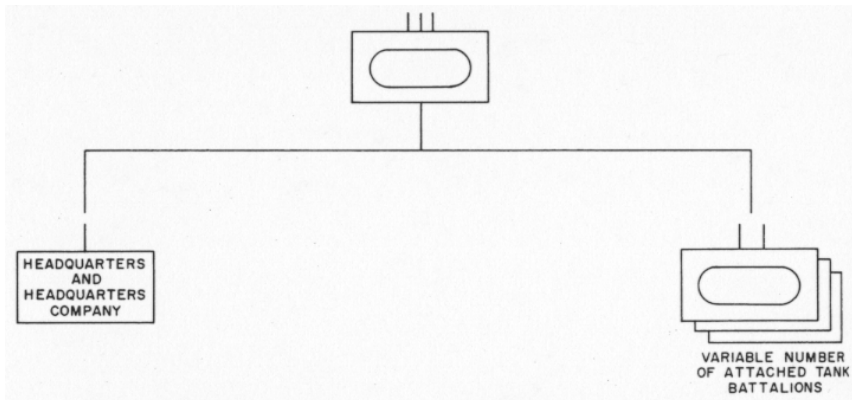


Figure 6. The armor group—a powerful force intact or when augmenting the tank strength of infantry or armored divisions.

To perform its mission, the armor group has a headquarters and headquarters company and a variable number of attached tank battalions (fig 6).

The headquarters and headquarters company (fig 7) includes the minimum essential men and equipment for the control of units attached to the group. It is a tactical headquarters like the combat command headquarters of the armored division (ARTILLERY TRENDS, May 1960). The aggregate strength of this company is only 64 officers and enlisted men; the group staff has only 8 officers. It can be seen in figure 7 that this headquarters is not designed to command many units in sustained combat operations. For example, the communications section has only 19 men. Furthermore, the group headquarters has only 12 radios and *no* armored vehicles. The unit can be mounted on 16 trucks.

With these personnel and this equipment, the company can effectively control several attached tank battalions for sustained periods when no combat is required. In combat, it can function for a short time as a task

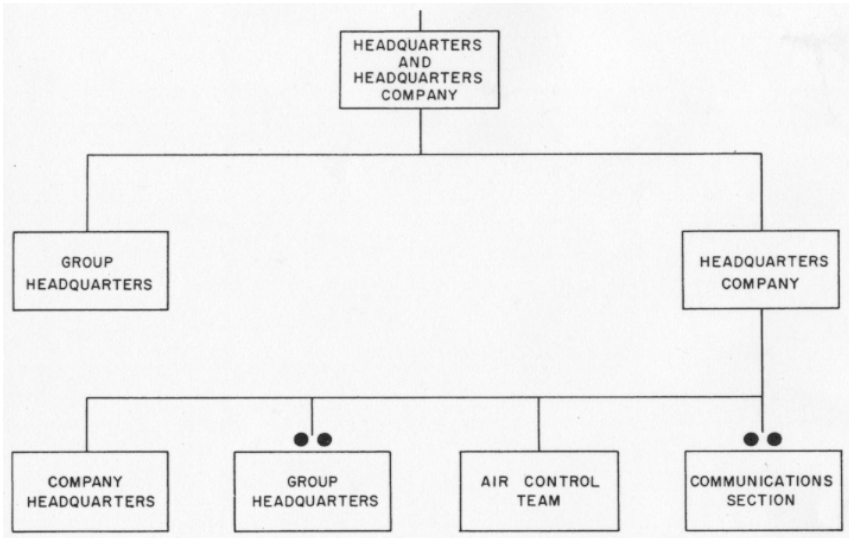


Figure 7. The armor group headquarters and headquarters company.

force headquarters comparable to a combat command. Also, the group headquarters can function as an armor section of a corps or army headquarters.

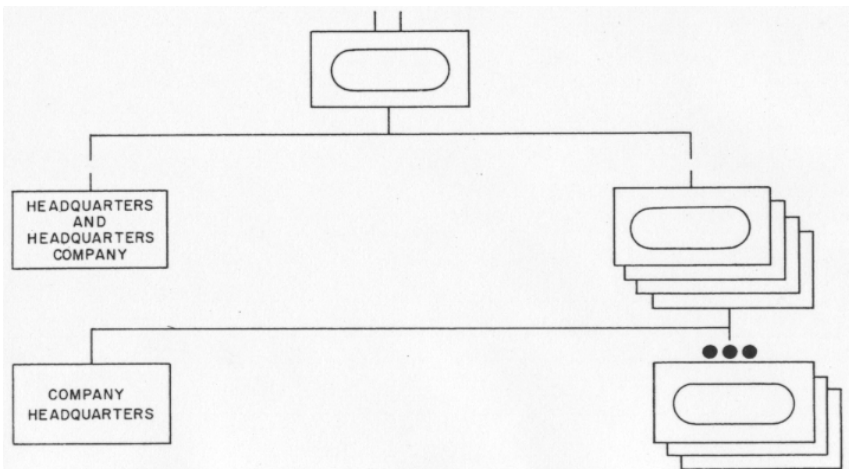


Figure 8. A tank battalion of the armor group.

ARMOR GROUP'S FIGHTING FORCES

A typical armor group contains three tank battalions. The tank battalions, also known as armor battalions, have the mission of closing with and destroying the enemy in coordination with other arms. To perform this task, each battalion (fig 8) has a headquarters and headquarters company and four tank companies (fig 8).

The headquarters company of the tank battalion includes both combat and administrative elements. Because the battalion frequently operates deep in hostile territory, with no friendly units to its flanks or immediate rear, the headquarters company has a scout platoon to provide reconnaissance and security. To provide a source of indirect fire support responsive to the commands of the battalion commander, the company has a mortar platoon of four 4.2-inch mortars; each mortar is mounted in, and fired from, an armored mortar carrier. The final combat element of the headquarters company is a tank section of four tanks. These tanks are provided for the battalion commander and his staff which includes his S3, the air liaison officer, and the artillery liaison officer who accompanies the battalion in combat. The headquarters company includes sufficient logistical support units to enable the tank battalion to be logistically self-sufficient for a limited time.

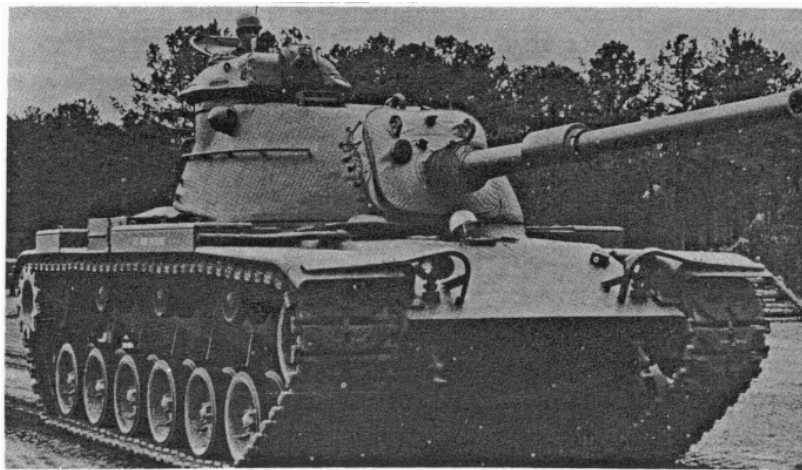


Figure 9. The armor group's newest medium tank—the M60.

Each of the four tank companies has three tank platoons of five medium tanks each. The newest medium tank is the M60 (fig 9). This tank has a 105-mm high velocity gun, a coaxially mounted 7.62-mm machinegun, and a .50 caliber machinegun. The M60 is powered by a diesel engine, which provides much greater operating ranges than does a spark ignition engine. There are two more tanks in the company headquarters; one is for the use of the artillery forward observer. Thus, there are 72 tanks in each tank battalion.

TANK BATTALIONS BOLSTER INFANTRY AND ARMORED DIVISIONS

The tank battalions of the armor group are normally used to bolster the tank strength of the infantry and armored divisions of the corps.

The infantry division has an organic tank battalion of five companies; however, when facing an enemy strong in armor or when required to execute an offensive mission requiring great speed and shock action, the division needs more tanks. To fill this need, one or more tank battalions from the armor group can be attached to the infantry division. When this is done, the attached battalion is not split between battle groups or intermingled with organic tank units. It is employed intact as a powerful striking force. With a nonorganic tank battalion, the infantry division commander can be more liberal in attaching his organic tank elements to his battle groups.

Here then is another maneuver element of the infantry division for which fire support must be provided. Artillerymen must anticipate this need and be prepared to furnish additional liaison officers and forward observers.

The armored division sometimes encounters a need for additional tanks. For example, in a deep exploitation across trafficable terrain and against strong hostile tank forces, the division commander, in organizing for combat, would probably want to strengthen each of his three combat commands with tanks. But he cannot do this with his organic tank forces of four battalions. In such a case, he could request that the corps commander attach one or more tank battalions from the armor group to his armored division.

Because these battalions are identical to those organic to the armored division in both combat and logistical elements, they are easily integrated into the division. When attached to the armored division, the armor group tank battalions are employed similarly as the organic tank battalions. Tank companies of the nonorganic battalions are crossattached with armored infantry companies of the organic armored infantry battalions so that the nonorganic tank battalions become "task forces."

ARTILLERYMEN FURNISH FIRE SUPPORT

Fire support for these additional task forces must be provided by the armored division artillerymen. This means an additional liaison officer who will act as the fire support coordinator for each additional task force and a forward observer for each additional company. If artillerymen are informed of the anticipated employment of the armor group, they will plan for these requirements and provide the needed fire support more effectively.

The armor group's tank battalions are sometimes attached to the armored cavalry regiment. Each corps commander has one armored cavalry regiment, and each army commander has two. These regiments are occasionally used as nuclei for large, strong combined arms teams to perform such missions as exploiting gains made by infantry divisions.

In such a case, more tank power is needed because there are only three companies of medium tanks in the armored cavalry regiment. This tank power is provided by attaching tank battalions of the group to the regiment.

The armor group may be used to form the nucleus of a task force comparable to a combat command. For example, a corps commander, with all of his infantry and armored divisions engaged, may suddenly need a strong force to exploit an unexpected gain or to block an enemy counterattack. He can form the combined arms force that he needs by attaching infantry and artillery to the armor group.

This will give him great flexibility and he can readily tailor the group for the task at hand. In a type corps there is an infantry battle group, four armored carrier companies (equipped with armored personnel carriers), corps engineers with three combat engineer battalions, and corps artillery with a wide variety of weapons. Thus, the corps commander can attach the infantry battle group to the armor group, he can make the battle group "armored infantry" with his carrier companies, he can attach combat engineers and bridging as needed, and he can call upon the corps artillery for either self-propelled or towed battalions of diverse calibers. An example of an armor group organized as a task force is shown in figure 10.

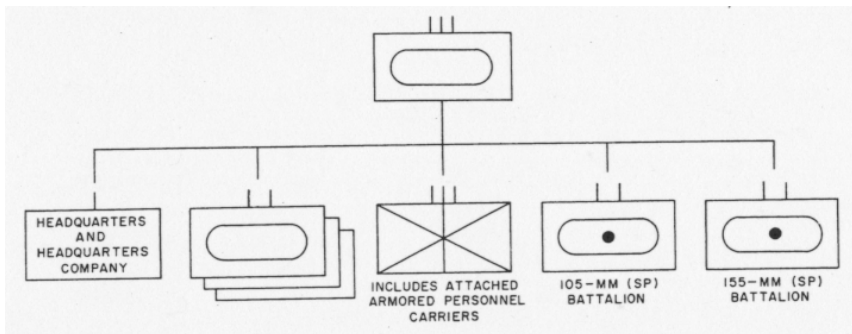


Figure 10. An example of an armor group used as a nucleus for a task force.

The employment of the armor group as a separate maneuver force will raise problems for artillerymen attached to the group. For example, the provision of sufficient FO's will be difficult, since there are only three FO's in a separate 105-mm self-propelled howitzer battalion and two in a 155-mm howitzer battalion. However, such problems will be transitory because the armor group headquarters does not have the personnel and communications equipment to control a large force in sustained combat.

ARMOR GROUP CONTROLS SPECIALIZED EQUIPMENT

The armor group also controls specialized armor equipment assigned to the group. This equipment is attached to divisions when it is needed. For example, when a division is facing a large number of enemy pillboxes, the division commander might request flame-throwing tanks (fig 11); or when the division is attacking through extensive minefields, he might request mine-exploding tanks equipped with flails. Other equipment sometimes made available include tanks equipped with flotation devices and heavy tanks for greater firepower.



Figure 11. A flame-throwing tank belching fire at a target.

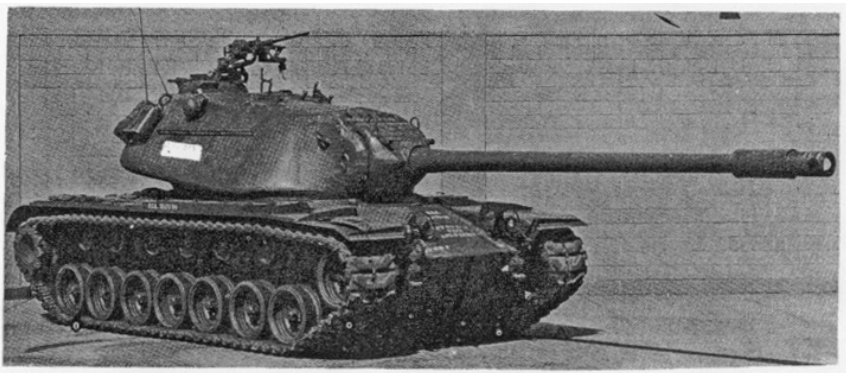


Figure 12. The M103 tank is equipped with a 120-mm gun.

Armor groups were employed effectively during World War II and are currently fulfilling vital tasks. For example, the 4th Armor Group, a part of V Corps, is in Germany today. Two medium tank battalions

and three armored infantry battalions are presently assigned to this group. One of the tank battalions was sent to Lebanon during the 1958 crisis in that country. For some time, the group included a heavy tank battalion equipped with the M103 heavy tank (fig 12).

Armor groups like the 4th Armor Group fulfill a vital role in the modern army, which is heavily dependent on mobility. Armor is expensive, and every division and armored cavalry regiment cannot have in its organic structure all of the tanks that it might need for missions requiring a large number of tanks. But the necessary tanks can be attached as required from armor groups, which are, in effect, "pools of tanks." In this way, the armor group provides flexibility in the employment of armor.

The armor group's versatility enhances its value. In addition to controlling tank battalions which may be attached to maneuver elements of the corps, the armor group can be used to form a powerful combined arms striking force, provide an armor section for a corps or army, and control special purpose armor equipment. Because of its wide variety of uses, artillerymen will be involved with the armor group in any mobile, large-scale campaign. Now is the time to understand what this group is and what it does so that you'll not say, "The armor group? What's that?"

●

IROQUOIS HU-1

The Iroquois HU-1 is the Army's first turbine-powered, rotary-wing helicopter. It replaces the H-19 Chickasaw which is currently organic to the Infantry Division Aviation Company. The HU-1 is smaller, easier to maintain, more versatile, and has an increased payload capacity. The new aircraft was "battle tested" during Exercise Banyan Tree II in the Panama Canal Zone. It provided tactical support for this maneuver and served as a mobile command post for staff and troop commanders.



In addition to fulfilling an urgent requirement for a general purpose utility vehicle, the helicopter can function as a mobile launching platform for the SS10 guided missile, or the SS11 which is scheduled to replace the SS10. The SS10 is currently organic to the assault weapon platoon of the Infantry Battle Group Combat Support Company.

●

"The strong effect of massing artillery fire . . . has been proven beyond question."

General Douglas MacArthur

FUZES AND BOOSTERS

Lieutenant Colonel (Ret.) Zack C. Mathis
Gunnery/Cannon/Rocket Department

In the anatomy of the artillery projectile, the fuze is the brain. The fuze is the means by which the explosive action can be controlled in the target area, when the shell is out of the hands of the artilleryman. Artillerymen should be familiar with the fuze actions available through the use of various fuzes. This article discusses the fuzes in use in artillery projectiles today. The charts, (fig 13, 14, 15, 16, and 17) show all artillery and tank projectiles and fuzes and their weights. For complete information, the ammunition manuals (TM 9-1300-203 and TM 9-1300-205) should be consulted.

FUZE CLASSIFICATION

Fuzes are classified in two ways—by the position of the fuze on the projectile and by the types of explosive action they cause. Fuzes are located either in the nose or in the base of the projectile—in the nose, it is called a point-detonating fuze; and in the base of the projectile, it is called a base-detonating fuze.

The method of function further classifies the fuze into four categories—impact, time, variable time, and selective.

Impact Fuzes

There are three impact fuze actions; the difference between them depends on the length of time from impact of the projectile with a solid object to the actual explosive burst. A fuze is therefore either superquick, delay, or nondelay.

Superquick fuzes are manufactured with the firing pin in the nose of the fuze (at the very point of the projectile). The instant the projectile makes contact with a solid object, the fuze is activated and the bursting explosive train is begun. Superquick affords the best action above the ground, as evidenced by the small crater which it leaves. The fuze is so sensitive that it should not be used in heavy rain or hail.

Nondelay fuzes have a slower action because the firing pin is located in the rear of the fuze, and the fuze is activated only when the pin is driven forward by the inertia created upon impact. This type fuze is used in armor-defeating projectiles.

Delay fuzes depend on the burning of a black powder pellet. Ignition of the powder occurs when the projectile strikes an object. The delay caused by the burning pellet varies between 0.025 seconds and 0.15 seconds, which permits ricochet or penetration before burst.

Weapon	Ammunition Type	Item Description	Weight of Projectiles (pounds)	Weight of Complete Round	How Shipped	Point-det	Base-det	FUZES		VT
								Time (powder)	Time (mech)	
4.2-inch mortar, M2 and M30 (maximum propelling charge for M2 mortar is 25 1/2 increments)	High Explosive	Shell, HE, M3	23.8	26.46	Fuzed	M51A5				
		Shell, HE, M3A1	23.8	26.46	Fuzed	M51A5, M535			M500A1, M520	
		Shell, HE, M329, and M329B1	23.8	26.92	Fuzed	M51A5, M535			M500A1, M520	M513, M513B1, M513A1
Smoke	Smoke	Shell, smoke, FM, M2	23.8	25.1	Fuzed	M8				
		Shell, smoke, WP, M2A1	24.8	25.5	Fuzed	M8				
		Shell, smoke, WP, M328	24.8	27.45		M521				
Gas	Gas	Shell, Gas, Persistent, HD, M2	23.5	24.2	Fuzed	M8				
		Shell, Gas, Persistent, HD, M2A1	23.5	24.2	Fuzed	M8				
500,000 CP for 70 seconds	Illuminating	Shell, Illuminating, M335	26.0	26.7	Fuzed					M501A1

Figure 13.

105-mm howitzer, M2A1, M2A2, M4, M49	HE	Shell, HE, M1	33.0	42.0	Fuzed (will be unfuzed in the future)	M51A5, CP, M78, M78A1		M55A1, A2, A3	M500A1, M520	M513, M513B1, M513A1
	HE, antitank	Shell, HE, TP-T, M67	28.80	37.06	Fuzed					
		Shell, HE, TP-T, M327	23.38	33.35	Fuzed					
	Smoke	Shell, smoke HC, M84B1	32.86	41.93	Fuzed				M501A1	
		Shell, smoke WP, M60	34.83	43.81	Fuzed	M51A5, M57				
	Colored Smoke	Shell, smoke M84B1	Yellow 30.29	Yellow 39.38 Red 33.78 Green & Violet 30.48	Fuzed					M501A1
			Red							
			Green & Violet							
	Gas	Shell, gas, M60	33.94	42.92	Fuzed	M51A5				
		Shell, chemi- cal, M360	35.59	43.86	Fuzed	M508				
	Illumi- nating	Shell, Illumi- nating, M314A1*	36.55	46.43	Fuzed				M54	M501A1
			28.80	37.06	Complete					
	Target Practice	Shell, TP-T, M67								
	Blank	Ammunition, blank, M395								
Drill	Cartridge, drill, M14	42.06	42.06	Complete	M59 (Inert)			M54 (Inert)		

*500,000
CF for 80
seconds

Figure 14.

Weapon	Ammunition Type	Item Description	Weight of Projectiles (pounds)	Weight of Complete Round	How Shipped	Point-det	FUZES		VT
							Base-det	Time (powder)	
155-mm howitzer, M1, M1A1, M45	High Explosive	Shell, HE, M107	96.75	104.4 (GB) 112.1 (WB)	Unfuzed	M51A5, CP, M78, M78A1	M55A3	M500A1, M520	M514E2
	Smoke	Shell, smoke, HC, M116	86.43	94.1 101.77	Unfuzed		M54	M501A1	
		Shell, smoke, WP, M110	97.50	105.15 112.84	Unfuzed	M51A5			
	Colored Smoke	Shell, smoke, M116	86.43	94.1 101.77	Unfuzed		M54	M501A1	
Chemical	Shell, chemical, M121		99.70	107.35 (GB)	Unfuzed		M508		
	Gas	Shell, gas, M110	98.49	106.14 H- 113.83	Unfuzed	M51A5	M55A3	M500A1, M520	
		Shell, illuminating, M118A1	103.06	110.71 118.40	Unfuzed		M54	M501A1	
*1,000,000 CP for 75 seconds	Dummy	Projectile, dummy, M7	95.0	100.5 108.19	Complete				
	High Explosive	Shell, HE, M106	200.0	215.45 (GB) 230.45 (WB)	Unfuzed	M51A5, CP, M78, M78A1, M535		M500A1, M520	M514E2
High Explosive, Spotting		Shell, HES, M424							
		Nuclear Explosive	Shell, AE, M422						
Dummy		Projectile, dummy, M14	188.6	213.3 228.3	Complete				

Figure 15.

76-mm gun M32, M48	High Explosive	15.0	25.83	Complete	M51A5	M500A1 M520	
	Smoke	15.71	25.82	Complete	M48A3		
	Armor Piercing	14.56	27.32	Complete			
		8.22	20.72	Complete			
	Target Practice	14.50	27.32	Complete			
		15.00	27.18	Complete			
	90-mm gun, M36, M41, M54	High Explosive	23.40	42.00	Fuzed	M51A5, CP, M78, M78A1, M535	M500A1 M520
		High Explosive Marker	18.61	34.30			
	Smoke	23.6	42.03	Fuzed	M51A5, M78CP, M535	M55A3	M500A1, M502A2, M520
		23.64	42.52	Fuzed	M48A2 A3, M57		
Armor Piercing	24.18	44.97	Complete				
	24.18	44.97	Complete				
Target Practice	12.44	32.30	Complete				
	12.60	32.91	Complete			P1BD, M509E4	
Canister	12.44	32.30	Complete				
	24.10	44.97	Complete				
	23.24	41.61	Complete				

Figure 16.

Weapon	Ammunition Type	Item Description	Weight of Projectiles (pounds)	Weight of Complete Round	How Shipped	Point-det	Base-det	FUZES		VT
								Time (powder)	Time (mech)	
175-mm gun, SP, M107	High Explosive	Shell, HE, M437			Unfuzed	M51A5, M78, M535			M520	M514E2
		Projectile, HE, M73	50.0	99.71	Fuzed	M51A5			M61, M61A1, M61A2, M506	M504, M514B1
120-mm gun, M1A3, M58	High Explosive	Projectile, HE-T, M356	50.41	89.15	Fuzed	M51A5				
		Projectile, AP-T, M358	50.85	107.31	Complete					
	Target Practice	Projectile, TP-T, M359	50.85	107.31	Complete					
	Smoke, WP	Projectile, T16E3	50.41	89.15	Complete	M48A3				
280-mm gun, M66	High Explosive	Shell, HE, M124	600.00	759.07	Unfuzed	M535			M520	M514E2
	Nuclear Explosive	Shell, AE, M366								

Figure 17.

Time Fuzes

Powder time fuzes depend on the burning rate of compressed black powder rings to vary the length of time before the high explosive element is activated. This length of time can be predetermined and set but is subject to error because of the hygroscopic nature of black powder. This fuze is limited standard but some are still in stock.

The mechanical time fuze incorporates a clocklike mechanism which uses a gear train and the forces (inertial and centrifugal) upon the projectile to trip the firing pin at a predetermined, mechanically-set time.

Variable Time Fuzes

Variable time (VT) fuzes employ a transmitter-receiver radio, which sends out radio waves when the fuze is armed. As the projectile approaches an object, the waves are reflected back at an increasing intensity and picked up by the receiving unit in the fuze. When the waves reach a preset intensity, the fuze functions.

Selective Fuzes

Selective fuzes are those which contain more than one fuze action which can be selected and set in the field (e.g., superquick and delay [SQ-DEL] or mechanical time and superquick [MTSQ]).

ARTILLERY FUZES IN USE TODAY

M91 Base-Detonating (BD) Fuze, Nondelay

The M91 is used in all 105-mm and 75-mm HEAT-T projectiles. It has a tracer element located in its base which burns for 7.5 seconds. The tracer element is the only difference between the M91 and the M62, which the M91 is replacing. Both fuzes have a booster charge. A slider assembly provides bore safety.

M51 Point Detonating (PD) Fuze

The M51 is a selective fuze, incorporating superquick and delay actions. The superquick (SQ) function is obtained by turning the slot to the vertical position. Delay action is controlled by a 0.05-second delay element and can be set by turning the screw on the fuze body 90° to a horizontal position. This fuze (M51A5) can be used with all standard artillery ammunition, from 75-mm to 280-mm.

M535 (T177E3) PD Fuze

The M535 is to replace the M51. The M535 is ballistically the same as the M51, but it has an improved-sensitivity superquick element and is used with the M124 booster. This booster contains a ball-type rotor which arms the fuze 70 to 100 feet from the muzzle in order to minimize the danger of premature muzzle bursts.

M508 Superquick Fuze

The M508 is a single action impact fuze which is essentially the M51 minus the delay element. It incorporates a M125 booster, which provides for a long-delay arming of the fuze. It is used with the 105-mm and 155-mm howitzer burster-type chemical projectiles.

M78 Concrete-Piercing (CP), Delay, and Nondelay

The *delay* fuze of this series is fitted with delay action (0.025 seconds) only. It has a black powder delay element and requires no setting.

Using this fuze and booster can convert a high explosive (HE) round to a concrete-piercing round.

The CP M78 *nondelay* single-action fuze has the same ballistic characteristics as the M78 *delay* and permits adjustment on fortifications without using ballistically different fuzes. The *nondelay* fuze has a 1-inch white stripe on the point to distinguish it from the *delay* fuze which is not painted.

M54 Time Fuze (TSQ)

The M54 is a selective fuze made for use in base-ejection, smoke, and illuminating projectiles. It has both superquick and powder train time elements. The two connected black powder rings govern timing from 0.4 seconds to 25.0 seconds. When the setting on the time increment ring is at safe (S), the fuze action will be superquick. It does not have a booster.

M55 Time Fuze (TSQ)

The M55 is identical to the M54, but it incorporates the M21 booster. Both M54 and M55 are being replaced by the M500 and M501 mechanical time superquick series.

M67 Mechanical Time Fuze

The M67 is a mechanical time single action fuze. It can be set for a maximum of 75.0 seconds and a minimum of 1.5 seconds. It is incremented every 0.5 seconds. The fuze may or may not be equipped with a booster. When the M67 is used with a base-ejection shell (smoke or illuminating), the booster is *not* attached. This is a limited standard fuze but is still available in stock.

M500 Mechanical Time Fuze (MTSQ)

The M500 is a selective fuze, combining the 75-second time ring features of the M67 with a superquick element. It incorporates a booster of the M21 series and is designed to replace the M55 and M67. When set for a time setting (airburst) and the time element fails to function, impact superquick action can be expected. If the projectile strikes a solid object before the time set on the fuze, the superquick element will function.

M501 Mechanical Time Fuze (MTSQ)

The M501 is a companion of the M500 in their replacement of the M54 and M67. The M501 is to be used with base-ejection, smoke, and illuminating shells. It does not have a booster.

M520 Mechanical Time Fuze (MTSQ)

The M520 incorporates a new booster (M125) into the M500 fuze; see ARTILLERY TRENDS, March 1961, page 69. This is an improvement which delays arming of the fuze until the projectile is well clear of the tube, minimizing the possibility of muzzle burst.

M513 and M514 Variable Time Fuzes

Both the M513 and M514 employ a wet-cell battery which is charged upon firing by electrolyte. This powers a transmitter-receiver radio. The radio is activated approximately 5 seconds before the time setting (computed time to target) placed on the fuze. A mechanical delay arming device is provided, therefore, to insure maximum time of unarmed

flight. The arming time for the fuze is said to be "time to target minus 3 seconds," assuming that the target time is correctly computed (see FM 6-40 for details). This particular feature precludes the possibility of premature functioning and decreases the chance of the enemy jamming the fuze and causing premature detonation. When waves reflected back to the receiver reach a predetermined intensity, the explosive train is initiated and the projectile explodes in the air.

The M513 is used with ammunition up to 120-mm, while the M514 is used in separate-loading ammunition. They include impact elements (superquick) which function on impact in the event that the VT element malfunctions or the projectile strikes a solid object before the time set on the time ring. All VT fuzes contain an integral booster.

BOOSTERS

The booster component of the fuze is actually comprised of two parts, each of which performs one of the two primary functions of the booster. The first function of the booster is to assure that a high order burst will occur. This is accomplished by the presence of tetryl, a highly sensitive explosive, which transmits action from the fuze to the bursting charge. The second function of the booster is to provide bore safety, made possible by the booster rotor, which is eccentrically placed in the booster, off-setting the flash channel from detonator to bursting charge. When the projectile clears the muzzle of the weapon, the rotor turns and the flash channel is lined up, "arming" the projectile.

The M21, M24, and M25 boosters are the most commonly used today. The M24 performs the same function as the M21 and is ballistically identical. The only difference is in the rotor, which revolves in a vertical rather than a horizontal plane. The M25 is used only with the CP M78 fuzes. It has only three external threads as opposed to the normal nine. It also has a cotter pin which holds the rotor in place. This pin must be removed prior to firing.

Two new boosters, the M124 and the M125, are ballistically identical to the M21 and M24, and they function identically, except that the M124 has a ball-type rotor which delays arming the point-detonating fuze M535 until it is 70 to 100 feet from the muzzle. The M125 booster was developed to provide a long-delay arming time for chemical shells (arming distance: 90 to 220 feet from the muzzle). Tests proved it to be compatible with the MTSQ fuze M501, so the two were combined to make the M520 MTSQ fuze.

Note. A short article that appeared on page 69, ARTILLERY TRENDS, March 1961, implied that the minimum arming rotational velocity of 2,000 rpm is reached only between 90 and 200 feet from the muzzle. In reality, the rotational velocity of 2,000 rpm can be reached *before* the projectile leaves the tube. This 2,000 rpm rotational velocity is necessary to *begin* the arming process. The arming process is not completed (i.e., the fuze is *not armed*) until the projectile is 90 to 220 feet from the muzzle.

Ammunition, which includes fuzes, is a category which is undergoing constant improvement through research and development. Changes and improvements are introduced into the system as quickly as they are proved by field testing. All artillerymen concerned directly with ammunition should make a constant effort to be aware of these developments by looking for the latest changes to the ammunition manuals which are published periodically.

●

NEW P(f) COMPUTER

A new and more useful P(f) computer has recently been developed at the US Army Artillery and Missile School which overcomes many of the limitations of the earlier model. One side of the computer is devoted to area targets. A rapid and accurate solution can be obtained for the following data when the desired probability (P) of fractional damage is 90%:

1. Fractional damage $d(\text{offset}) = 0$
2. Fractional damage $d(\text{offset}) \text{ not} = 0$
3. Required radius of damage (R_D) $d = 0$
4. Required radius of damage $d(\text{offset}) \text{ not} = 0$
5. Maximum d
6. Maximum CEP $d = 0$
7. Post strike $d = 0$
8. Post strike $d \text{ not} = 0$.

Also on the area target side of the computer (superimposed) is the capability for solving the following data for probability other than 90%:

1. Fractional damage $d = 0$
2. Required R_D $d = 0$
3. Maximum CEP
4. Probability $d = 0$.

The back side of the P(f) computer has been converted to handle point targets. It can be used to solve for the following information:

1. Probability of damage $\left(\frac{d}{\text{CEP}} \right) < 7.5$
2. Required R_D
3. Maximum d offset

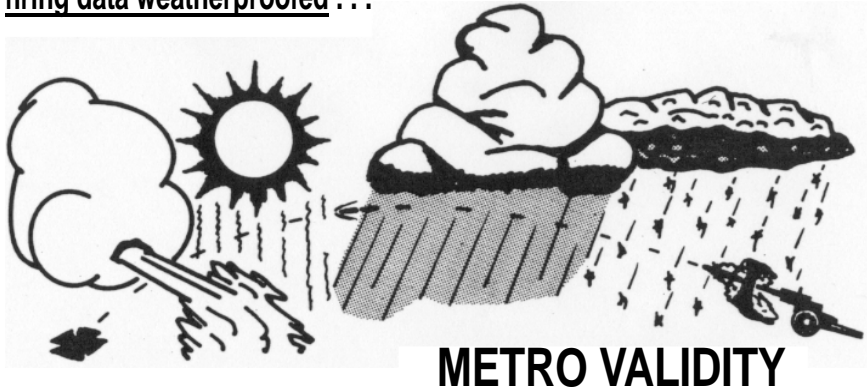
These features of the new P(f) computer enable the Nuclear Weapons Employment Officer to solve nearly all the problems associated with target analysis. The computer can be obtained, at a cost of \$6.75, by mailing check, postal or money order to the Book Department, US Army Artillery and Missile School, Fort Sill, Oklahoma.

●

FINISH IT NOW!

Many extension course students are now on the verge of completing certain subcourses. Don't let the summer season stop you. Finish now!

firing data weatherproofed . . .



Major Raymond N. Barry
Target Acquisition Department

While in the process of determining weather corrections to firing data, the artilleryman might ask himself, "Just how valid is the information contained in this latest met message?" Although an accurate and precise answer is not readily available, there are some considerations that will provide the artilleryman with an excellent indication of the validity of the meteorological (met) message.

Two factors which affect the validity of met message data are the accuracy of the weather measuring system and the variability of the atmosphere. Artillery meteorological sections are capable of obtaining accurate measurements of the atmosphere through which the radiosonde travels using a special type of equipment; however, in the true sense, these measurements pertain only to one location and one instant in time. The values of wind, air density, and air temperature continuously undergo a complex, inconsistent variation in both time and space. Occasionally, these weather variables may change abruptly over a short distance or over a brief interval of time. The change may be extremely gradual with respect to both distance and time on other occasions and in other geographical areas. Most of the trajectory of the artillery projectile will usually be some distance from where the weather elements were actually measured. Also, some time must elapse between the measurement of atmospheric conditions and the firing of the weapon. This is because of the time required to complete the radiosonde flight, to compute and transmit the message, and to determine corrections at the fire direction center (FDC) after receipt of the message. Thus, the validity question arises.

Generally, the validity of a met message will decrease with increasing distance from the met section sounding site. Local topography has a pronounced effect on the distance met data may be reasonably extended. For example, mountainous terrain will particularly influence the

wind, causing large variations over short distances. This orographic effect on wind frequently extends to heights much greater than the mountain tops. It would be impossible to compute a specific message validity distance for every combination of weather and terrain which might exist; however, two general rules may be used as a guide:

(1) A met message is considered valid up to 20 miles over fairly level terrain, for example, the central United States.

(2) The validity distance should be reduced by approximately 50 percent in mountainous terrain.

The proximity of large bodies of water will have an effect on both the time and space validity of met messages due to the existence of land and sea breezes and the humidity effect on density (an increase in humidity decreases air density). Therefore, the space validity of a met message should be reduced by approximately one-third when operating along coastlines.

PASSING TIME DECREASES MET MESSAGE VALIDITY

Due to the perishable nature of weather data, the validity of a met message will decrease as time passes. It is difficult for the artillery met section to provide ballistic messages more frequently than every 2 hours with present equipment. Experience has shown that intelligent use of met data furnished on a 2-hour interval greatly increases the accuracy of artillery fire. The use of electronic computers and new atmospheric sounding devices, such as rocketsondes (ARTILLERY TRENDS, September 1960, page 85), will eventually produce even greater accuracy by providing the FDC with weather corrections instantaneously as the elements are measured.

If a mechanical failure of electronic equipment occurs, met sections compute ballistic weather data based on surface and pilot balloon observations. This is sometimes referred to as the visual technique; the resulting product is called a visual met message. Although visual messages are less accurate than messages based on a radiosonde sounding, they provide an alternate source of met data. When the visual method is used, air densities aloft are not actually measured, but are taken from climatological tables (ballistic density departure tables, TM 6-241).

The results of a series of experimental firings conducted at Fort Sill, Oklahoma, in 1958 indicate that the accuracies of met message densities, in order of accuracy, are as follows:

(1) Current met message from met section in close vicinity of firing site.

(2) Current met message from any met section within 20 miles of the firing site.

(3) Two-hour-old met message from met section in close vicinity of firing site.

(4) Current met message from any met section between 20 and 50 miles from firing site, or 2-hour-old message from met section within a 20-mile radius.

(5) Current met message from met section 50 to 70 miles distant, 2-hour-old message from met section 20 to 30 miles distant, or 4-hour-old message from met section in close vicinity of firing site.

(6) Ballistic density departure tables.

Due in part to the validity question, there has been in the past some reluctance by artillerymen to place full confidence in met data. However, many previously skeptical artillerymen became firm believers in met corrections during the Korean conflict, when they were sometimes confronted with situations where weather effects alone moved artillery fire over 2,000 yards away from the intended target. A full understanding of meteorological information by those who use it, coupled with the application of automatic data processing to the meteorology field, will greatly enhance the role weather corrections play in helping achieve effective artillery fire.



'TELL' ARTILLERY TRENDS YOUR IDEAS

Did you ever hear somebody in your unit say, "sure we can do it, all we have to do is rig up a . . ." or how about, "here, let me show you a better way to do that." Or, "let me tell you how we licked that problem in the last unit I was with."

The new ideas and the practical knowledge which are being exhibited daily in troop units are invaluable to the field artillery. Yet all too often, only those immediately involved benefit from this information. The US Army Artillery and Missile School would like all artillerymen to benefit from the ideas and experience which are usually revealed to only a fortunate few. But how can this be done?

There is no reason why *you*, the man in the unit, cannot be the School's writing contributor. If you have or know of an idea that has been successfully put into practice in your unit, send it to ARTILLERY TRENDS. If, through your experience, you have learned a better way to get some job done, send an explanation of your method to ARTILLERY TRENDS.

If your article is printed in ARTILLERY TRENDS, you and your unit will be given credit. You also will be awarded an ARTILLERY TRENDS Certificate of Contribution which is presented to all authors (not for "Gems"). However, ARTILLERY TRENDS reserves the right to edit your article for style and format and to make appropriate changes if necessary. The facts in your article will not be changed. In some cases, the information will be turned into a "Gem," especially if it is short and simple.



"The infantry must never be deprived of powerful artillery support."
Ludendorff

premeditated destruction . . .

Fire Planning

Captain Harlan C. Chase
United States Marines Corps
Tactics/Combined Arms Department

Guilty or not guilty? . . . several artillerymen, both resident and nonresident US Army Artillery and Missile School alumni, are assembled before you in a hushed state of anticipation. The question . . . how many of them are guilty of not being able to prepare a thorough and workable artillery fire plan *right now*? Can you? You are your own judge and jury.

Let us review some basic principles and facts before you reach your decision. Whether you are a battalion commander, an S4, or a chief of section, you realize that an artilleryman must be proficient in a variety of related artillery skills. Training schedules always include gunnery, adjustment of fire, service of the piece, maintenance, and survey. But how about fire planning? A thorough knowledge of fire planning is necessary if maximum effect is to be obtained from available artillery support.

Students may well remember the "tissue issue" that characterized fire planning classes at Fort Sill. The solution of the School often precipitated or provoked the inevitable argument from the more vociferous "crystal ball gazers," officially known as fire planners. At that time, you were probably convinced of the importance of fire planning and its applicability in combat. But in how many cases has this conviction worn off?

How can fire planning be included in the training program to maintain realism and insure proficiency in this subject? One answer might be as a part of field exercises. Practical application is the ultimate use of all military skills. However, merely preparing fire plans in the field is not enough to develop this skill. Of the fire plans produced during field training exercises (FTX) and command post exercises (CPX), how many are evaluated for their effectiveness upon the conclusion of the exercise? Too many fire plans are prepared in a haphazard manner by inexperienced personnel. These usually end up as the old nemesis "measle sheet," an overlay with numerous circles placed at random with no apparent reason other than that of assuring the "old man" that a form of fire planning has been accomplished.

Means to prevent these shortcomings have been established, and they will be discussed later in this article.

ARMY TRAINING TEST PLANNERS RECOGNIZE WEAKNESS

One of the primary motivating forces in the formulation of training schedules is the Army Training Test (ATT). Much training is aimed at one goal—to pass the ATT with flying colors. This is commendable, but any subject not included within the scope of these tests may frequently be overlooked or given low priority when training requirements are prepared. This might be the case with fire planning. Planners of ATT's recognize this weakness, and action is being taken to include a requirement for fire planning. This will take time. During this period some positive action must be taken to fill the void in the proficiency of the average artillery unit. Training is the step that will remedy this problem.

Consider first *how* you want fire planning accomplished in your unit. Guidance for this action is sought from your next higher artillery headquarters. After you have decided how you want to conduct fire planning, it must be taught and applied in your training. All officers and the enlisted personnel who work in the fire direction center (FDC), liaison personnel, and the forward observer (FO) teams must receive this training.

The first step in training would be a classroom presentation of the fundamentals of fire planning, to consist of fire planning terminology, fire planning channels available to your unit, and a step-by-step explanation of what is involved in the preparation of an artillery fire plan. This phase of instruction will normally require three hours.

The second phase should include practical exercises in the classroom. It is recommended that fires be planned on familiar terrain in such a class. Class members should understand fire planning activities from all viewpoints—from the FO to the FDC—so that they know the problems and requirements encountered at each of these levels.

THREE WAYS TO MAINTAIN PROFICIENCY

When formal instruction has been completed, fire planning should be integrated continually into training to maintain proficiency. Three ways in which this may be done are by—

- (1) Conducting frequent map exercises (similar to the one used in the original instruction).
- (2) Including fire planning requirements in each CPX and FTX in which your unit is involved.
- (3) Including fire planning requirements in every exercise which involves a supported force.

In preparing for all combined arms type field exercises, artillerymen should familiarize personnel of the supported force with artillery fire planning, what can be expected from it, and what they can do to facilitate it. Forward observers should work closely with company commanders; battalion S3's and liaison officers should work with the S3's of battle groups and combat commands. Instruction on fire planning to supported unit personnel by forward observers, liaison officers, and S3's will certainly prove of great value to all concerned.

The following points should be stressed in all command post, field training, map, and combined arms exercises:

(1) All personnel that would normally be involved in fire planning should participate in the exercise. This includes communication personnel who would normally transmit and receive fire planning information by radio or telephone.

(2) Fire planning should be evaluated and the results critiqued when the exercise is completed. Positive action should be taken to correct all errors.

(3) In exercises involving a supported force, critiques should be held with the commanders and operations personnel of the force.

Another means available to aid a unit in artillery fire planning training is the USAR fire planning classes offered by the Artillery and Missile School (fig 18).

<u>Subject Number</u>	<u>Title</u>
T 3000.3	Fire Planning by the Forward Observer.
T 3008.3	Introduction to Artillery Fire Planning.
T 3063.4	Fire Planning at Battle Group (Combat Command) Level.
T 3105.6	Division Artillery Fire Planning.
T 3111	Corps Artillery Fire Planning.

Figure 18. United States Army Reserve classes offered at the Artillery and Missile School.

The preceding classes can be obtained by writing to: Commandant, US Army Artillery and Missile School, Fort Sill, Oklahoma, ATTN: AKPSINI.

Have you reached a verdict? Could the defendants, including you, produce a workable fire plan? If found "not guilty" then pass in review for acquittal. If "guilty," take action to redeem yourself by writing for one or more of the above courses and by taking immediate action to include fire planning in your training objectives.



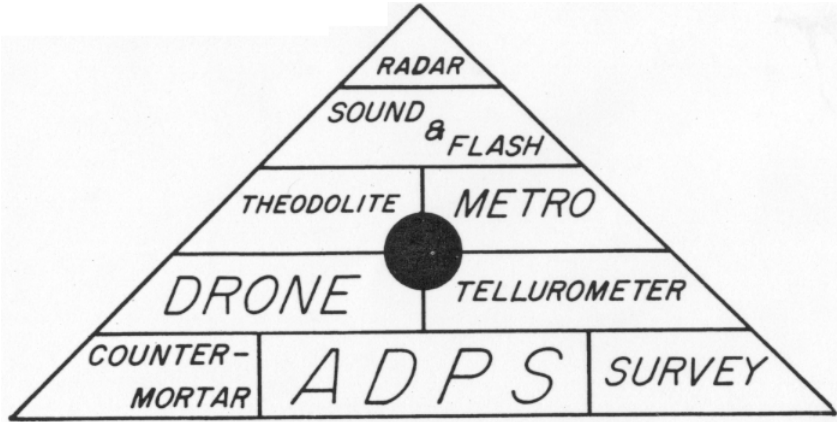
An error exists in Instructional Note, MAT 100, dated August 1959. On page 7 the Muzzle Velocity for 105-mm howitzer, M52, *should be* 1550 feet per second. For details, see Changes 3 to FT 105-H-4.



"Modern warfare demands of the artilleryman a perfect technical knowledge of his weapon and a thorough understanding of its tactical employment."

General John J. Pershing

specialization and teamwork . . .



The Weapons System

Colonel James P. Smith
Target Acquisition Department

The old adage, "shoot, move, and communicate," has always represented the artillery's well-organized interdependency. It symbolizes the teamwork of all the elements that make up the artillery. The modern battlefield requires even more and closer teamwork and a higher degree of interdependency. And yet, seemingly working against this all-important oneness is an obvious factor—specialization. The complications that make up our present weapons system preclude the possibility of one man, or even a few men, possessing all the knowledge and technical skills required. The gunnery officer can *not* do artillery's job alone.

In the past, if an artilleryman knew and understood what such terms as T, t, c, d, S, r/R, Fork, GT line, ranging rounds, and many others meant, he was a qualified artilleryman. With this knowledge, some luck, and much perseverance, he could inflict damage on the enemy by adjustment.

But this is no longer good enough. Adjustment will be too time-consuming in future clashes. Gunnery must strive for the first-round, one-shot kill. This requires pinpoint accuracy of target location, which is not possible for the forward observer. Target acquisition is a growing demand, and like so many other facets of modern artillery, it is in the hands of skilled, trained, technical experts. Radar, drone systems, improved survey with new, more accurate instruments, meteorological messages, and automatic data processing are all forms of target acquisition which can be performed by specialist personnel only. The battery commander and his executive officer cannot be saddled with such complex devices and methods. But the battery commander and executive officer

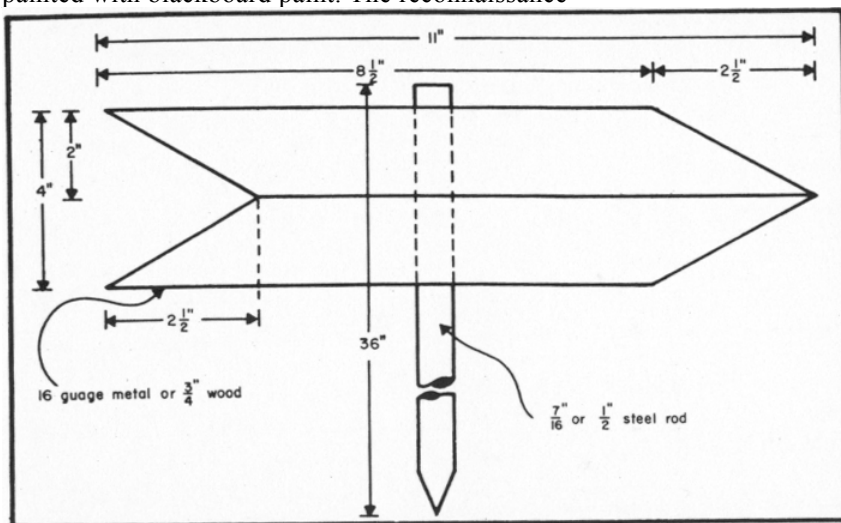
as well as the battalion S3 must depend on all these aspects if artillery is to reach the new heights of nonadjustment fire techniques necessary.

And although all this specialization is necessary, and justified, the teamwork must still be there. This is the job of the battalion S3, who must coordinate all the combined efforts and bring them together to accomplish the artillery's mission. With this vast amount of technical knowledge and wise coordination, the artillery will continue to give close and continuous fire support, by shooting farther, moving faster, and communicating over longer distances. We *must* specialize to survive.

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A GEM FOR THE BATTERY EXECUTIVE OFFICER

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. 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 an 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.

—Submitted by Capt Charles W. Hughes
2d How Bn, 178th Arty, National Guard
Lyman, South Carolina

RESIDENT COURSES - -

U S ARMY ARTILLERY & MISSILE SCHOOL



The rapid advancement in the development of new materiel and techniques requires a continuous revision of courses conducted at the US Army Artillery and Missile School, Fort Sill, Oklahoma. As a result, many units lack up-to-date information on courses offered.

This article consolidates the latest pertinent information concerning the 40 courses scheduled for FY 62 at the Artillery and Missile School. Complete details of the courses, including prerequisites, are listed in Department of the Army Pamphlet 20-21. *The Army School Catalog*, and changes 1 through 141.

COURSE CHANGES

The Artillery Officer Career Course has been reduced from 42 weeks to 38 weeks (FY 62). The projected input has increased from 495 officers (FY 61) to 800 (FY 62). Officers will report in increments of 200 each during the months of July, October, January, and March. They will receive 25 weeks of instruction at Fort Sill and 13 weeks at the Air Defense School, Fort Bliss, Texas. No significant changes have been made in the other officer career courses.

Prefix digit 5 is still awarded to those successfully completing that portion of the course in the Associate Field Artillery Officer Career Course and the Artillery Officer Career Course.

Other changes in course lengths include:

- (1) Artillery Target Acquisition Officer Course (formerly Artillery Officer Observation) from 9 weeks to 10 weeks.
- (2) LaCrosse Officer Course from 4 weeks, 3 days to 5 weeks.
- (3) Artillery Communication Officer Course from 12 weeks, 1 day to 13 weeks, 3 days.
- (4) Artillery Vehicle Maintenance Supervisors Course from 6 weeks, 4 days to 7 weeks, 2 days.

SCHEDULE OF CLASSES

US Continental Army Command publishes a schedule of classes taught at the USCONARC schools entitled "Detailed Schedule of Classes, Army Service Schools." This schedule of classes contains the course titles, class numbers, reporting dates, starting dates, close dates, and the class capacity. The detailed schedule of classes is distributed throughout the Army.

Career active duty artillery officers are selected to attend the officer career courses by the Artillery Section, Officers Assignment Division, DCSPERS, 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 School may apply through channels. Army Reserve officers not on active duty may make applications for attendance for any course (providing they meet all prerequisites) in accordance with the provisions of AR 140-220. Only active status members of the Army Reserve are eligible for selection. National Guard officers on active duty should make application (National Guard Bureau Form 64) for admission to the US Army Artillery and Missile School resident courses to the Chief, Army National Guard Bureau, ATTN: Schools Division, Washington 25, D.C. Warrant officers and enlisted personnel of the National Guard and the Army Reserve, not on active duty, will submit application for attendance at Army service schools in the same manner as commissioned officers of their respective components who are not on active duty.

DESIGNATION OF COURSES

Courses conducted at US Army service schools are designated by a series of numbers and letters. Field Artillery officer and enlisted courses taught at the US Army Artillery and Missile School are identified by the initial digit 6 (fig 19). The School courses which train personnel in a specific military occupational specialty (MOS) have the MOS number in the course designation. For example, graduates of course 6-A-0140, Field Artillery Radar Officer, will receive MOS 0140.

Enlisted men successfully completing course 6-R-156.1, Field Artillery Radar Operator, will receive MOS 156.1.

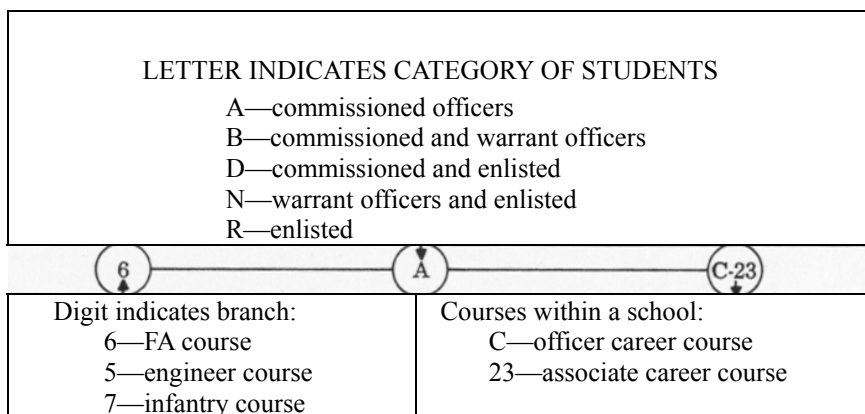


Figure 19. Explanation of the digits and letters comprising a typical course number. The example shown is the Associate Field Artillery Officer Career Course.

Listed below are all the officer and enlisted resident courses scheduled to be taught at the US Army Artillery and Missile School during FY 1962. All courses listed below which exceed 20 weeks are attended in a permanent change of station (PCS) status and those 20 weeks or below in length are attended in temporary duty (TDY) status. A brief summary of each course is given:

OFFICER CAREER COURSES

1. FA OFFICER ORIENTATION (FAOOC) (6-A-C20) (8 weeks). To provide basic branch training and orientation in field artillery for newly commissioned artillery officers. Class capacity: 102; FY 62 classes: 19.

2. ARTILLERY OFFICER BASIC (AOBC) (6-A-C1C/44-A-C1C) (20 weeks). To provide basic branch training and orientation for newly commissioned regular army artillery officers (United States Military Academy graduates and ROTC Distinguished Military Graduates only). Course conducted jointly by US Army Artillery and Missile School and US Army Air Defense School. Class capacity: 150; FY 62 classes: 3.

3. ARTILLERY OFFICER CAREER (AOCC) (6-A-C22) (38 weeks). To train Regular Army (RA) and career reserve officers (with 3 to 8 years commissioned service) in Field Artillery and Air Defense Artillery command and staff duties and responsibilities of artillery officers. Course conducted jointly by US Army Artillery and Missile School and US Army Air Defense School. Officers are selected for attendance at Department of Army (DA). Prefix digit 5 awarded upon successful completion of nuclear weapons employment phase of course. Class capacity: 200; FY 62 classes: 4.

4. ASSOCIATE FA OFFICER CAREER (AFAOCC) (6-A-C23) (18 weeks, 2 days). To provide branch training in the duties and responsibilities of active duty and reserve component artillery officers. Active duty officers are selected for attendance at DA. Reserve officers not on active duty may make application for the course. Prefix digit 5 awarded upon successful completion of nuclear weapons employment phase of course. Class capacity: 100; FY 62 classes: 4.

5. FA OFFICER FAMILIARIZATION (FAOFC) (6-A-C21) (6 weeks, 4 days). To provide familiarization with field artillery tactics and techniques for officers transferred from other branches to field artillery or assigned to field artillery duties without prior formal field artillery training. Class capacity: 75; FY 62 classes: 4.

6. FIELD ARTY FIELD GRADE OFFICER REFRESHER (RES COMP) (FAFGORC) (6-A-C11) (2 weeks). To provide refresher training in tactics, techniques and materiel appropriate to field artillery field grade reserve component officers not on active duty. Class capacity: 90; FY 62 classes: 2.

OFFICER FUNCTIONAL COURSES

7. DIVISION ARTILLERY STAFF OFFICER REFRESHER (DASORC) (6-A-F5) (1 week). To provide refresher training as a team (minimum

of 6 officers) to National Guard and USAR division artillery or artillery group commanders and principal staff officers. Class capacity: 60; FY 62 classes: 2.

8. SENIOR FIELD ARTILLERY OFFICER (SFAOC) (6-A-F6) (2 weeks, 3 days). To provide refresher training for senior artillery officers on field artillery tactics, techniques, organization, and equipment in current employment and to provide orientation on trends proposed for the future. Class capacity: 50; FY 62 classes: 3.

OFFICER MOS COURSES

9. FA RADAR OFFICER (FAROC) (6-A-0140) (7 weeks). To train captains and lieutenants of the active army and reserve components to supervise field artillery radar operation, maintenance, and employment, including target acquisition, fire direction, position fixing and vectoring of light army aircraft. Class capacity: 25; FY 62 classes: 2.

10. ARTILLERY TARGET ACQUISITION OFFICER (ATAOC) (6-A-1154) (10 weeks). To qualify active army and reserve component officers in sound and flash ranging techniques and target acquisition battalion survey, and to provide them with a general knowledge of field artillery radar operations, corps and division functions and ballistic met data and airborne target location system techniques. Class capacity: 35; FY 62 classes: 2.

11. ARTILLERY SURVEY OFFICER (ASOC) (6-A-1183) (8 weeks). To train active army and reserve component captains and lieutenants in artillery survey. Class capacity: 39; FY 62 classes: 3.

12. CORPORAL OFFICER (COC) (6-A-1190A) (9 weeks, 3 days). To train active army officers in the characteristics, operating principles, capabilities, and limitations of the Corporal missile system. Class capacity: 15; FY 62 classes: 4.

13. REDSTONE OFFICER (ROC) (6-A-1190B) (7 weeks). To train active army officers in the characteristics, operating principles, capabilities and limitations of the Redstone missile system. Class capacity: 20; FY 62 classes: 1.

14. LaCROSSE OFFICER (LOC) (6-A-1187) (5 weeks). To qualify active army officers in the characteristics, operating principles, fire direction procedures, tactical employment, and capabilities of the LaCrosse missile system. Class capacity: 20; FY 62 classes: 3.

15. CORPORAL MAINTENANCE OFFICER (CMOC) (6-A-1191) (33 weeks). To train active army captains and lieutenants in the functions, technical operations, characteristics, and maintenance of the Corporal missile system. Class capacity: 18; FY 62 classes: 0.

16. ARTILLERY COMMUNICATION OFFICER (ACOC) (6-B-0200) (13 weeks, 3 days). To train active army and reserve component officers in the grade of major or below in the supervision and coordination of installation, operation and maintenance of artillery communication systems. Class capacity: 40; FY 62 classes: 3.

17. ARTILLERY MOTOR TRANSPORT (AMTC) (6-B-0600/0606) (8 weeks, 2 days). To train active army and reserve component company grade officers in the supervision of organizational maintenance and recovery of artillery vehicles. Class capacity: 55; FY 62 classes: 2.

OFFICER/ENLISTED COURSES

18. FA OFFICER CANDIDATE (6-N-F1) (FAOCC) (23 weeks). To train selected warrant officers and enlisted men to be reserve second lieutenants. Class capacity: 100; FY 62 classes: 6.

19. FA OFFICER CANDIDATE (RES COMP) (6-N-F2) (FAOCC) (RC) (11 weeks). To train National Guard and USAR personnel to be second lieutenants. ARNG personnel are selected by the State Adjutant General for attendance. USAR personnel must meet requirements of AR 140-50. Class capacity: 100; FY 62 classes: 2.

20. NUCLEAR PROJECTILE ASSEMBLY (NPAC) (6-D-142.0) (1 week). To train active army officers and enlisted men in the mechanical assembly, disassembly, and prefiring preparation of nuclear projectiles. EM receive MOS 142.0. Class capacity: 30; FY 62 classes: 4.

21. ROCKET NUCLEAR WARHEAD ASSEMBLY (RNWAC) (6-D-147.2) (1 week, 1 day). To train active army officers and enlisted men in prefiring procedures, storage, and logistical consideration of nuclear warheads for the 762-mm and 318-mm rockets. Enlisted men receive MOS 147.2. Class capacity: 20; FY 62 classes: 13.

22. ARTILLERY BALLISTIC METEOROLOGY (ABMC) (6-N-103.1) (11 weeks). To qualify warrant officers and enlisted personnel in the installation and operation of an artillery meteorological station. Enlisted men receive MOS of 103.1. Class capacity: 32; FY 62 classes: 6.

23. FA RADAR MAINTENANCE (FARMC) (6-N-1121/211.2) (32 weeks). To thoroughly ground warrant officers and enlisted men in the operation, adjustment, and organizational maintenance of field artillery radar equipment. Warrant officers receive MOS 1121. Enlisted men receive MOS 211.2. Class capacity: 25; FY 62 classes: 3.

24. WEATHER EQUIPMENT MAINTENANCE (WEMC) (6-N-8219/205.1) (13 weeks, 4 days). To thoroughly ground warrant officers and enlisted personnel in the organizational maintenance of electrical and electronic meteorological equipment used in artillery ballistic sections. Warrant officers receive MOS of 8219. Enlisted men receive MOS of 205.1. Class capacity: 15; FY 62 classes: 6.

25. CORPORAL FIRE CONTROL SYSTEM MAINTENANCE (CFCSMC) (6-N-1186/215.1) (31 weeks, 3 days). To thoroughly ground warrant officers and enlisted personnel to adjust, maintain, and operate the fire control systems for the Corporal missile. Warrant officers receive MOS 1186; enlisted personnel receive MOS 215.1. Class capacity: 15; FY 62 classes: 2.

26. CORPORAL ELECTRONIC MATERIEL MAINTENANCE (CEMMC) (6-N-1192A/214.1) (29 weeks). To thoroughly ground warrant officers and enlisted men to assemble, install, calibrate, adjust, and maintain on-missile

electronic guidance control components, systems, and associated electronic test equipment for the Corporal II missile. Warrant officers receive MOS 1192; Enlisted men receive MOS 214.1. Class capacity: 18; FY 62 classes: 0.

27. LACROSSE FIRE CONTROL SYSTEM MAINTENANCE (LFCSMC) (6-N-217.1) (24 weeks). To thoroughly ground warrant officers and enlisted personnel of the active army in organizational maintenance, operations, and procedures of LaCrosse fire control and associated equipment. Enlisted men receive MOS of 217.1. Class capacity: 12; FY 62 classes: 1.

28. REDSTONE ELECTRONIC MATERIEL MAINTENANCE (REMMC) (6-N-1192B/218.1) (20 weeks). To thoroughly ground selected warrant officers and enlisted personnel of the active army to assemble, install, calibrate, adjust, and maintain on-missile electronic guidance control components, systems, and associated electronic test equipment for the Redstone missile. Warrant officers receive MOS of 1192. Enlisted personnel receive MOS of 218.1. Class capacity: 12; FY 62 classes: 2.

OFFICER/ENLISTED FUNCTIONAL COURSES

29. CORPORAL NUCLEAR WARHEAD ASSEMBLY (CNWAC) (6-D-F13) (1 week, 3 days). To qualify active army officers and enlisted men in the prefiring procedures involving assembly, nuclear, and mechanical tests of the Corporal nuclear warhead. Class capacity: 15; FY 62 classes: 4.

30. CORPORAL HANDLING EQUIPMENT MAINTENANCE (CHEMC) (6-H-F8) (4 weeks). To train selected officers, warrant officers, non-commissioned officers, and enlisted personnel presently assigned to a Corporal unit in the operation and maintenance of Corporal handling equipment. Class capacity: 15; FY 62 classes: 1.

ENLISTED MOS COURSES

31. ARTILLERY SURVEY ADVANCED (ASAC) (6-R-153.1) (8 weeks). To qualify enlisted personnel to supervise, coordinate, and participate in operations of an artillery survey party, battery detail, or survey information center, and to assist in establishment of observation. Receives MOS of 153.1. Class capacity: 68; FY 62 classes: 9.

32. ARTILLERY SOUND RANGING ADVANCED (ASRAC) (6-R-155.2) (8 weeks). To qualify enlisted personnel in the installation, operation, and organizational maintenance of a field artillery sound ranging unit. MOS for which trained: 155.2. Class capacity: 30; FY 62 classes: 2.

33. ARTILLERY FLASH RANGING ADVANCED (AFRAC) (6-R-154.1) (6 weeks). To qualify enlisted personnel in the installation, operation, and organizational maintenance of a field artillery flash ranging unit. Receives MOS of 154.1. Class capacity: 30; FY 62 classes: 2.

34. FIELD ARTILLERY RADAR OPERATION (FAROC) (6-R-156.1) (10 weeks). To qualify enlisted personnel in the operation, tactical employment, and utilization of field artillery radar. Receives MOS of 156.1. Class capacity: 35; FY 62 classes: 9.

35. CORPORAL MECHANICAL MATERIEL MAINTENANCE (CMMMC) (6-R-164.3) (8 weeks). To train E-6's and below to assemble, install, maintain, and adjust Corporal mechanical on-missile guidance control systems and associated test equipment, and to assemble missiles and perform required checks on Corporal propulsion and mechanical systems. Receives MOS of 164.3. Class capacity: 16; FY 62 classes: 3.

36. ARTILLERY RADIO MAINTENANCE (ARMC) (6-R-313.1) (14 weeks). To qualify E-5's and below in the installation, operation and performance of organizational maintenance on communication equipment used in artillery communication systems or units employing similar equipment. Receives MOS of 313.1. Class capacity: 40; FY 62 classes: 23.

37. REDSTONE MECHANICAL MATERIEL MAINTENANCE (RMMMC) (6-R-169.1) (7 weeks, 3 days). To qualify E-6's and below in the installation and maintenance of Redstone on-missile guidance and control systems; in the assembly of missiles; and in the performance of mechanical and pneumatic checks. Receives MOS of 169.1. Class capacity: 20; FY 62 classes: 0.

38. ARTILLERY COMMUNICATION SUPERVISORS (ACSC) (6-R-313.6) (15 weeks). To qualify enlisted personnel of Grade E-4 or above in the supervision, coordination and participation in the operation of a communication section of an artillery unit. Receives MOS of 313.6. Class capacity: 40; FY 62 classes: 3.

39. ARTILLERY VEHICLE MAINTENANCE SUPERVISORS (AVMS) (6-R-631.7/632.7) (7 weeks, 2 days). To qualify E-5's or above in the supervision of turret maintenance, organizational maintenance, and recovery of vehicles used in the artillery. Receives MOS of 631.7 or 632.7. Class capacity: 45; FY 62 classes: 2.

40. ARTILLERY TRACK VEHICLE MAINTENANCE (ATVMC) (6-R-632.1) (11 weeks, 3 days). To thoroughly ground enlisted personnel to perform organizational maintenance on artillery track vehicles, self-propelled mounts, associated accessories and equipment, to include turret maintenance. Receives MOS of 632.1. Class capacity: 40; FY 62 classes: 20.

CURRENT RESIDENT SCHEDULE

Effective with the March 1961 issue, ARTILLERY TRENDS began publishing a schedule of US Continental Army Command approved classes to be conducted at the US Army Artillery and Missile School, Fort Sill, Oklahoma. The schedule included officer and enlisted resident courses to be taught through 30 June 1961.

Listed below are the resident courses to be conducted through 30 September 1961:

Course	CI Nr	Report			Start			Close			Input	
Arty Officer Basic (6-A-C1C/44-A-C1C)	1-62	13	Aug	61	16	Aug	61	16	Jan	62	145	
Field Artillery Officer Orientation (6-A-C20)	1-62	24	Jul	61	28	Jul	61	20	Sep	61	90	
	2-62	7	Aug	61	11	Aug	61	4	Oct	61	90	
	3-62	21	Aug	61	25	Aug	61	18	Oct	61	90	
	4-62	3	Sep	61	8	Sep	61	1	Nov	61	90	
	5-62	18	Sep	61	22	Sep	61	15	Nov	61	90	
Field Artillery Officer Familiarization (6-A-C21)	1-62	10	Jul	61	11	Jul	61	25	Aug	61	66	
	2-62	11	Sep	61	12	Sep	61	27	Oct	61	66	
Arty Officer Career Course (6-A-C22)	1-62	9	Jul	61	12	Jul	61	18	Apr	62	200	
Associate Field Arty Officer Career (6-A-C23)	1-62	3	Jul	61	6	Jul	61	10	Nov	61	103	
Field Arty Field Grade Officer Refresher (Res Comp) (6-A-C11)	1-62	30	Jul	61	31	Jul	61	11	Aug	61	46	
Senior Field Artillery Officer (6-A-F6)	1-62	16	Jul	61	17	Jul	61	2	Aug	61	20	
	2-62	6	Aug	61	7	Aug	61	23	Aug	61	20	
Field Artillery Radar Officer (6-A-0140)	1-62	31	Jul	61	2	Aug	61	21	Sep	61	15	
Arty Target Acquisition Officer (6-A-1154)	1-62	6	Jul	61	10	Jul	61	15	Sep	61	17	
Arty Survey Officer (6-A-1183)	1-62	23	Aug	61	29	Aug	61	19	Oct	61	38	
Corporal Officer (6-A-1190A)	1-62	10	Jul	61	13	Jul	61	14	Sep	61	13	
	2-62	11	Sep	61	14	Sep	61	15	Nov	61	13	
Redstone Officer (6-A-1190B)	1-62	26	Jul	61	28	Jul	61	13	Sep	61	15	
LaCrosse Officer (6-A-1187)	1-62	30	Jul	61	31	Jul	61	2	Sep	61	20	
Artillery Communication Officer (6-B-0200)	1-62	13	Sep	61	14	Sep	61	19	Dec	61	36	
Field Artillery Officer Candidate (6-N-F1)	1-62	14	Aug	61	21	Aug	61	6	Feb	62	53	
Nuclear Projectile Assembly (6-D-142.0)	1-62	6	Aug	61	7	Aug	61	12	Aug	61	25	
Rocket Nuclear Warhead Assembly (6-D-147.2)	1-62	9	Jul	61	10	Jul	61	17	Jul	61	20	
	2-62	30	Jul	61	31	Jul	61	7	Aug	61	20	
	3-62	13	Aug	61	14	Aug	61	21	Aug	61	19	
	4-62	10	Sep	61	11	Sep	61	18	Sep	61	19	
	5-62	24	Sep	61	25	Sep	61	2	Oct	61	19	
Artillery Ballistic Meteorology (6-N-103.1)	1-62	7	Jul	61	12	Jul	61	22	Sep	61	25	
	2-62	25	Aug	61	30	Aug	61	10	Nov	61	25	
	3-62	29	Sep	61	4	Oct	61	15	Dec	61	25	
Weather Equipment Maint (6-N-8219/205.1)	1-62	9	Jul	61	11	Jul	61	12	Oct	61	8	
	2-62	20	Aug	61	22	Aug	61	22	Nov	61	8	
Field Artillery Radar Maintenance (6-N-1121/211.2)	1-62	18	Aug	61	21	Aug	61	18	Apr	62	25	
Redstone Electronic Materiel Maintenance (6-N-1192B/218.1)	1-62	13	Jul	61	17	Jul	61	4	Dec	61	11	
Cpl Nuclear Warhead Assembly (6-D-F13)	1-62	24	Jul	61	25	Jul	61	3	Aug	61	12	
Artillery Survey Advanced (6-R-153.1)	1-62	20	Jul	61	25	Jul	61	15	Sep	61	61	
	2-62	3	Aug	61	8	Aug	61	29	Sep	61	61	
Arty Sound Ranging (Advanced) (6-R-155.2)	1-62	29	Aug	61	31	Aug	61	25	Oct	61	19	
Field Arty Radar Operation (6-R-156.1)	1-62	25	Jul	61	27	Jul	61	4	Oct	61	33	
	2-62	29	Aug	61	31	Aug	61	8	Nov	61	33	

Cpl Mechanical Materiel Maintenance (6-R-164.3)	1-62	5	Jul	61	6	Jul	61	30	Aug	61	15
Artillery Radio Maintenance (6-R-313.1)	1-62	9	Jul	61	11	Jul	61	16	Oct	61	40
	2-62	23	Jul	61	25	Jul	61	30	Oct	61	40
	3-62	6	Aug	61	8	Aug	61	13	Nov	61	40
	4-62	20	Aug	61	22	Aug	61	28	Nov	61	40
	5-62	10	Sep	61	12	Sep	61	18	Dec	61	40
	6-62	24	Sep	61	26	Sep	61	15	Jan	62	40
Artillery Track Vehicle Maintenance (6-R-632.1)	1-62	9	Jul	61	11	Jul	61	21	Sep	61	35
	2-62	23	Jul	61	25	Jul	61	5	Oct	61	35
	3-62	6	Aug	61	8	Aug	61	19	Oct	61	35
	4-62	20	Aug	61	22	Aug	61	2	Nov	61	35
	5-62	3	Sep	61	5	Sep	61	16	Nov	61	35
	6-62	17	Sep	61	19	Sep	61	30	Nov	61	35
Corporal Handling Equipment Maintenance (6-H-F8)	1-62	23	Jul	61	24	Jul	61	12	Aug	61	3
	2-62	13	Aug	61	14	Aug	61	2	Sep	61	3
	3-62	4	Sep	61	5	Sep	61	25	Sep	61	3

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SATELLITE DETECTOR SCREEN PLANNED

The Army Ordnance Ballistics Research Laboratories at Aberdeen Proving Grounds, Maryland, are reported to have the high spot in considerations for a satellite-detection screen in the United States. The screen is especially qualified for detection of "dark" or nontransmitting satellites with the DOPLOC system.

The present single test facility with a radar transmitter at Fort Sill, Oklahoma, and "detector" at Forrest City, Arkansas, first located and identified the "mystery satellite" that proved to be part of Discoverer V. The key to the system is the complex of high-speed computers at BRL to analyze the data transmitted from Forrest City.

TANK NIGHT VISION IN DEVELOPMENT

Searchlights, periscopes, and binoculars which will enable tank operators to observe the enemy at night by using either visible or infrared light are under development at the Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia.

The items will form a tank kit consisting of an infrared-visible xenon searchlight, a gunner's infrared-visible periscope, a commander's infrared periscope, and hand-held infrared binoculars. The searchlight is mounted so that it operates in unison with the tank gun. Its beam can be varied in width and intensity in either light mode. The xenon searchlight emits infrared radiation which reflects off objects under observation. The periscope and binoculars detect the reflected rays.

The gunner's periscope has both wide-angle and high-magnification channels using ordinary light and a high-magnification channel using infrared light. The commander's infrared periscope provides him with a closed-hatch infrared viewing capability. The hand-held infrared binoculars permit open-hatch infrared viewing by the tank commander.

NEWS NOTES FOR ARTILLERYMAN

EQUIPMENT MAINTENANCE

The Continental Army Command is considering measures for improving the maintenance and storage of Army Reserve equipment.

Civil Service technicians who are employed full time in maintenance and storage activities would be active reserve members of the employing unit and have military assignments compatible with their full-time duties. Shop facilities would be equipped, as far as possible, with tools, vehicles, and other necessary items that are part of the unit organic equipment.

The assignment of maintenance technicians to reserve units would improve organizational maintenance training. However, actual first-echelon maintenance would be carried out solely by unit personnel during drill periods.

In field maintenance support, the most economical use would be made of existing and prospective facilities and capabilities of the Army. The use of National Guard, Army and Air Force facilities would be considered. Where new facilities are required, consideration would be given to locations outside metropolitan areas where equipment can be operated. Such locations would also be desirable to minimize the effect of nuclear attack.

SCHOOLS WILL MEET AT SILL, DISCUSS EXTENSION PROGRAM

Fort Sill will host an Army-wide conference on Army Extension Course Programs from 12-14 July 1961 sponsored by Headquarters, US Continental Army Command. It is anticipated that approximately 70 representatives will attend. Each of the 23 Army service schools administering extension courses will send two representatives. Other participants will include officers from Headquarters, Department of the Army and Headquarters, US Continental Army Command.

The purpose of the conference, the first to be held since 1946, is two-fold; to standardize extension courses, where practicable; and to develop new procedures required to guide the Army extension course program, bring it up-to-date and keep it current.

NEW SHELL PROCESS

The US Army Ordnance Special Weapons-Ammunition Command, with headquarters at Picatinny Arsenal, Dover, N.J. has been instrumental in the development of a new process which sharply reduces the cost of producing an 8-inch artillery shell.

The new process, developed jointly by the Army Ordnance Corps and the US Hoffman Machinery Corporation, employs unfinished steel costing \$19 a ton less than the premium steel formerly used. Potential peacetime savings is one million dollars a year.

New precision manufacturing techniques have reduced metal scrap and cut the amount of steel needed to forge shells. Reduction in the steel tonnage requirements would be of great importance to commercial steel users in the event of a war.

NEW TANK CARTRIDGE CASE

A revolutionary development has been made in Army ammunitions which provides for complete combustion of the cartridge case when fired. The casing is designed primarily for use in tank guns, but testing is now underway for use in artillery weapons. The ultimate aim is to substitute the new casing for the present brass shell case in all Army guns.

The new casing not only minimizes gases released from fired ammunition but leaves no residue in the gun tube after firing, thereby eliminating a cause of premature detonation of the succeeding round.

Up to ten times lighter than a conventional brass case (depending on ammunition caliber), the combustible case will lead to improved storage, shipping, and handling, and less gun-crew fatigue. It is less susceptible to such handling damage as dents and scratches, and like conventional cases, will not explode if hit by bullets or shell fragments.

The new shell case has proved its effectiveness in a recent series of tests which culminated five years of extensive research and engineering.

SEISMIC STATION COMPLETED

A new seismic research station designed to study the problem of detecting and identifying earthquakes and underground chemical and nuclear explosions has been completed at Fort Sill, Oklahoma. The station, to be called the Wichita Mountains Seismological Observatory, is part of the U.S. seismic improvement program known as Project Vela-Uniform.

This station fulfills the original conditions of the Conference of Experts, consisting of representatives of the United States, United Kingdom, France, Canada, U. S. S. R., Romania, Czechoslovakia, and Poland who met at Geneva, Switzerland, in 1958 to "study the possibility of detecting violation of a possible agreement in the suspension of nuclear tests."

The program is under the overall direction of the Department of Defense's Advanced Research Projects Agency.

COMBAT GAS MASKS

The new M17 combat gas mask marks the first major change in mask evolution since 1947. Developed by the Army Chemical Corps, it is designed to give respiratory and germ-warfare protection against war gases, and protection against germ-warfare agents, and airborne radioactive fallout particles.

A major feature of the mask is that it does not have the protruding canister common to the masks of all armies of the world. The canister has been eliminated through the use of a newly developed lightweight filter material. Pads of this material are enclosed within cavities molded into the rubber facepiece of the mask.

SOVIET CHEMICAL WARFARE

A recent estimate of Soviet chemical warfare training and doctrine states that the USSR has a policy of providing every suitable ground weapon with a chemical capability.

The estimate, published by the *Armed Forces Chemical Journal*, credits the USSR with having more mustard gas than any other chemical agent at this time. It is known, however, that near the end of World War II the Soviets captured German factories and personnel capable of producing a G-agent (nerve gas). Since that time they have been producing an agent called "tabun" which is probably the original German product. Little information is available on the Soviet development of persistent nerve gases but they are known to have produced a closely related insecticide. The USSR has also emphasized the production of toxic smokes, vaporizing toxic agents, and tear gas.

The Soviet protective gas mask, the *Shlem Maska-1*, is a helmet mask which affords virtually complete coverage of the head with a soft rubber hood. This mask is considered to be highly effective.

Soviet troop units undergo gas chamber exercises at least once a year and are required to participate in conditioning exercises during which gas masks are worn for extended periods.

GOER—ala NIKE-HERCULES

The Douglas Aircraft Corporation, in conjunction with the Western Electric Company and the Bell Telephone Laboratory, is testing a new "weapon" which is a truly new concept in firepower and mobility. The weapon is a combination of the GOER vehicle acting as transporter-launcher for the NIKE-HERCULES missile.

The objective has been to incorporate the best features of both components into one hard-hitting, fast-reacting system. The artillery has become more interested in the NIKE-HERCULES with the realization of surface-to-surface and anti-tactical missile missions, in addition to the proven surface-to-air role. Mounting the HERCULES on the GOER permits cross-country travel, rapid emplacement and march order, minimum manpower requirements, and reduced convoy size.

The system has had successful firing tests at White Sands, New Mexico, including demonstration firings for military personnel. Further testing is planned.



"The artillery must be prepared to concentrate a great volume of fire wherever it is needed, at any moment, so as to dominate rapidly any part of the battlefield which may be threatened."

General Charles deGaulle
"The Army of the Future" 1941

STATUS OF TRAINING LITERATURE

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

- A. FIELD MANUALS (FM):
 - 6-10 Field Artillery Communications
 - 6-15 Artillery Meteorology
 - 6-20 FA Tactics and Techniques
 - 6-58 Changes 1, FA Rocket, Honest John, with Launcher XM33
 - 6-59 Changes 1, FA Rocket, Honest John, with Launcher M386
 - 6-60 Changes 1, FA Rocket, Honest John, with Launcher M289
 - 6-61 Changes 2, FA Missile Battalion, Honest John Rocket
 - 6-120 FA Target Acquisition Battalion and Batteries
 - 6-121 Field Artillery Target Acquisition
 - 6-() Field Artillery Graphical Firing Equipment
 - 6-() US Army Missile Command
 - 6-() Radar Set, AN/TPS-25
 - 6-() 115-mm Multiple Rocket Launcher M91, and Toxic Rocket M55
- B. TECHNICAL MANUALS (TM):
 - None
- C. ARMY TRAINING PROGRAMS (ATP):
 - 6-100 Field Artillery Unit
 - 6-302 FA Rocket Units (Honest John, Little John)
 - 6-545 Field Artillery Missile Battalion, Corporal
 - 6-555 FA Missile Battalion, Sergeant
 - 6-575 FA Target Acquisition Battalion
 - 6-630 FA Missile Battalion, Redstone

2. Training literature submitted to USCONARC:

- ATP () Training Program for non-unit obligors
- ATT 6-() Field Artillery Missile Battalion (Battery), Little John Rocket
- FM 6-56 FA Missile Battalion (Battery), Little John Rocket
- FM 6-() Radar Set, AN/MPQ-4
- FM 21-13 The Soldiers Guide

3. Training literature at the Government Printing Office:

- FM 6-2 Artillery Survey
- FM 6-16 Tables for Artillery Meteorology
- FM 6-45A FA Missile Battalion, Lacrosse, Gunnery
- FM 6-57 The FA Rocket, Little John, w/Launcher XM34
- FM 6-81 155-mm Howitzer, M1, Towed
- FM 6-90 8-inch Howitzer, M2, Towed
- TM 6-300-62 Army Ephemeris for 1962
- TM 6-() Logarithmic and Mathematical Tables

4. Training literature recently printed:

FM 6-44A FA Missile, Lacrosse
FM 6-75 105-mm Howitzer, M2 Series, Towed
ATT 6-10 Changes 1, FA Missile Battalion, Corporal

5. Artillery training films currently under production and scheduled for release during calendar year 1961:

Laying the Field Artillery Battery
318-mm Rocket
 Part I. Introduction to the system
 Part II. Description of equipment
 Part III. Loading, preparation for action, firing, and march order
Field Artillery, RSOP
 Part I. Deliberate
 Part II. Rapid
Ground Surveillance Radar, AN/TPS-25
 Part I. Theory, installation and operation
 Part II. Moving target detection
The 762-mm Rocket
 Part I. Introduction to the system
 Part II. Mechanical assembly and electrical checkout
 Part III. Loading, preparation for action, firing, and march order
Countermortar Radar AN/MPQ-4A
 Part II. Preparation and performance checks

6. Artillery training films currently under production and scheduled for release during calendar year 1962:

None

7. Artillery training films production completed and scheduled for release in calendar year 1961:

Countermortar Radar, AN/MPQ-4A
 Part I. Operation (TF 6-3096) (25 minutes)
Lacrosse Battalion Assembly Section—Crew duties in prepare for action, checkout and assembly, and march order (25 minutes)
Lacrosse Battalion—Firing Section—Crew duties in prepare for action, firing, and march order.
Lacrosse Battalion—RSOP
Extension of Direction for Artillery by Simultaneous Astronomic Observation (25 minutes)

8. Artillery training films scheduled for production and release during calendar year 1962:

Field Artillery Sound Ranging
Field Artillery Target Acquisition Battalion

9. Artillery training films recently released:

Lacrosse Battalion Guidance Section

Part I. Duties in prepare for action and march order (TF 6-3097) (25 minutes)

10. Status of Army Subject Schedules (MOS):

A. UNDER PREPARATION OR REVISION BY THE US ARMY ARTILLERY AND MISSILE SCHOOL:

- ASubjScd 6-103 MOS Technical Training of the Ballistic Meteorology Crewman
- ASubjScd 6-104 MOS Technical Training of the Field Illumination Crewman
- ASubjScd 6-154 MOS Technical Training of the FA Flash Ranging Crewman
- ASubjScd 6-155 MOS Technical Training of the Sound Ranging Crewman
- ASubjScd 6-156 MOS Technical Training of the Radar Crewman
- ASubjScd 6-166 MOS Technical Training of the FA Missile Crewman (Lacrosse)
- ASubjScd 6-167 MOS Technical Training of the FA Missile Fire Control Crewman (Lacrosse)
- ASubjScd 6-168 MOS Technical Training of the FA Missile Crewman (Redstone)

B. SUBMITTED TO USCONARC:

- ASubjScd 6-147 MOS Technical Training of the FA Rocket Crewman
- ASubjScd 6-152 MOS Technical Training of the FA Operations and Intelligence Assistant
- ASubjScd 6-153 MOS Technical Training of the Artillery Surveyor
- ASubjScd 6-164 MOS Technical Training of the FA Missile Crewman (Corporal)
- ASubjScd 6-165 MOS Technical Training of the FA Missile Fire Control Crewman (Corporal)

C. AT GOVERNMENT PRINTING OFFICE:

- ASubjScd 6-142 MOS Technical Training of the Heavy and Very Heavy FA Crewman

11. Status of Army Subject Schedules (Non-MOS):

A. UNDER PREPARATION OR REVISION BY THE US ARMY ARTILLERY AND MISSILE SCHOOL:

- ASubjScd 6-2 FA Air Observer Training
- ASubjScd 6-3 Cannoneer and Rocketeer Instruction
- ASubjScd 6-8 Counterbattery Operations
- ASubjScd 6-9 Countermortar Operations
- ASubjScd 6-10 Field Artillery Radar Operations
- ASubjScd 6-11 Defense of Artillery Position Areas
- ASubjScd 6-17 Liaison
- ASubjScd 6-21 Operation of Meteorological Section

- B. AT GOVERNMENT PRINTING OFFICE:
 - ASubjScd 6-6 Communication Exercise for Artillery Units
- C. RECENTLY PUBLISHED:
 - ASubjScd 6-4 Combat Intelligence
 - ASubjScd 6-12 Field Exercises
 - ASubjScd 6-16 FA Instruction and Duties of Instrument Operator
 - ASubjScd 6-24 Organization and duties of Operations section, FA Observation Battalion
 - ASubjScd 6-29 Artillery Survey
 - ASubjScd 6-41 Organization, Mission and Employment of Armored and Infantry Units

ARTILLERY INFORMATION LETTERS

The following artillery information letters containing items of technical nature have been published by the US Army Artillery and Missile School since the MARCH 1961 issue of ARTILLERY TRENDS. Distribution is made *only* to the units and their controlling headquarters which are authorized the equipment discussed in these letters:

- CORPORAL INFORMATION LETTER NUMBER 24 dated 28 March 1961
- HONEST JOHN INFORMATION LETTER NUMBER 24 dated 28 February 1961
- HONEST JOHN INFORMATION LETTER NUMBER 25 dated 19 April 1961 (SRD)
- METRO INFORMATION LETTER NUMBER 7 dated 6 April 1961
- REDSTONE INFORMATION LETTER NUMBER 3 dated 20 April 1961



Available from the Book Department, US Army Artillery and Missile School, is a new fire planning template. This handy tool includes barrage and concentration symbols for both 1:25,000 and 1:50,000 scales; artillery map symbols, coordinate scales and information on capabilities of artillery weapons. The template is selling for \$.45 and can be ordered by sending check, postal or money order to Book Department, US Army Artillery and Missile School, Fort Sill, Oklahoma.

"The artillery . . . is constant. It can fire day and night, in any kind of weather, and is limited in the protection that it affords the infantryman only by the supply of ammunition."

"Battlefield Information"
The Field Artillery Journal, 1944