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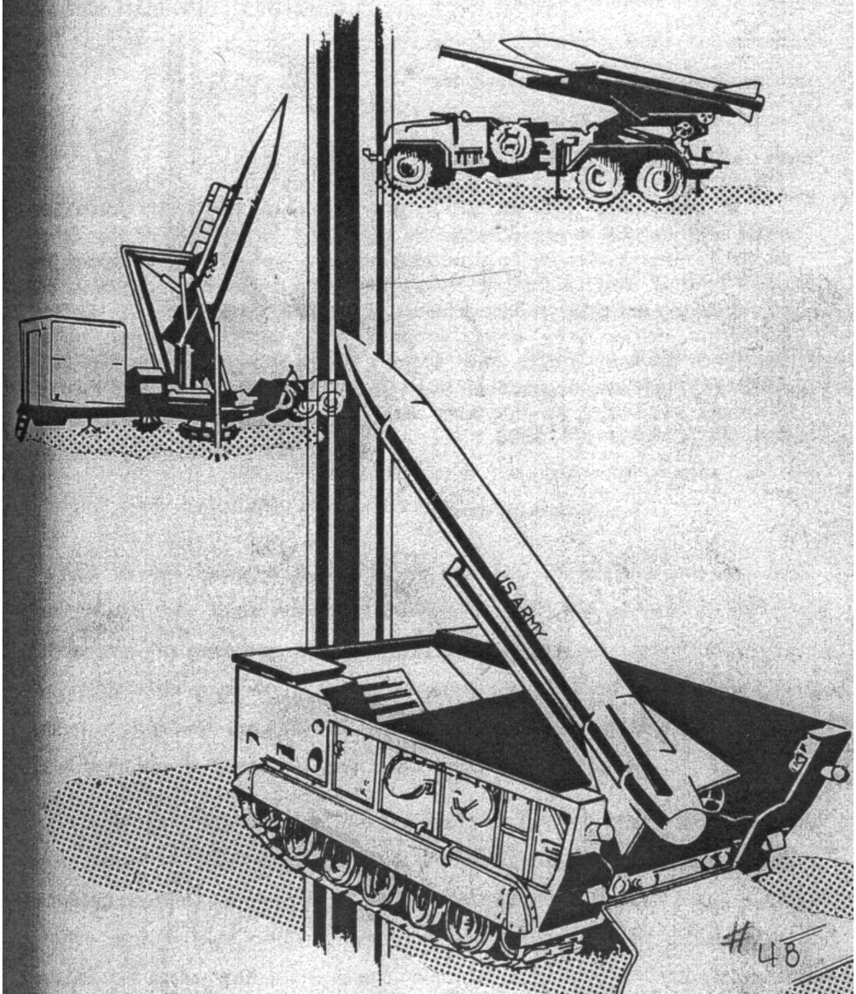
The FIELD ARTILLERYMAN



U. S. ARMY FIELD ARTILLERY SCHOOL

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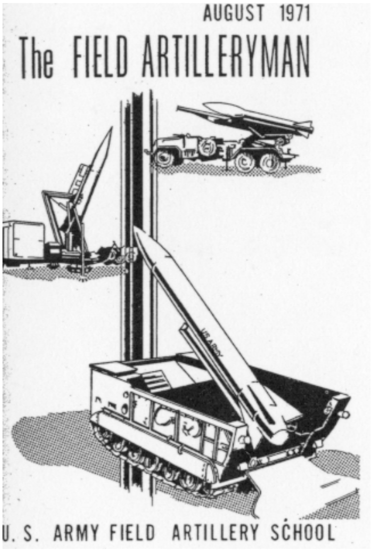


Today's force commander needs a highly responsive, rugged, and reliable general support missile capable of delivering both nuclear and nonnuclear warhead sections against a wide range of critical targets. Lance is this missile. **The Field Artilleryman** presents as its feature article (page 4) a description of the Lance missile system including its historical development and a listing of the system's capabilities. The Lance, when it is fielded, will replace both the Honest John rocket and the Sergeant missile in the Army inventory.

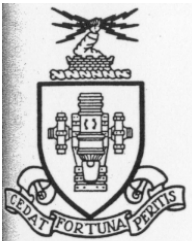
Also in this issue (page 12) is an analysis of a phenomenon more talked about than understood but nevertheless of vital concern to all field artillerymen—the weather. If you have ever wondered about highs and lows, cold fronts and warm fronts, or what causes good weather and bad weather, this article provides an explanation of the most important theories available today in predicting and understanding the weather.

One of the most exciting developments in field artillery technology in recent history is TACFIRE (page 24). TACFIRE is a tactical, automatic data processing system with computer centers located at cannon field artillery battalion and division artillery levels. It will assist the field artilleryman in mony of his tasks with more speed, with more accuracy, and with greater effect and economy than is possible with currently used methods.

Other articles featured in this issue include a description ("The First FO," page 39) of a signal-flag network which enabled Union guns to deliver indirect fire on a Confederate battery during the Civil War; a history of the remarkable role artillery played in the Indian Wars ("Artillery Helped Win the West," page 59); and a useful compilation of advice or "tips" for the novice, or experienced, air observer ("Air Observer Tips," page 64).

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

ARTICLES



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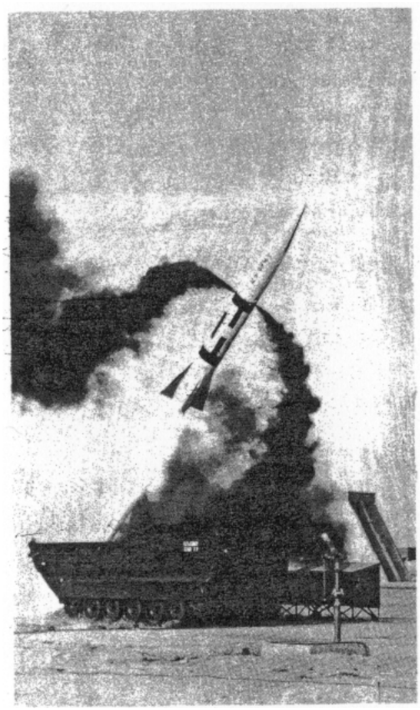


LANCE

by
MAJ Lee O. Ringham

With the development of Lance, a giant step has been taken toward achieving one of the field artillery's ultimate objectives—a missile system which is as simple, as rugged, as mobile, and as reliable as conventional cannon artillery. The Lance system incorporates many new technological developments such as prepackaged bipropellant liquids and a new simplified inertial guidance concept. The latest materials and manufacturing techniques have been utilized to produce a weapon system which, while less expensive than prior systems, combines the simplicity of a free rocket with the long-range accuracy of a guided missile.

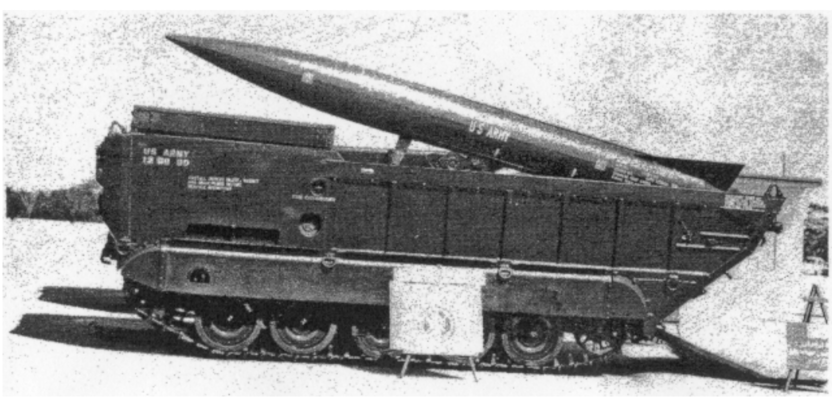
Development of Lance began in 1959 when the Army furnished defense contractors with requirements information for a family of surface-to-surface missiles. In 1962, Ling-Temco-Vought (LTV) was selected as the prime contractor for the system, which was officially named "Lance." This designation, derived from the cultural traditions of the North American Indians, is symbolized by a shield with a missile in the center of a lance head. The symbolically painted shield afforded the Indians both spiritual and physical protection in battle.

The Lance missile system will replace both the Honest John rocket and the Sergeant missile systems and will be assigned to the mission of force general support. The Lance missile system features a high degree of responsiveness to the ground gaining arms because it has—

- No requirement for meteorological data or associated data-measurement equipment;
- An improved mobility through the use of lightweight, tracked prime movers;
- A quick reaction time;
- Reduced requirements for supporting (ancillary) equipment, such as missile heating blankets and power generators;
- The capability to deliver both nuclear and nonnuclear warheads to ranges greater than that of the Honest John rocket system.

Lance Guided Missile, XMGM-52C

The Lance missile is 6.15 meters long and 0.56 meters in diameter; it weighs 1,488 kilograms with a 454-kilogram nonnuclear warhead section and 1,236 kilograms with a 211-kilogram nuclear warhead section. The missile consists of two sections, the warhead section and the main assemblage. The main assemblage contains the guidance and control package (which weighs only a little more than 15 kilograms), fuel and oxidizer tanks, and the racket engine. A set of four, fixed, canted fins is mounted to the aft end of the main assemblage. There are two different sizes of fin sets, cooresponding to the two sizes of the warhead section. The prepackaged, bipropellant, liquid propulsion system utilizes unsymmetrical dimethylhydrazine (UDMH) as fuel and inhibited red fuming nitric acid (IRFNA) as an oxidizer. These hypergolic propellants (which ignite spontaneously when mixed) are pressure-fed to the rocket engine by high-pressure gases from a solid-propellant gas generator. These high-pressure gases are also vented through spin ports to impart the initial stabilizing spin to the missile. The fixed fins maintain missile spin throughout the remainder of flight. The unique rocket engine used with Lance actually consists of two engines—a booster engine, which is utilized during the initial boost



Self-propelled launcher XM752

phase of flight, and a sustainer engine, which is mounted concentrically within the booster engine and used for sustained, powered flight.

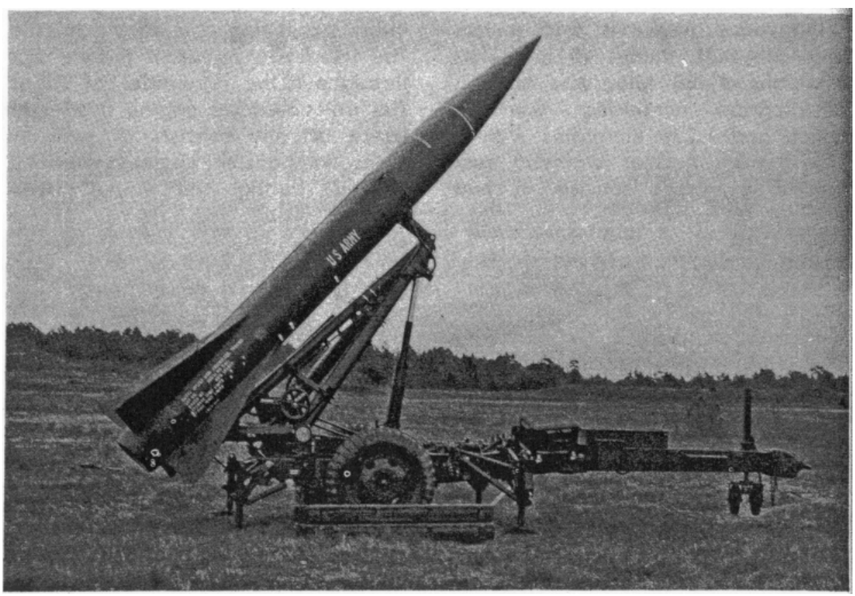
Ground Support Equipment

Three major items of ground support equipment are required by the Lance missile system—

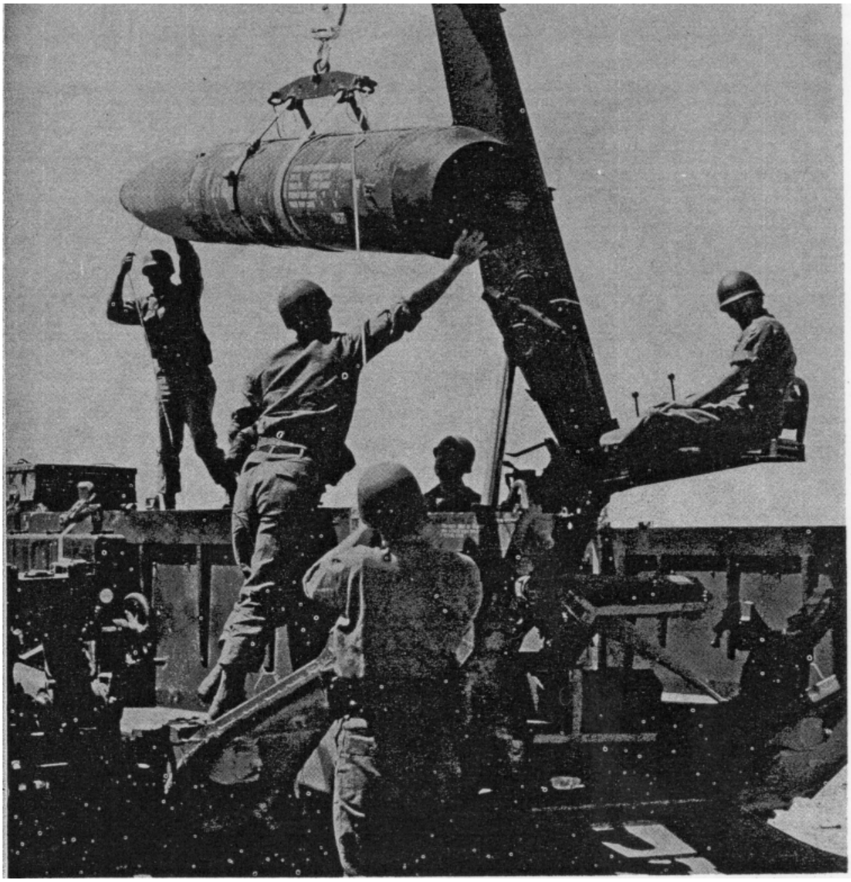
- Launcher, carrier mounted, (SPL) XM752.
- Launcher, zero length, (LZL) XM740.
- Loader-transporter (LT) XM688E1.

The basic vehicle of self-propelled launcher (SPL) XM752 is the XM667E1 tracked vehicle, which was developed from the M113A1 personnel carrier. It is phase-1 air transportable by C130-type aircraft, is air droppable, and has an inland waterway swimming capability. Stabilization of the launcher during firing is provided through the use of a hydraulic suspension lockout system. The SPL provides room for the basic launch fixture with the missile, six members of its crew, and all supporting equipment required for firing the missile. The basic launch fixture supports the missile in transit and during firing and provides the means to manually traverse and elevate the missile to the required firing azimuth and elevation.

The basic launch fixture is a unique feature of the Lance system. The launcher, zero length, is assembled by removing the launch fixture from the XM667E1 tracked vehicle and combining it with a mobility kit, which essentially consists of a

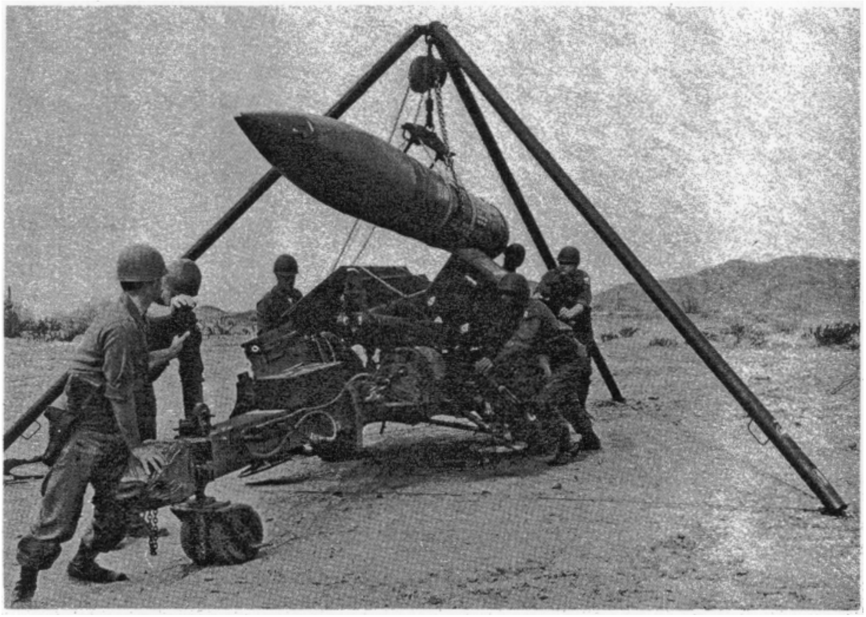


Launcher, zero length XM740



Loader-transporter XM688E1 loading a missile on the SPL

tow bar, two wheels, and four stabilizing jacks. The resulting lightweight, towed lanucher is phase-1 air transportable and airdroppable like the SPL, and it is also helicopter transportable by CH-47 type helicopter as an internal or sling load. The launcher, zero length, carries all supporting equipment required for firing the missile. The remaining major item of ground support equipment, the loader-transporter (LT), XM688E1, also uses the same basic vehicle as the SPL, the XM667E1. A high degree of component interchangeability is thus assured. The loader-transporter can carry two complete missiles on cradles mounted inside the loader-transporter, and it is equipped with a hydraulically-operated, fixed-length boom that can be used by the crew in assembling and disassembling missiles and in handling missile sections and



A hoisting unit tripod being used to load a missile on the LZL.

their containers. The loader-transporter has the same mobility and air delivery capabilities as those of the self-propelled launcher.

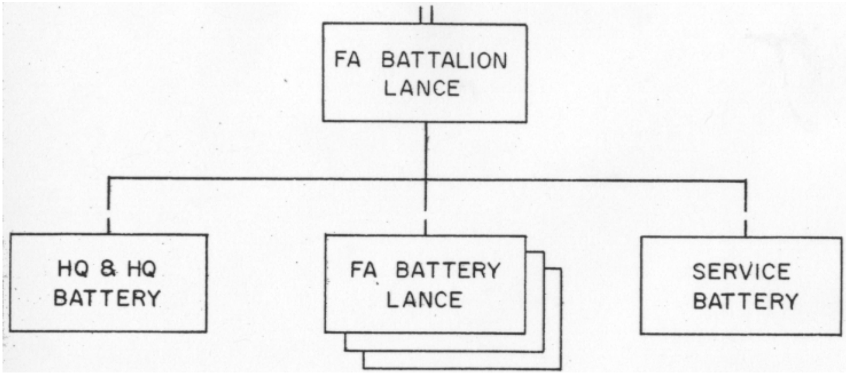
Ancillary Equipment

Several items of ancillary equipment support the Lance missile system—

- Monitor-programmer, missile guidance set, AN/GJM-24 (XO-2).
- Firing device, guided missile, XM91E1.
- Sling, beam-type, XM22E1.
- Hoisting unit, tripod, XM38E1.
- Missile section containers.

Much of the Lance's simplicity can be credited to its monitor-programmer. The monitor-programmer is used to check out the missile prior to firing, to insert firing data into the missile, and to serve as a junction box for all electrical connections. It provides the operator with a simple, sequential checkout capability, utilizing GO/NO GO indications extensively. The complete checkout and data-insertion sequence can be completed in less than 5 minutes. A 24-volt NICAD battery is the only power source required for these operations and for firing the missile.

The firing device consists of a 100-meter cable, which is used to remote the firing device to a remote firing position; an arm switch; and a fire switch, which is used to complete the firing circuit to launch the missile. A simple I-beam-type sling, the XM22E1, is used for handling all missile sections and containers and the launch fixture.



FA Battalion, Lance

In operations such as airmobile operations, when the towed launcher (LZL) might be employed, a device is required for handling the missile sections and containers. The hoisting unit tripod satisfies this requirement.

Containers for the Lance missile consist of a hermetically sealed warhead section container; a missile main assemblage container; and fin containers, which are used to store two fins each.

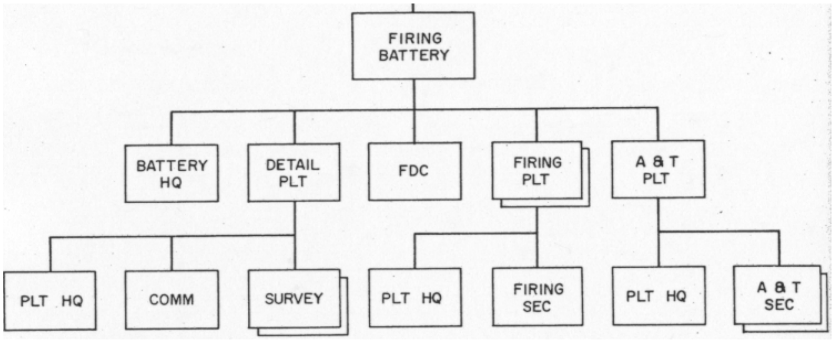
Fire Direction and Control

Fire direction for Lance is accomplished with the field artillery digital automatic computer M18 (FADAC). With data inputs of launcher and target locations and the type of warhead to be employed, one of two standard elevations (48° or 54°) is selected, the firing azimuth is computed, and parameters for booster and sustainer engine cutoff and fuze settings are determined. A manual backup fire direction capability is also available.

Fire control, the transfer of directional control to the missile, is accomplished by using a sighting and laying set consisting of a reference T2 theodolite with a target set and a T2 theodolite sight unit with a mounting bracket. The sight unit and bracket are mounted directly to the missile, and autocollimation procedures with a forward mirror bracket mated to the guidance and control package are followed to "boresight" the missile. Standard reciprocal laying procedures with the reference T2 theodolite are then followed to lay the missile for azimuth. Calibrated elevation stops and a split level bubble on the sight bracket are used to lay the missile for elevation.

Organization

The organization of a Lance missile battalion will be similar to that of a conventional cannon artillery battalion, with a headquarters and headquarters battery, a service battery, and three identical firing batteries. The headquarters and headquarters battery and the service battery will follow conventional field artillery organization.



Firing Battery, LANCE

Maintenance Concept

The long-sought "certified round" (wooden round) maintenance concept has been attained in the Lance system. Organizational personnel do not perform any maintenance on the warhead section other than normal preventive maintenance. Organizationl maintenance for the remaining system-peculiar equipment is limited to simple functions, such as the replacement of fuzes and indicators. System-peculiar direct support maintenance is provided by a direct support contact team from a rocket and missile support detachment (TOE 9-550G), which uses a guided missile system test set (GMSTS) to fault-isolate and repair down to the plug-in circuit board or replaceable subassembly level. A land combat support system (LCSS) test and maintenance detachment, a part of TOE 9-550G, also supports the Lance system. General support for the Lance system is essentially the same as direct support, the basic difference being the number of contact teams assigned. Piece-part repair of components will be accomplished at depot level.

The US Army Field Artillery Board (USAFABD) began the service test at Fort Sill, Oklahoma, and White Sands Missile Range, New Mexico, in June 1971. The US Army Field Artillery Center at Fort Sill has placed a provisional Lance battalion in direct support of the USAFABD. The provisional battalion consists of a firing battery and selected elements of a headquarters and headquarters battery and a service battery. The USAFABD is collecting the majority of the data required for the service test during field exercises at Fort Sill and field exercises and firings at White Sands. During the field exercises the Lance firing battery will store, transport, assemble, load, check out, and fire the Lance missile-under tactical conditions during daylight and under blackout conditions.

Key staff members throughout the Department of the Army attended the contractor-conducted staff planners new equipment training (NET) courses in early 1970 in preparation for the fielding of Lance. Technical specialist NET courses are currently in progress along with the engineer test/service test (ET/ST) and artillery instructor NET courses. The US Army Field Artillery School is conducting an extensive study of instructional requirements, to include anticipated student load, instructor and equipment requirements, and funding. Preparation of programs of instruction (POI's) and instructional material has been initiated.

Today's force commander needs a highly responsive, rugged and reliable general support missile capable of delivering both nuclear and nonnuclear warhead sections against critical targets over a wide-range spectrum. Lance provides this capability.

Weather

By LTC William E. Rawlinson

In the planning and execution of military operations, weather is one variable that must be considered by the commander. Although he may not be among those select few who seem to understand the weather (or, at least, are able to discuss the weather in technical if sometimes noncommittal terms), the commander must make the decisions. He must interpret and act upon information as it is made available to him. He does not need nor can he possibly hope to be an expert in every field, but he does require a working knowledge of those fields which vitally affect his command and operations. In particular, he cannot afford to be "in the dark" about such a ubiquitous phenomenon as the weather. This article will try to cast a little light on the subject of the weather by defining a few of the terms most commonly used in describing it and by elucidating the most current theories employed in trying to predict it.

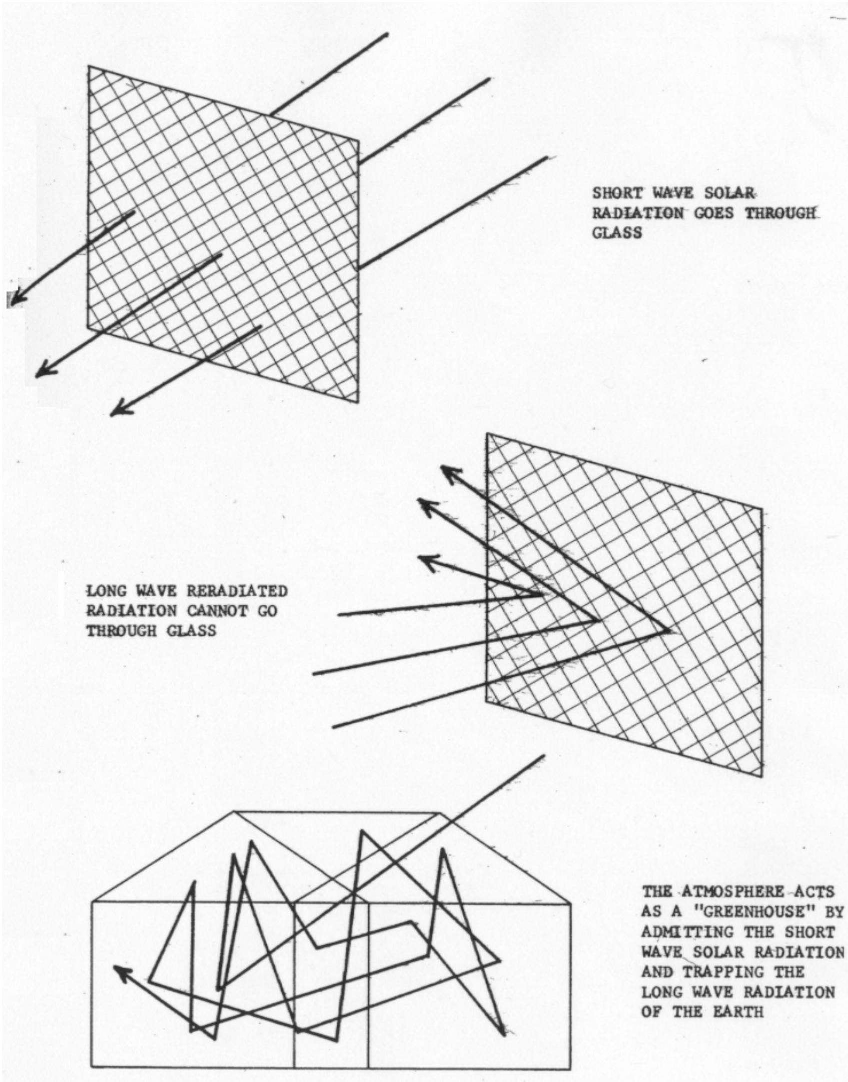
Weather is the state of the atmosphere, especially as it affects human activities. As distinguished from climate, weather consists of the short term (minutes to months) variations of the atmosphere. Popularly, weather is thought of in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, and wind. Let us begin our investigation of the weather and the systems that produce weather with a discussion of the atmosphere and the general circulation of the atmosphere.

The atmosphere is a huge heat engine. It is fueled by radiation from the sun, which it receives at the rate of about 2.0 calories/centimeters^2/minute. (In gross terms, this amounts to about 126 trillion horsepower every second.) The atmosphere also acts as a protective covering over the earth. It absorbs dangerous incoming short-wave radiation and retains reradiated long-wave radiation from the cooling of the earth's surface. This latter characteristic is known as the greenhouse effect. This effect partially accounts for the small diurnal change in atmospheric temperature and for the fact that the hottest part of the day occurs after 1200 hours and the coldest part of the night during the early morning hours.

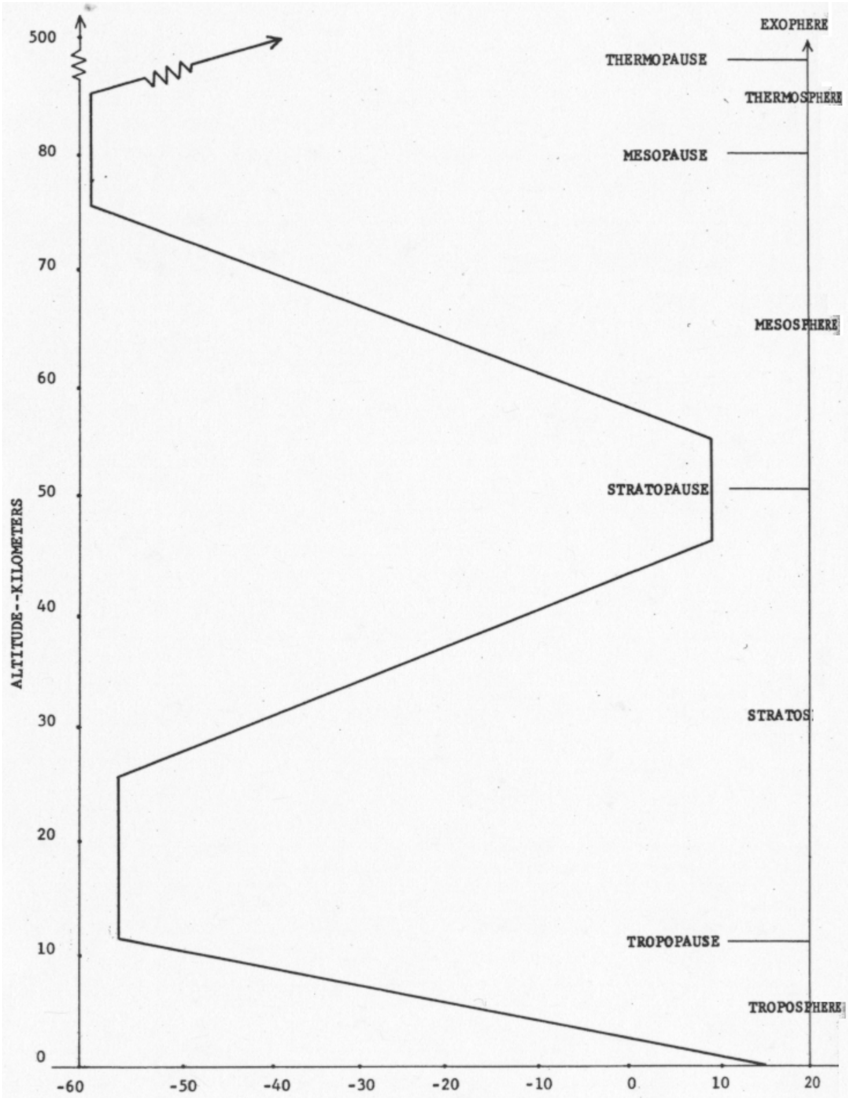
ICAO

Page 14 is a trace of the International Civil Aeronautical Organization (ICAO) atmosphere on a basis of temperature versus height. The ICOA atmosphere is a hypothetical atmosphere and is often referred to as the standard atmosphere. It is used in missile design, the development of a artillery ballistic tables, aircraft performance and design, and a multitude of other programs and calculations involving the atmosphere. Although the quantitative data of the ICAO atmosphere are not essential to our discussion, there are certain features that are of interest to us.

First, there are the various atmospheric layers — the troposphere, the stratosphere, the mesosphere,



The greenhouse effect



TEMPERATURE--DEGRESS CELSIUS

Thermal structure of the atmosphere

the thermosphere, the exosphere, and the associated boundaries of these layers. The troposphere is of particular interest. Although it is estimated that the atmosphere extends out to about 18,600 miles above the earth's surface, the mass of the atmosphere is concentrated in the troposphere. For example, approximately three-fourths of the earth's atmosphere is below an airplane flying at 34,000 feet. Since there can be no weather without atmosphere, the first few thousand feet play the most important part both in producing and in forecasting weather. The troposphere is the zone of weather.

Secondly, there are the temperature gradients. There are three types of gradients—

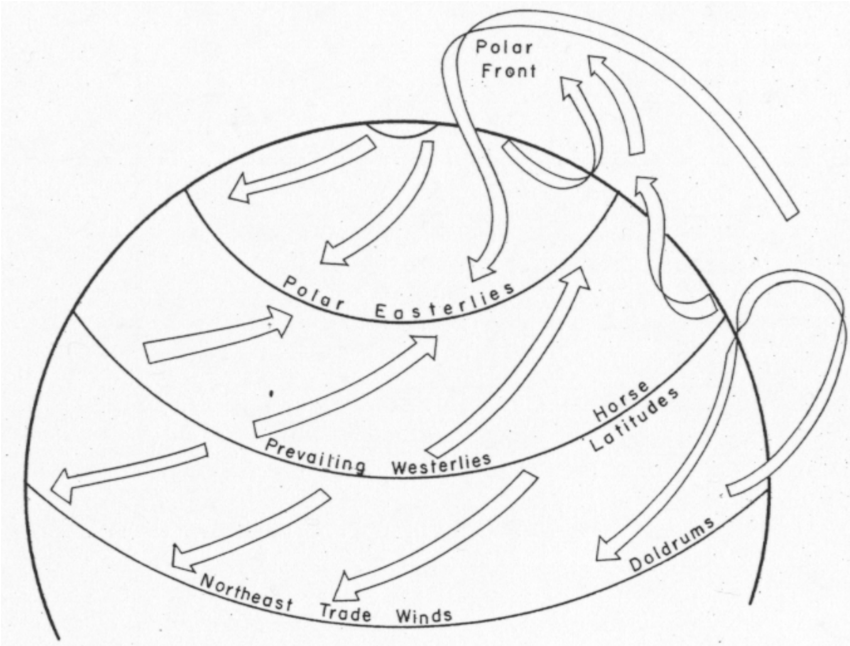
- Lapse rate—the decrease of temperature with height. This is the normal condition of the troposphere.
- Isothermal—equal or constant temperature with height.
- Inversion—the increase of temperature with height.

Page 14 illustrates the three types of temperature gradients by reference to a particular section of the ICAO atmosphere. However, all three gradients occur daily in the troposphere. Temperature gradients are indications of atmospheric stability, with stability increasing as conditions progress from lapse rate to inversion.

Beginning with the general circulation of the atmosphere, our discussion will be limited to the Northern Hemisphere. (Weather-wise, the Southern Hemisphere is a mirror image of the Northern Hemisphere.) In this day and age of giant strides in science and technology, meteorology finds itself in a perplexing situation. Despite literally thousands of weather observations being made each day and the development of highly sophisticated computers, no mathematical model has yet been constructed that will satisfactorily predict the weather. Accordingly, the art of weather forecasting is a much debated subject. This also holds true for explanations of the general circulation of the atmosphere.

To be acceptable, a theory of the general circulation of the atmosphere must account for certain phenomena. First, as already noted, the atmosphere absorbs vast quantities of heat from the sun. Although the area of the Equator receives more solar radiation than do the areas of the poles, the equatorial atmosphere does not continually rise in temperature nor does the polar atmosphere continually cool over the years. Therefore, a theory of the general circulation must account for the transfer of heat from the Equator to the poles. Secondly, there are generally three wind belts in the Northern Hemisphere—the polar easterlies, the prevailing westerlies, and the northeast trades. A satisfactory theory must account for these wind belts. Thirdly, since there are no significant variations in atmospheric pressure over a long period of time, a theory must provide for the steady distribution of the mass of the atmosphere. Finally, a theory must explain the redistribution of water vapor.

The figure on the following page depicts the general circulation of the atmosphere as theorized from observations. First, air at the Equator, heated by solar radiation, ascends and flows toward the North



General circulation of the atmosphere in the Northern Hemisphere

Pole. As this air rises and cools, water vapor in the air condenses, causing the density of the air to increase. In the area of 30° North Latitude the denser air sinks and separates. Some of the sinking air flows north toward the pole and some flows south toward the Equator. The mass of air moving northward is deflected to the right under the effect of the Coriolis force and forms the prevailing westerlies. The air moving southward is similarly deflected and forms the northeast trades. (The Coriolis force is an apparent force which causes moving particles to be deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.)

The area of the predominantly sinking air, about 30° north latitude, is an area of weak and undependable surface winds. A common name for this region is the "horse latitudes." This name probably originated with sailing ships transporting horses from Europe to America. These ships often became stranded in this area because of the absence of winds. If the ships ran out of forage and water, they dumped their cargo overboard. Consequently, the sea was often littered with the bodies of starved horses.

There is some high altitude flow that continues northward toward the pole. At about 60° north latitude there is a phenomenon known as the polar front. This polar front is a semipermanent feature that is caused by the interaction of the cold polar air and the warmer air of the prevailing westerlies. As a result, the 60° north latitude circle is an area of habitual rain, mist, and fog.

The rising air of the prevailing westerlies combines with the air flowing northward from the Equator.

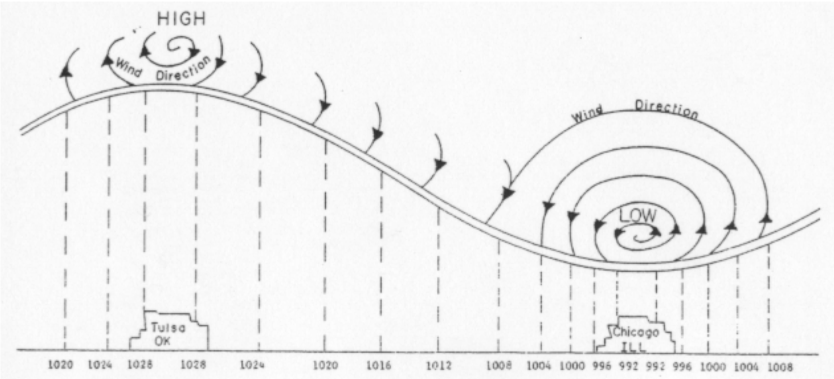
This combination of air continues northward toward the pole, is further cooled, loses additional water vapor, becomes denser, and eventually sinks in the polar area. The polar area becomes a source area for the cold, dry air that periodically flows south. This cold air breaks through or pushes aside the polar front and becomes the cold waves characteristic of northern hemispheric weather. As this air moves southward, it is deflected to the right by the Coriolis force and forms the polar easterlies.

The theory of general circulation outlined above provides an explanation of the major phenomena characteristic of the Northern Hemisphere. Of course, further observations and more advanced scientific methods will no doubt supply many modifications and refinements. We already know just from day-to-day experience that the gross circulation patterns of the general circulation must be modified to include an explanation of smaller circulation perturbations in the form of high- and low-pressure areas and weather fronts. Therefore, at this point, let us turn our discussion to these pressure areas and fronts.

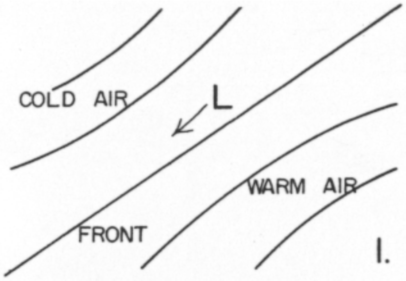
Highs, Lows, and Fronts

A high-presure system (high) may be visualized as a mountain of air, a low-pressure system (low) as a valley. This is illustrated in the figure below. Just as water runs downhill or as electricity flows from a high potential to a low, so too air—and therefore weather—moves from a high to a low.

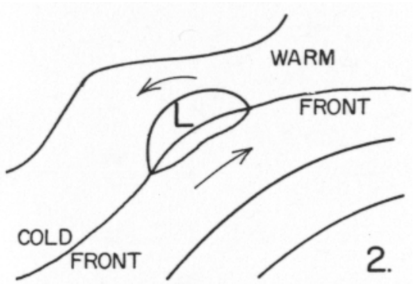
What actually is the difference between a high and a low? On a surface weather chart both are given pressure values. Is a system a high or low in relation to the 1013 millibar standard surface pressure of the ICAO atmosphere? Is a system a high or low by a relative comparision of pressure values for a given synoptic condition? The answer to



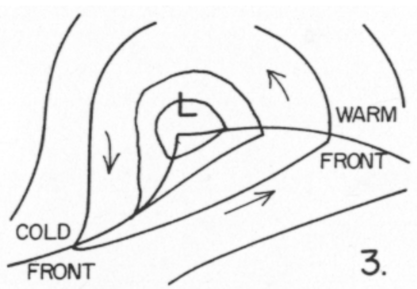
The relationship between high and low pressure



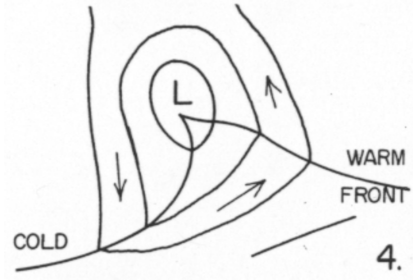
A FRONTAL LINE EXISTS AT A LOW-PRESSURE TROUGH BETWEEN COLD AND WARM AIR MASSES.



COLD AIR BEGINS TO PUSH UNDER THE WARM AIR.

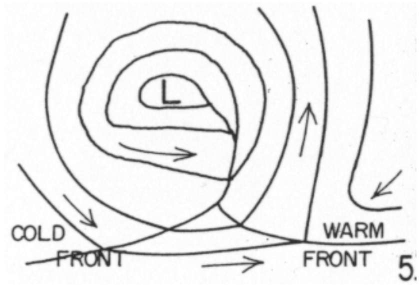


COLD AIR CONTINUES TO PUSH UNDER THE WARM AIR.

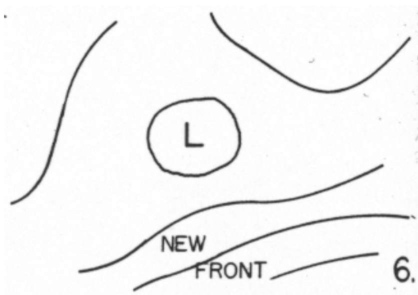


FRONT

THE COLD FRONT PLUNGES AHEAD ABOUT TWICE AS FAST AS THE WARM FRONT.



THE COLD FRONT OVERTAKES THE WARM FRONT.



ONLY THE LOW PRESSURE AREA REMAINS.

Life history of a frontal low

both these questions is "No." Whether a system is a high or low is determined by its circulation pattern.

As has already been suggested, water vapor plays an important, if not the dominant, role in the meteorological processes that produce weather. And of primary importance is the ability of the atmosphere to hold water vapor. The amount of water vapor that a parcel of air can hold is directly proportional to the temperature of the air parcel. With this in mind, let us look at the mechanics of a high.

The circulation pattern of a high is clockwise and out from the center. Additionally, a high is characterized by subsidence—that is, a descending motion. Although this descending motion of the air in a high is very slow compared with the horizontal motion, it is very significant. As the air descends, it is compressed and heated. The air's ability to hold moisture is increased and, therefore, clouds are dissipated. As a result, clear skies are associated with a high. A high is formed by sinking cool air, which in turn is compressed and heated by the increasing atmospheric pressure. As the air sinks, it slowly develops into a clockwise, spiraling mass of air. The air flows from a high into an area of low pressure. As the air rushes out, it is deflected to the right by the Coriolis force. Highs vary in size but are usually several hundred miles in diameter.

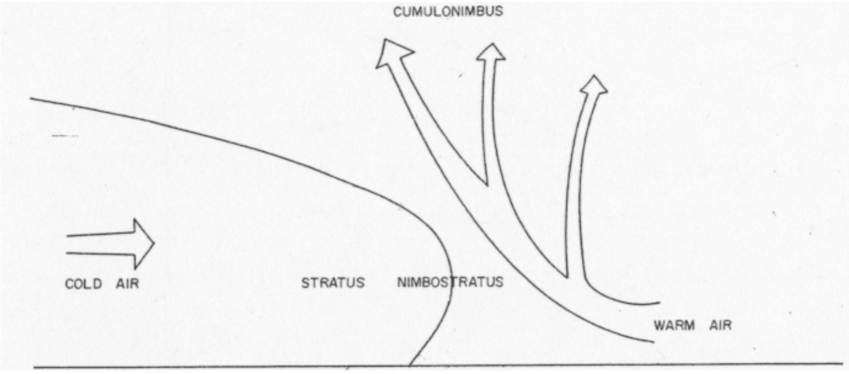
The circulation pattern of a low is counterclockwise, in and up. As the air rises, it expands and cools due to the decreasing atmospheric pressure. The ability of the cool, ascending air to hold moisture decreases. Water vapor is condensed out, clouds are formed, and skies become overcast. The formation of a lows, as illustrated on page 15, are of a high. Heat lows may form because of the intense heating of a small localized area. Lows may also form as a result of the rapid updraft under large cumulonimbus (thunder) clouds. These lows, however, are local phenomena. Major lows, as illustrated on page 18, are formed by a wavelike action that occurs between highs of different temperatures.

Although highs and lows are associated with good and bad weather, respectively, the day-to-day weather is more often determined by weather fronts. A front is the interface, or transition zone, between two air masses of different temperature. Basically, there are four types of fronts—

- Cold front—any nonoccluded front that moves so that colder air replaces warmer air at the surface.
- Warm front—any nonoccluded front that moves so that warmer air replaces colder air at the surface.
- Occluded front—a composite of two fronts formed as a cold front overtakes a warm front.
- Stationary front—a front that moves at a speed of less than about 5 knots.

Cold fronts

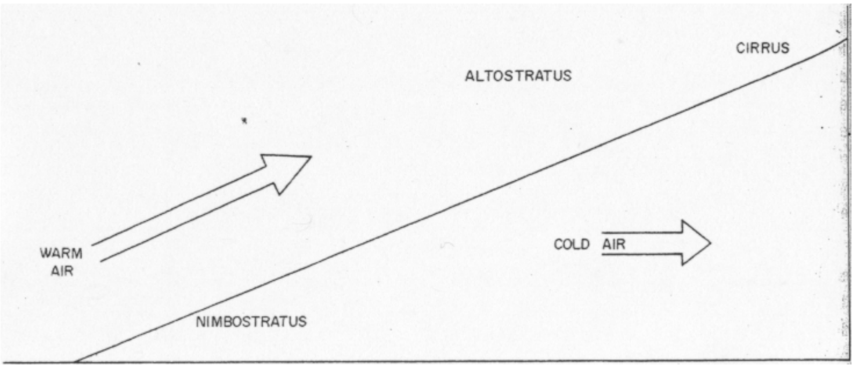
Fronts form when air masses collide. For instance, we know that the descending air over the North Pole forms a high-pressure area. As this mass of air accumulates in the polar region, it takes on the characteristics of that area—cold and dry—and eventually breaks through



The cold front

or pushes aside the semipermanent polar front of the 60° north latitude circle. The leading edge of the cold air delineates the cold front. As the mass of cold air pushed by the polar high moves southward, the warmer air is lifted upward. The violence of the weather associated with a particular cold front depends primarily upon the characteristics of the warmer air, the speed at which the cold front is moving, and the slope of the cold front. The more violent weather accompanies a fast-moving, steep cold front that is lifting warm, moist air rapidly. The following are characteristics of the passage of a cold front—

- Precipitation varies from a steady downpour and sheets to a slight drizzle or no rain.
- Temperature drops across the front.
- There is a pronounced wind shift.



The warm front

● Pressure drops slowly at first but then increases rapidly.

● Weather clears rapidly after the passage of the front.

Warm fronts

Warm fronts occur on the east side of a low. Because of the counterclockwise circulation of a low, air coming from the south will be warm and, at times, moist. The leading edge of the warm air delineates the warm front. Warm front weather is not as violent as that associated with a cold front. For one thing, warm fronts usually move at slower speeds than do cold fronts. Also, the slope of a warm front is not as steep as that of a cold front. Consequently, the air in a warm front is not lifted as rapidly as that in a cold front. Typical warm front weather consists of a slow drizzle with fog extending over a large area and may last for days. The following are characteristics of the passage of a warm front—

● Precipitation alternates between a heavy downpour and a slow, steady drizzle, which may be accompanied by fog.

● Temperature rises across the front.

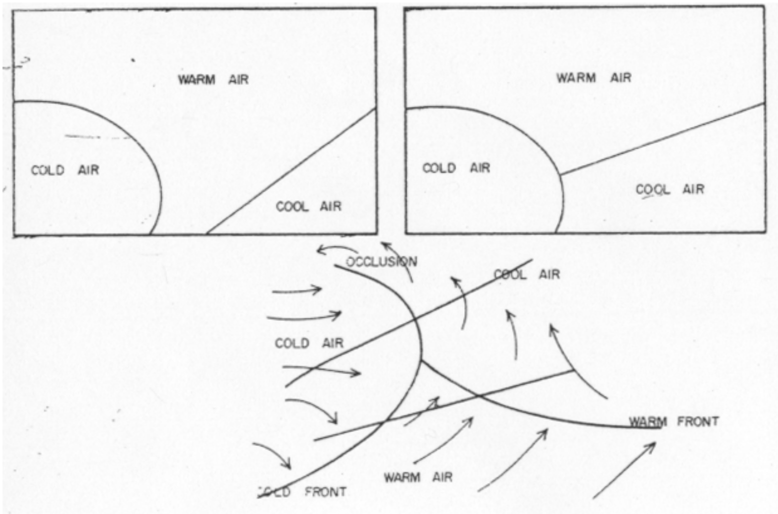
● There is a slight wind shift.

● Pressure drops slowly without a rapid increase after frontal passage.

● Weather clears slowly after the frontal passage. Poor weather may last for several days.

Occluded front

Whenever a cold front overtakes a warm front, an occluded front is formed. The air of the warm front is lifted by the oncoming cold air. Within the occlusion, weather is usually similar to a warm front. Immediately preceding the occlusion, warm front weather is quickly followed by cold front weather.



The occluded front

Stationary fronts are those that are moving slowly or not at all. A stationary front typically occurs when highs of almost equal pressure are formed on both sides of a front. Stationary frontal weather is similar to that of a warm front, but usually milder.

While frontal weather dominates North America and a large portion of Eurasia, the monsoon is the most influential weather factor for the majority of the nations on the periphery of the Asian land mass. The monsoon is the sea breeze effect on a large scale. A sea breeze is a consequence of the ocean acting as a large heat reservoir. Oceanic temperatures vary only a few degrees annually. On the other hand, the diurnal variance of temperature of a land area is wide and rapid. (The difference in temperature is more marked during the summer months within a few degrees of the Equator.) Solar radiation is absorbed by the land surface and is subsequently reradiated as long-wave radiation, which is absorbed by the layer of air next to the land surface. The heated air rises and forms a low-pressure area. The moist air overlying the adjacent ocean area rushes in because of the atmospheric pressure differential. As this moist air rushes in, it too is heated and rises. As a result of expansive cooling, the water vapor is condensed and yields rain (the monsoon). In some areas, there is the additional orographic lifting caused by an inland mountain range. Such an effect occurs in India, where the Himalayas add to the lifting effect of the Indian land mass low.

Another important facet of weather is the point of continuity. For example, thunderstorms and monsoonal activity broadcast their advent over a period of hours or days. Nature simply does not move large masses of air and water vapor without giving some indication of a forthcoming change.

Weather has a varying impact on military operations. Even the "good" weather of a hot, clear Oklahoma day can limit or complicate the full use of weapons, men and machines. In Oklahoma, for instance, the weather can increase or decrease the lift capacity of helicopters and can cause artillery to shoot long or short. Military commanders at all levels can use their knowledge of the weather to turn existing weather conditions to an advantage. This can vary from the use of monsoonal activity to cover the movement of a Viet Cong squad to the use of a warm front fog to cover deployment of a division. But making the most of weather conditions is possible only for the force that has the technical capability and scientific knowledge to produce a reliable forecast.

In general, there are two observations that should be kept in mind—

- The first is the direction from which the wind is blowing. the advection of temperature and moisture is accomplished by the wind. The physical characteristics of the area over which the air mass forms and/or over which it moves will dictate the characteristics of the air mass.

- The second is the location and direction of travel of pressure systems. These will have an effect not only on the wind direction but also on the type, change, and severity of the weather to be experienced.

The following are also worth remembering in our forecasting of weather—

- Bad weather is associated with a low.
- Cold front weather is usually more severe but of shorter duration than warm front weather.
- Good weather is associated with a high.
- The circulation patterns associated with highs and lows have a marked effect on local weather.

Although it is the staff weather officer who conducts weather briefings and answers questions concerning the weather, it is the commander and his staff who must ascertain both the impact of the weather upon operations and the methods to use in turning the weather to an advantage. A knowledge of the mechanics of weather systems broadens the professional background of the officer and contributes to the effective use of all human and material resources. Weather is one of the essential tools in the science of the employment of military forces.

TACFIRE

by
CPT William W. Beverley

Today, developments in modern warfare, its tactics and its equipment, have created new threats which the field artillery must counter if it is to maintain its dominant role on the battlefield. Highly mobile enemy forces, with sophisticated equipment to locate and destroy forward observers and weapons, demand quick and accurate fires from the field artillery. The weapons and ammunition are there. Modern artillery has remarkable accuracy, range and rate of fire; what has failed to keep pace are the fire planning and fire direction processes, which at present are not capable of responding with sufficient speed to meet the critical needs of the modern battlefield. In addition, the volume of intelligence data collected and generated in a tactical situation has generally prohibited the timely and effective analysis, attack, or dissemination of intelligence targets or data. To correct this situation, TACFIRE (tactical fire direction system) has been developed.

TACFIRE is a tactical, automatic, data processing system with computer centers located at cannon field artillery battalion and division artillery levels. TACFIRE will assist the

PROGRAMS	FSE	DIV ARTY FDC	BN FDC
Ammunition and fire unit status	X	X	X
Preliminary target analysis	X		
Nuclear target analysis	X		
Chemical target analysis	X		
Fallout prediction	X		
Non-nuclear fire planning	X	X	X
Target intelligence	X	X	
Tactical fire control		X	X
Technical fire control			X
Artillery survey		X	X
Meteorological data	X	X	X

TACFIRE programs

field artilleryman in many of his tasks with more speed, more accuracy, and with greater effect and economy than is possible with currently used methods. TACFIRE will assume the time-consuming burdens of computations and data handling that are now done manually or manually with the help of FADAC.

The objective of TACFIRE is to increase the effectiveness of field artillery fire support through improved response, better and more rapid use of artillery target information, improved and faster fire support planning, and greater efficiency in the determination of fire capabilities and allocation of fire units to targets. TACFIRE automates the same field artillery techniques, procedures, and terminology that have been proven successful in manual systems.

TACFIRE functions are performed in a continuous process with a constant interface of functions as the situation dictates.

The ammunition and fire unit programs keep account of the fire unit status and the ammunition available to support those programs concerned with placing fire on enemy targets.

Preliminary target analysis, nuclear target analysis, nonnuclear fire planning, chemical target analysis, and fallout prediction programs will assist in fire support coordination. The purpose of the fire support element programs is to assist in planning and coordinating conventional, nuclear, and chemical fire support and in analyzing all available fire support means. Preliminary target analysis assists the fire support coordination center in determining the best means to defeat a target. This program considers available Army, Navy, and Air Force fire support means and provides data for decisions to the fire support element.

The nuclear target analysis program selects all fire units which can defeat designated targets with avaiable yields to achieve the required degree of damage without violation of given safety data. It produces data which describe the target, fire unit, yield, and height-of-burst combination for the most effective use of nuclear weapons. It will also produce a list of nuclear munitions required to destroy or neutralize a specified list of targets. This program provides input data for the nuclear schedule of targets.

The primary functions of the nuclear fire planning program are to match target, fire unit and weapon assignments and to create a nuclear schedule of targets. It will also prepare a list of contingent effects for targets and fire unit combination as specified. The computer transmits the nuclear schedule of targets and contingent damage effects upon command.

Chemical target analysis is performed for all chemical fire missions and for chemical fire planning. It produces the optimum choice of the fire unit, type of agent, and quantity necessary to achieve specified criteria.

The fire planning program provides for the selection of targets for the selection of targets for an integrated fire plan. Fire plans will be produced in significantly less time and with improved accuracy and completeness over the present manual operation. The program assigns fire units, number of rounds, types of ammunition and fuzes, and the specific time each target is to be attacked. Planning is done in accordance with guidance stored in the computer and incorporates limitations imposed by boundaries, no-fire lines, fire coordination areas, air corridors, and the amount of ammunition available. As an example, the Div Arty computer can produce a nonnuclear fire plan for the attack of 150 targets by 30 fire units in fifteen minutes as compared to several hours required with manual methods used today.

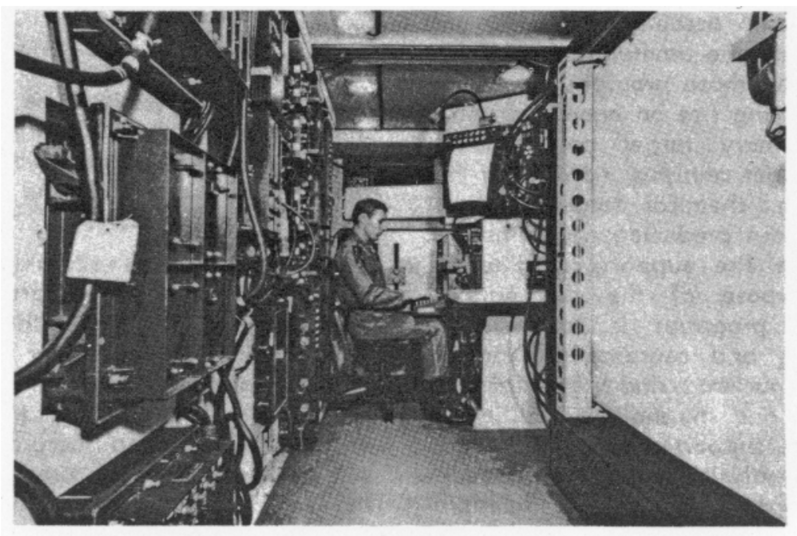
The artillery target intelligence function at division artillery provides assistance to the S2 in all phases of the intelligence cycle—collection, evaluation, interpretation, and dissemination. The result of this process is a complete, current, and accurate target list available on command.

The tactical and technical fire control functions enable the artillery commander to direct fires on enemy targets in a rapid and efficient manner. The computer accepts fire mission requests and produces fire commands appropriate to the specified target.

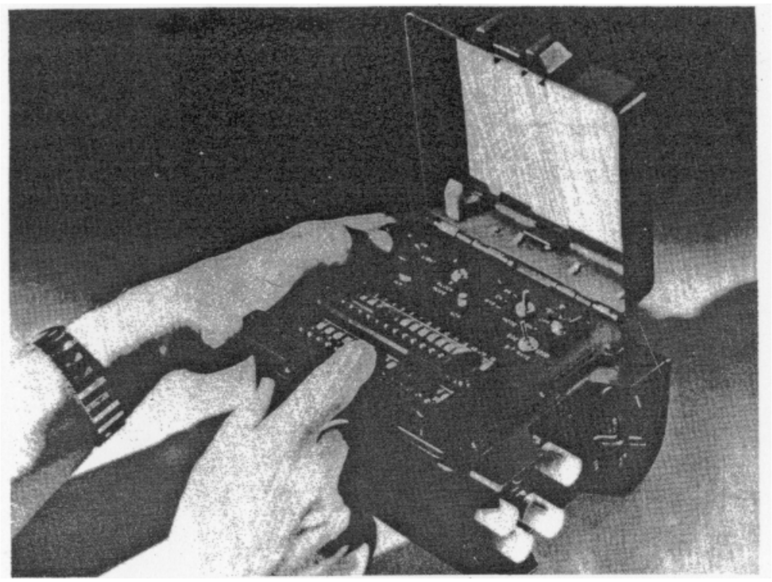
The survey program provides timely information and processing for all operations of the survey information center of division artillery and survey parties of both division artillery and battalions. The function provides for rapid storage, retrieval and computation of survey data.

The meteorological data function is responsible for updating met messages and distributing met data as directed by the Div Arty fire direction officer.

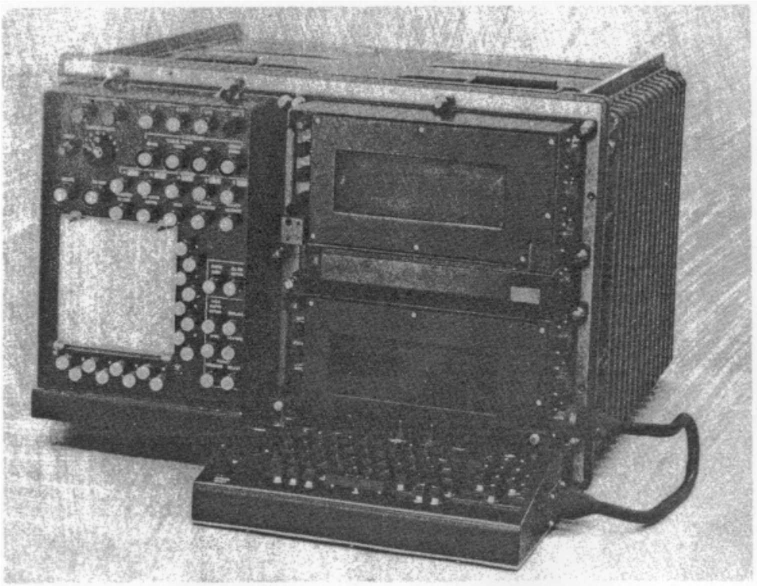
The fallout prediction program receives nuclear sighting reports, receives prestrike fallout requests, validates sighting reports to confirm a strike, stores and applies meteorological data, and determines applicable fallout risks for an attack based upon existing parameters. It



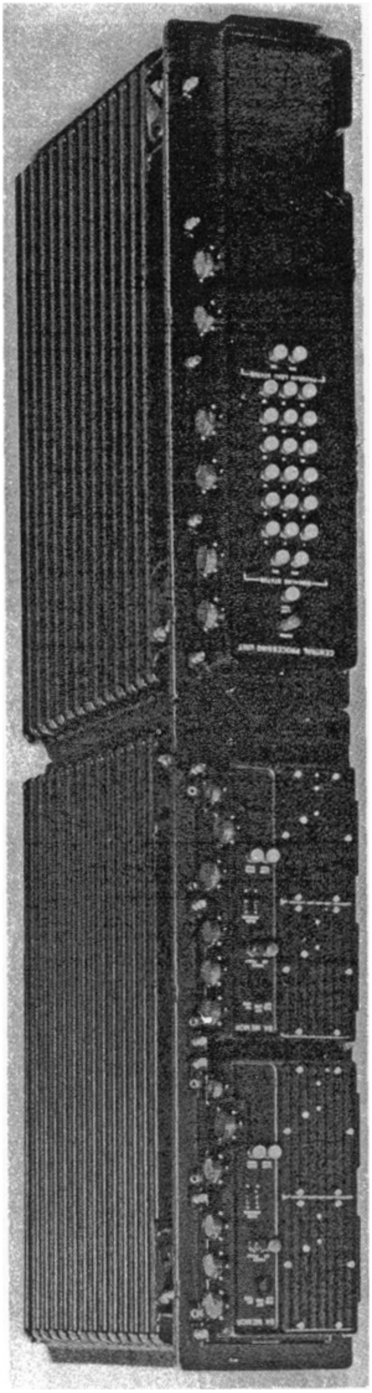
S-280 shelter



Fixed format message entry device (FFMED)



Artillery control console (ACC)



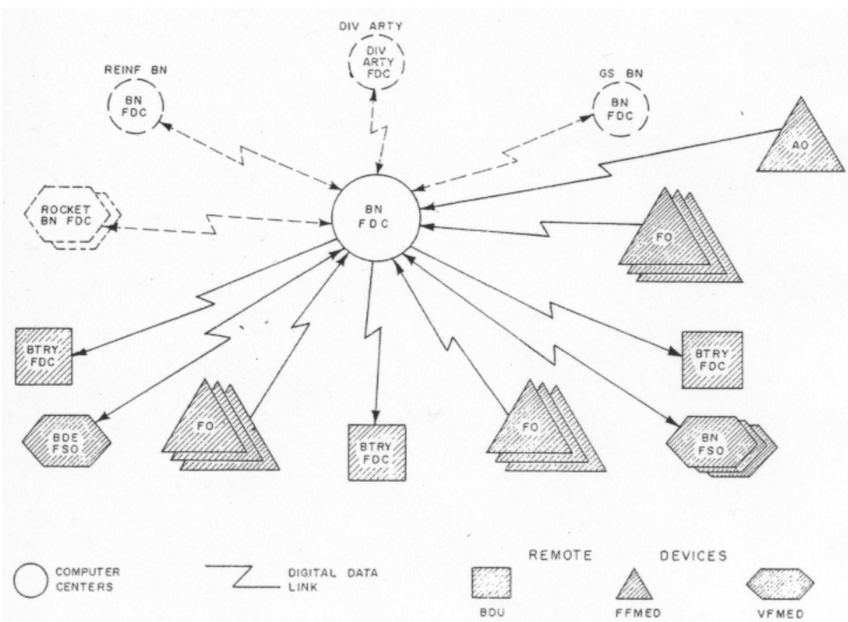
AN/GYK-12 computer

generates fallout prediction messages and an effective downwind message to allow units to evaluate their situation relative to a sighted burst or predicted burst.

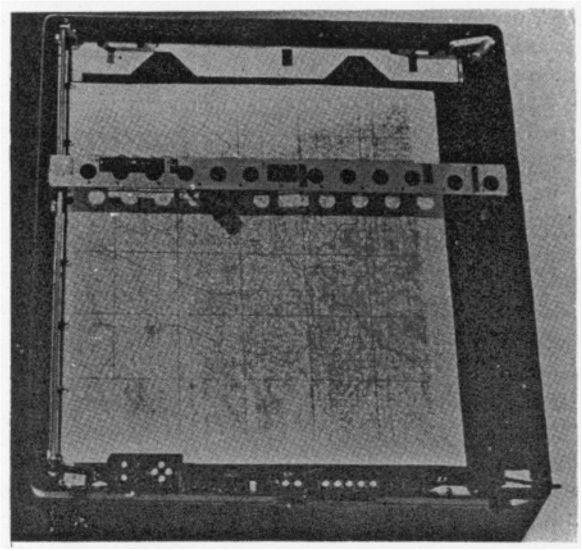
As an illustration of how the TACFIRE system operates at battalion level, assume a forward observer has just transmitted a request for fire to the battalion FDC, which is housed in one S-280 shelter. The observer used a fixed format message entry device (FFMED), connected to his organic radios or telephone, to send the messages in coded digital form. At the battalion FDC, the request is authenticated, expanded and entered directly into the computer. The artillery control console (ACC) provides a visual presentation of firing data generated by the AN/GYK-12 computer plus the original fire request, after the fire mission has been processed.

Also located in the battalion FDC is the digital plotter map (DPM), a 4-by-4 foot plotter for large-scale display of the tactical situation on an overlay or map, and an electronic line printer (ELP) that is used to provide a hard copy record of all incoming and outgoing messages. These devices give the FDO ready access to fire orders and commands for several missions, and allow him to monitor the situation, quickly establish priorities of targets during

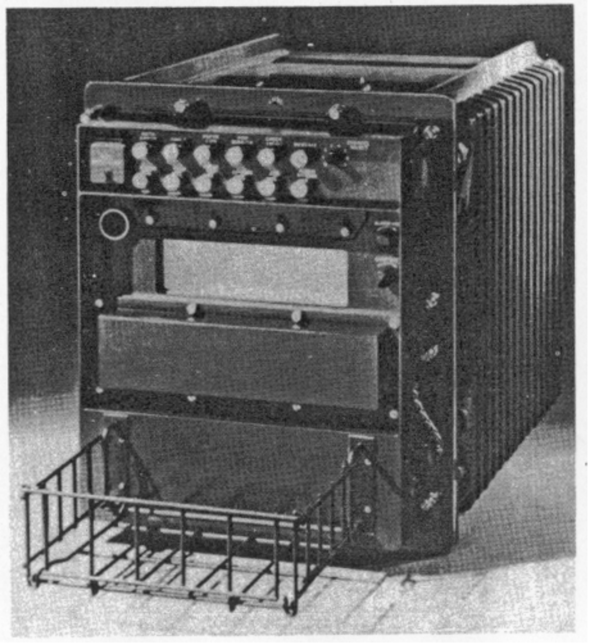
BATTALION COMPUTER CENTER CAPABILITIES



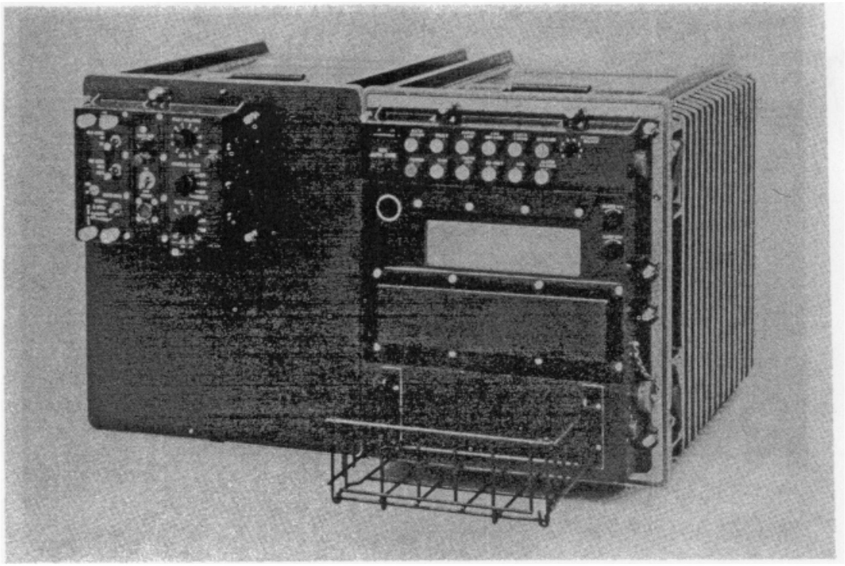
Battalion TACFIRE schematic



Digital plotter map (DPM)



Electronic line printer (ELP)



Battery display unit (BDU)

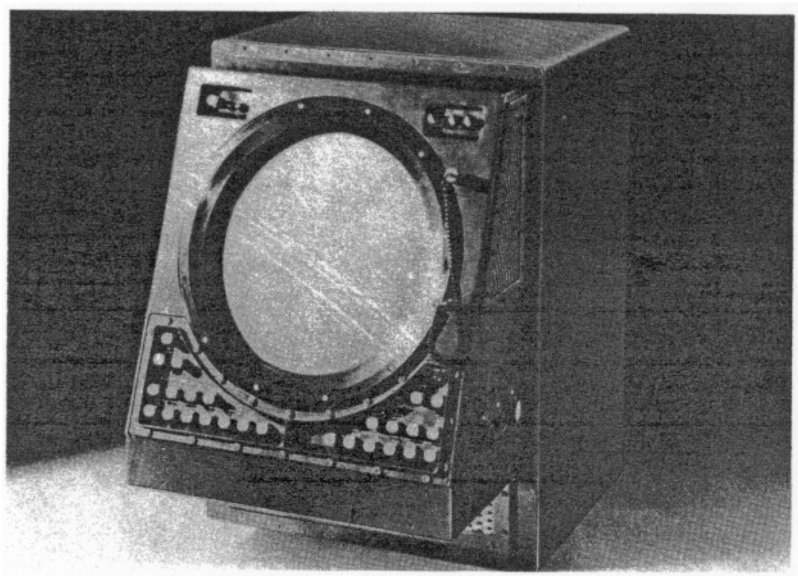
peak loads, and generally retain full control of the FDC operations. They also provide a complete hard copy record capability.

Once the fire commands produced by the computer are reviewed by the FDO, the ACC operator activates a switch on the ACC to send the commands to the batteries, where they are printed on an electronic line printer of a battery display unit (BDU). The battery radiotelephone operator activates the ACKNOWLEDGE switch on the BDU to transmit a signal back to the battalion FDC. The battery executive officer then announces the fire commands to the guns from the hard copy furnished him by the BDU.

The speed at which these computer decisions and calculations are made will result in printed fire commands at the battery in less than 10 seconds from the time the call for fire is originated.

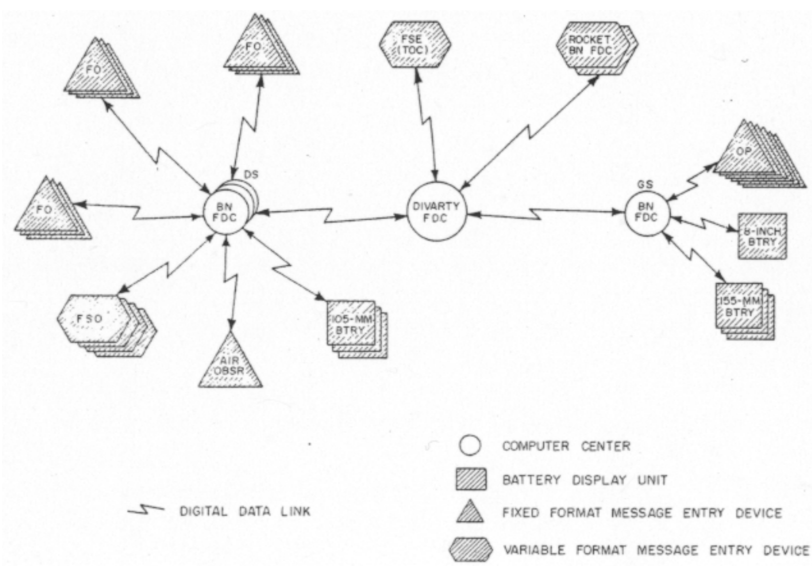
The TACFIRE computer center at division artillery is housed in two S-280 shelters because of additional equipment requirements. The division artillery equipment is identical to the battalion equipment but is supplemented with an additional memory drum, a second printer, and an electronic tactical display (ETD). The ETD provides a rapidly updated graphical display of the tactical situation. Data from the 4-by-4 foot digital plotter map can be expanded and displayed on this device. The S2 and the S3 may use this device independently or simultaneously to help accomplish their staff functions.

Unlike the fixed format message entry device, the variable format message entry device (VFMED) will provide two-way communiciations between users at the division, brigade, and battalion fire support element and to the missile battalion

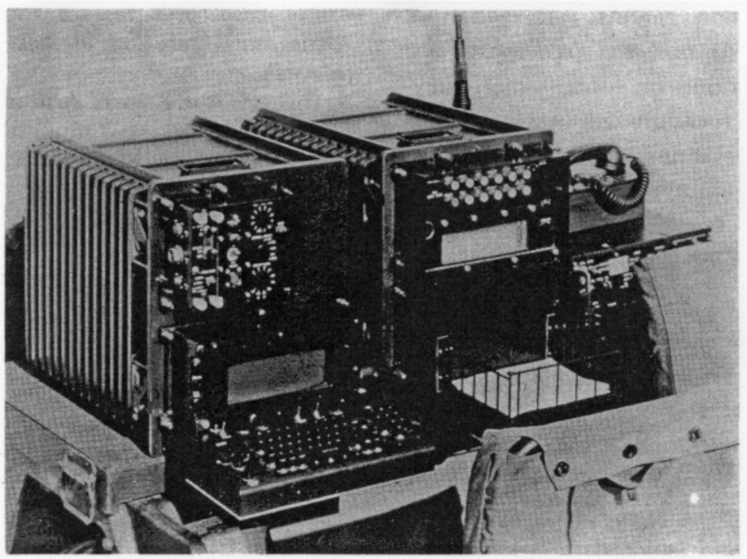


Electronic tactical display (ETD)

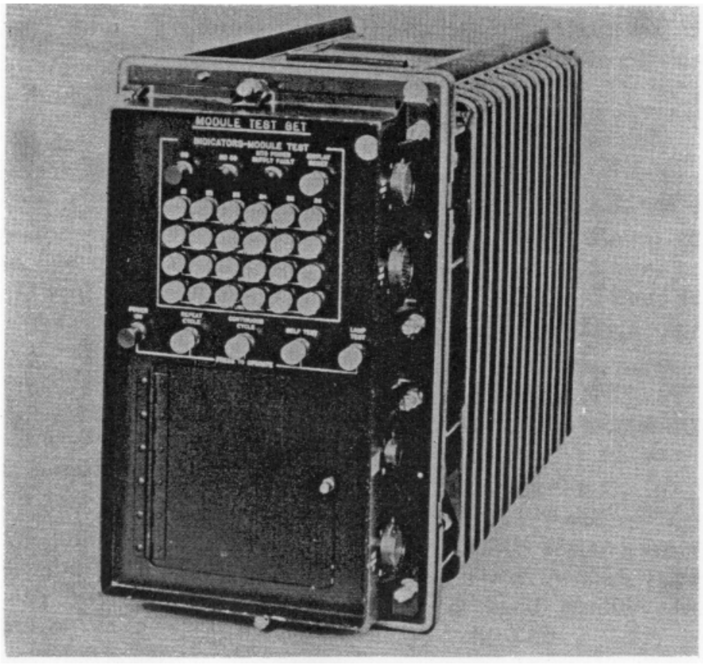
DIVARTY COMPUTER CENTER CAPABILITIES



Division artillery TACFIRE schematic



Variable format message entry device (VFMED)



Module test set (MTS)

fire direction centers. It is similar to the BDU but has a display and edit scope and an alphanumeric keyboard to facilitate editing and composing messages. The VFMED provides an input/output capability not found in the BDU, for the BDU is an output device only.

A unique feature of the TACFIRE system is the maintenance concept for the system. A maintenance and diagnostic software routine checks the system on a scheduled basis when the computer is not busy. Any failure that occurs can be rapidly detected and isolated to a few cards through the use of built-in computer programs. Rapid fault isolation down to the specific card is facilitated by a built-in, handheld GO/NO-GO circuit card tester called a module test set (MTS). Operating personnel can locate and replace a faulty card and restore the system to normal operation in less than 10 minutes.

The US Army Field Artillery Board has conducted a manual/FADAC comparative ser ice test which began on 14 December 1970 and was completed 30 April 1971. This test was conducted to measure the performance of a field artillery organization using the manual/FADAC system in accomplishing TACFIRE functions for later comparison with the performance of a field artillery organization equipped with TACFIRE. New equipment training for Board personnel scheduled to participate in the TACFIRE service engineer test (ET/ST) began 25 January 1971. The TACFIRE ET/ST is scheduled to begin on or about December 1971 and will last for approximately 10 months. The TACFIRE system will be fielded throughout the Army's field artillery units during the mid-1970's.

OCTOBER FIREX 70

The XVIII Airborne Corps Artillery conducted a unique field artillery firing exercise at Fort Bragg, North Carolina, in October 1970. OCTOBER FIREX 70 was designed to promote the "One Army" concept and interservice cooperation by demonstrating the feasibility and desirability of Active Army, National Guard, Army Reserve, and Marine artillery units combining their energies and assets in a nondirected field training exercise. The major objective of the exercise was to practice artillery fire support coordination and fire direction from battalion to corps artillery level.

The tactical setting for the exercise had the XVIII Airborne Corps, with the 82d Airborne and 2d Marine Divisions on line and the 30th Infantry Division (Mech) in reserve, in contact with the enemy and preparing to launch a corps attack. The artillery organization for combat mixed Active Army, National Guard, Army Reserve, and Marine batteries and battalions under division artillery and group headquarters.

The five major artillery headquarters under the control of XVIII Airborne Corps Artillery were organized for combat as follows:

Organization for combat
XVIII Airborne Corps Artillery
2-26 Arty: GS
2d Field Artillery Group (Marine Corps): GS
4-39 Arty (8-in, SP) (Active Army)
4-17 Arty (8-in, SP) (USAR)
2d 8-in Btry (Marine)
5th 175-mm Btry (Marine)
151st Field Artillery Group (SCNG): GSR 82d Abn Div Arty
3-178 Arty (8-in, SP) (SCNG)
4-178 Arty (155-mm, T) (SCNG)
6-82 Arty (155-mm, SP) (Active Army)

30th Infantry Division Artillery (Mech) (NCNG): GSR; on order revert to control 30th Inf Div
1-113 Arty (155-mm, SP) (NCNG)
4-113 Arty (155-mm, SP) (NCNG)
5-113 Arty (HJ) (NCNG)

82d Airborne Division Artillery:
1-319 Arty (105-mm, towed)
1-320 Arty (105-mm, towed)
2-321 Arty (105-mm, towed)
4-73 Arty (155-mm, towed)

10th Marine Regiment:
1-10 Marines (105-mm, towed)
2-10 Marines (105-mm, towed)
4-10 Marines (155-mm, SP)

OCTOBER FIREX 70 began when the XVIII Airborne Corps Artillery FDC called for fire from the 2d Marine Field Artillery Group and the 151st Field Artillery Group on targets located by the corps artillery target acquisition battalion. The intensity of the firing grew as the 82d Airborne Division Artillery and the 10th Marine Regiment joined the exercise early on the second day. More firepower became available to the corps when the 30th Infantry Division Artillery and the 4th Battalion, 17th Artillery, arrived at Fort Bragg late on the second day of the exercise. Firing continued throughout the night with radar registrations, illumination missions, countermortar and counterbattery fires, and harassing and interdiction missions.

By dawn on the last day the stage was set for the final portion of the exercise. Met messages were computed, communications were checked, and check-rounds were fired. Then came the final missions, requiring each of the five major headquarters to mass its fires on targets directed by the corps artillery FDC. The grand finale was a TOT preparation, fired by 15 battalions and witnessed by Lieutenant General William R. Peers, Chief, Reserve Components; Lieutenant General John J. Tolson, Commanding General, XVIII Airborne Corps and Fort Bragg; and other distinguished visitors.

The final touch was added immediately after the exercise when LTG Peers congratulated participating commanders on the success of the OCTOBER FIREX 70, highlighting the importance of the One Army concept and the desirability of future exercises involving all components of the Army.

The success of OCTOBER FIREX 70 cannot be measured only in terms of the firing conducted; it must also be viewed in terms of the advance planning and preparation required and in the solution of problems in the artillery fire direction, communications, and combat service support areas by participating commanders and staffs. Another significant factor was the low cost of the exercise. Funds were not allocated specifically for OCTOBER 70. Active Army units used normal operating and training funds while National Guard and Reserve units used weekend training and operating funds. The Marines participated as part of their semiannual firing exercise at Fort Bragg.

OCTOBER FIREX 70 provided opportunities for artillerymen from two services and three components to work together in a firing exercise, and it provided needed training in field artillery fire support coordination and fire direction. The results were a better understanding of respective problems and a realization that common doctrine and techniques permit rapid and effective massing of fires from battalion to corps artillery level. And the final mission will be long remembered by those who observed it—the massing of the artillery with the corps.

Field Artillery TOE's

All field artillerymen are acquainted to some degree with tables of organization and equipment (TOE). No doubt many have wondered where these tables are prepared and by whom. The purpose of this article is to provide you with this information and, in addition, explain the basic procedures by which a unit commander can influence the TOE of his unit.

Responsibility

At Department of the Army level, the Asistant Chief of Staff for Force Development (ACSFOR) has Army staff responsibility for the designation of DA staff agencies, field commands, and specified activities as TOE proponents. ACSFOR has tasked the Commanding General, US Army Combat Developments Command, (CG, USACDC), to develop all TOE's except military intelligence TOE's which are assigned to the Assistant Chief of Staff for Intelligence (ACSI). CG USACDC further tasks his subordinate branch agencies, such as the US Army Combat Developments Command Field Artillery Agency (USACDCFAA) located at Fort Sill, Oklahoma, for the development, preparation and processing of TOE's, TOE changes, TOE consolidated change tables, and TOE appendixes. The USACDCFAA is the proponent for all field artillery TOE's. At present, USACDCFAA is responsible for 111 separate field artillery tables.

Developmental Stages

New TOE's are developed in three stages, which are the draft plan TOE (DPTOE), the plan TOE, and the final (approved) TOE. The USACDCFAA, with DA approved guidance, develops the draft plan TOE. After development, this draft is coordinated with the US Army Field Artillery School (USAFAS) and all USACDC agencies having an interest. Subsequent to Agency-level coordination the DPTOE is submitted through channels to HQ USACDC, Fort Belvoir, Virginia, for approval. Agency responsibility for TOE development terminates at this point until the post publication review. At HQ USACDC, the Field Artillery Desk completes the development of the TOE. The initial action is an in-house review of the DPTOE in which the HQ USACDC staff may recommend changes or corrections. Upon correction, the DPTOE becomes a plan TOE and is processed through an "area of interest" coordination with the US Continental Army Command (CONARC) the US Army Material Command (USAMC), the Office of Personnel Operations, Department of the Army (OPO, DA), and the Chief of Reserve Components (CORC). Upon completion of this higher level coordination, the plan TOE is submitted to ACSFOR, DA, for final approval. Upon approval the TOE is sent to The Adjutant General for publication.

FA Application

Field artillery TOE's, like field artillery field manuals and other training documents are designated with the 06 or 39 prefix. Each TOE is composed of three sections. Section

I provides general information to include the unit's mission, assignment, capabilities, and limitations. Section II presents the personnel allowances for each subelement of the unit (sections, platoons, etc.) to include the title, grade, MOS, and branch of service for each position; the number of positions required; and remarks pertinent to duty positions indicated. Section III outlines the equipment allowances authorized each subelement of the unit, the federal nomenclature, and the line item number (LIN) for each item. Section III also provides a recapitulation of equipment for the unit by commodity command; i.e. electronics command, mobility command, weapons command, etc.

All TOE's developed by the Field Artillery Agency are for worldwide application. The resulting organizations are structured so that the units can perform their prescribed missions anywhere in the world. Often there is a requirement to alter a basic published TOE to meet the particular needs of a specific unit or group of units, to organize composite units using cellular TOE's, or to organize units to meet personnel or equipment constraints. A modified TOE (MTOE) prescribes the required and authorized allowances of personnel and equipment which the unit needs to perform its mission in a specific geograhic or operational environment. Also, an MTOE is the authority to change an existing MTOE document.

MTOE'S

MTOE's are of two types, detailed and summary. A detailed MTOE is a table which contains specific adjustments to published TOE's at battery level or for smaller sized units. It is used to change the mission, capabilities, and personnel and equipment allowances to meet the specific needs of a particular unit. It is published in the same basic format as a TOE. Only one MTOE will be in effect for a unit at a given time. A summary MTOE, on the other hand, is a table which reflects, in summary form, the modified requirements and authorizations of the units which compose the parent unit; i.e., the same general format as the DA published battalion-level recapitulation tables.

Thus, when a need arises to adjust the authorizations of a particular unit due to geographic or operational requirements, the field artillery commander (usually at battalion, group, division, or corps level) may initiate an MTOE action for his unit(s) under the provisions of AR 310-49. This regulation contains detailed instructions for the preparation of an MTOE and outlines the approval channels to follow. OACSFOR, DA, is the final approval authority. A battery commander who recognizes a need to alter a TOE should make detailed suggestions to his battalion commander, who, in turn, should evaluate and consolidate such requests and initiate the appropriate action according to the guidelines in the regulation. Higher headquarters should consider these suggestions with respect to those of similar units and make appropriate recommendations. It is important for commanders at every level to recognize the necessity for feedback from affected units and to understand the influence a well-prepared proposal for change can have on future TOE's.

The First FO

by
1LT Dale E. Williaims

Brigadier General Albert J. Myer, chief signal officer

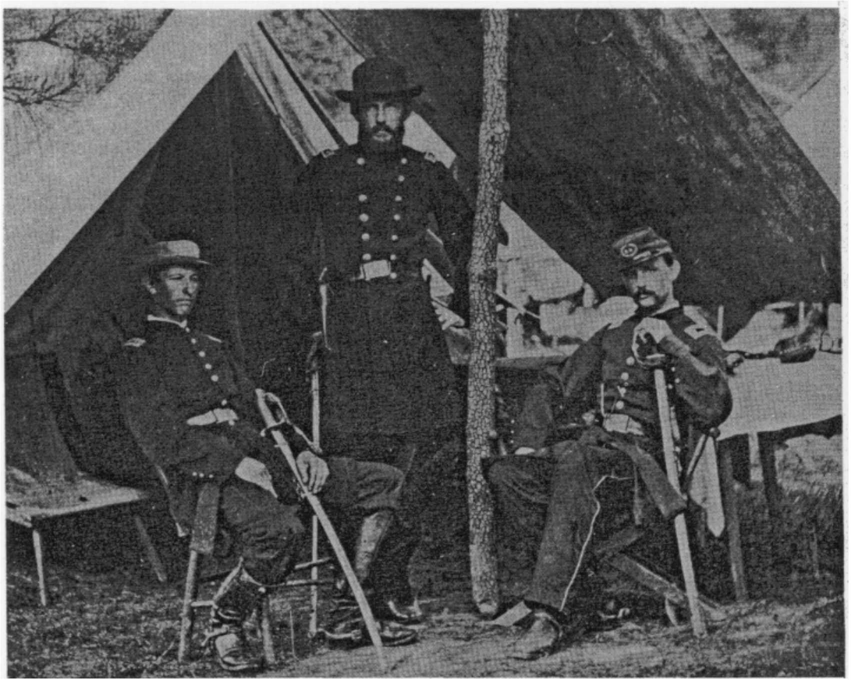
To most northerners in the early months of 1862, it seemed as if the war was almost won. The Confederacy was losing the Mississippi River and all of the West. Its Atlantic coastline was being sealed off, and it was obviously hard pressed. Secretary of War Stanton was so confident that on the 3d of April he noified the Army's recruiting offices to order all recruiting details back to their regiments. The Army of the Potomac, the nation's largest, carefully trained and equipped with everything an army might use, had landed in strength just above Fort Monroe on Virginia's Yorktown Peninsula. The aim of the Army was to crush the Confederate cause by taking its capital, Richmond, some eight miles to the west. The great rebel successes which would send this army scurrying northward to defend its own capital and which would prolong the war were still in the future.

So in May, 1862, President Lincoln's reluctant general, George McClellan, at the head of an army of 100,000 men, was slogging his way up the peninsula toward Williamsburg, which he thought would be strongly defended. The Confederate ironclad Virginia (Merrimack) was still at anchor at Norfolk, threatening the Union Navy. Norfolk had to be reduced before the Federal Navy could safely sail up the James River to protect the Union left flank. To capture the city it was necessary to silence the Confederate batteries on the mainland, particularly those at Sewell's Point.

Target in Defilade

The problem facing the artillery was this: The Confederate guns at Sewell's Point were out of the range of Fort Monroe. The new long-range Union guns on the manmade island of Fort Calhoun (built by Robert E. Lee as a lieutenant of engineers in 1831) could reach the point if the gunners could see. This was the problem. Sewell's Point was hidden from the Union gunners by a sand bar jutting northward from the Virginia coast. But there was a man at Fort Monroe, the Army's first signal officer, who supplied a solution. His name was Alfred Myer.

Major Alfred James Myer had become interested in the art of motion



Major A. J. Myer standing in his tent, Peninsula Campaign, Virginia summer 1862

telegraphy while a student at Buffalo Medical College. In doing research for his thesis, "A Sign Language for Deaf Mutes," he also pondered the military possibilities of this science. After graduation he established himself as a physician and practiced successfully for 3 years before he applied for and received a commission in the Army. He was sent to New Mexico where he found the solution to the problem of flag telegraphy in the signal system used by the Comanche warriors. The young surgeon devoted most of his leisure time to his idea and by 1856 had developed a simple yet efficient flag system for military signaling. A long bureaucratic struggle with the peacetime Army finally resulted in legislation providing for $2,000 for signal equipment and a signal officer with the rank of major, which Myer became. Soon after the war began, he opened a school for signal instruction at Fort Monroe. The tactical situation in May convinced him that the time had come to put his new signal system to the test.

On the 9th of May, the day preceding the landing of Federal troops at Norfolk, Major Myer, along with three lieutenants who were his students at Fort Monroe boarded a small tug and steamed into the choppy waters of Hampton Roads, just out of range of the Confederate guns at Sewell's Point. A mile or so west of Myer and also on the Roads, General Alfred Butler, the immediate commander of the operation, paced the bridge of a Federal gunboat. Myer was the center of a signal-flag network linking General Butler with Fort Calhoun and, finally, with headquarters at Fort Monroe.

FIRE!

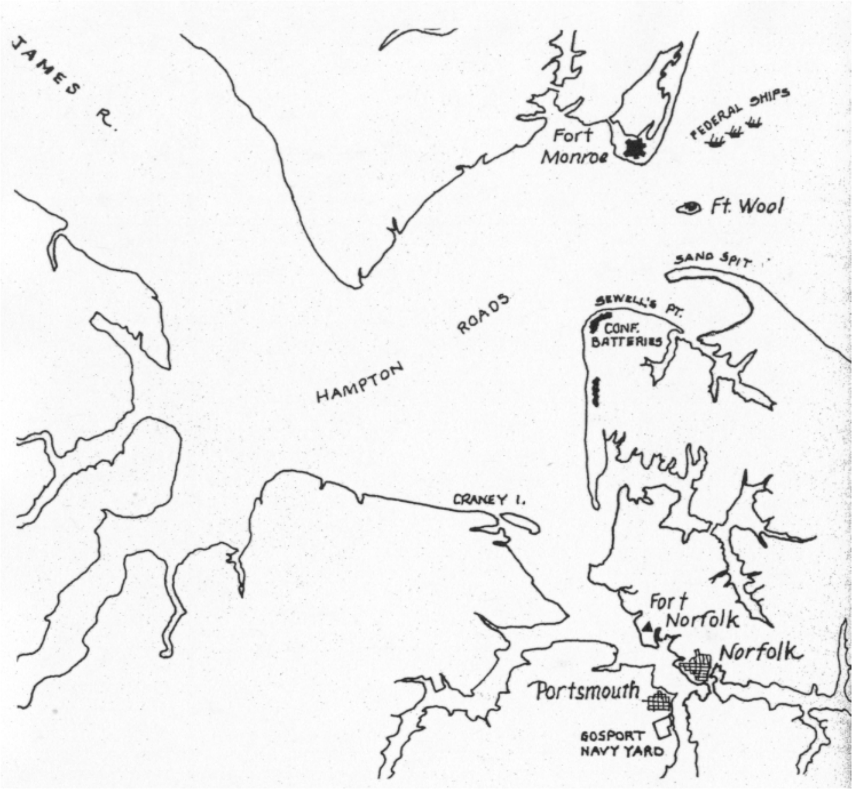
At Butler's command, relayed by Myer to the gunners at Fort Calhoun, the firing commenced. For half an hour the young signal officer reported hits, misses, and corrections, as well as Butler's orders to the guns. The next day the **National Intelligencer** published this dispatch from Fort Monroe: "An experiment with Sawyer's American Rifle Cannon at the Rip Raps (Fort Calhoun) last evening was a brilliant success. Sewell's Point is clearly within range of this tremendous projectile. Seven of the eleven 48-pound shells exploded a short distance from the rebel camp, one of them over their entrenchment. This of course created a great sensation among the secessionists. A house near the secession banner displayed a white flag. The first shot struck Sewell's Point, a distance of 4,300 yards, and exploded; the second struck the water but did not explode; and the third fell within fifty yards of the battery and exploded. General Butler was in a gunboat at Newport News for the purpose of witnessing the firing, and gave the directions by signal for elevating and lowering the range of the gun so as to strike particular points, the results of which were satisfactory in every instance."

Batteries Silenced

The bombardment continued during the day and into the night of the 9th. It was not until Saturday morning, the 10th, that the Confederate batteries at Sewell's Point and Willoughby Point to the west were sufficiently silenced to permit a safe landing. The Federals met very little resistance. The Confederates, just learning of the surprise Confederate abandonment of Williamsburg, were quite ready to leave Norfolk. The invaders found the business district stagnant and the old navy yard destroyed. The Ironclad Virginia was too unseaworthy for the open sea and drew too much water to run the James River to Richmond; she was blown up by her own crew on the 11th of May.

Although Myer's own actions as a forward observer were overlooked by contemporary press reports, he felt that the merits of his system had been proved. The following week he set up between Fort Monroe and Newport News a permanent flagtorch signaling network which operated on a 24-hour basis. Later, Myer went on to organize the signal system used by the Army in the war, to write a **Manual of Signals** in 1868 (which served as the standard work for years), and finally to retire as a brigadier general in 1880.

It cannot be stated with certainty that forward observation from the tug was chiefly responsible for silencing the Sewell's Point Battery, since Navy gunboats were also employed. In the confusion it would have been difficult to identify the source from which the really effective shots were coming.



Hampton Roads

This principle of indirect fire was not again applied in a major war for over 50 years. After the first Battle of the Marne, when the lines stabilized on the western front, the increasingly accurate and voluminous small arms fire drove artillery batteries off the immediate battlefield or into defilade; and the principle which proved effective at Hampton Roads in 1862 was applied in deadly earnest.

The Gap Filler

by
COL Bruce Holbrook

Five years of lessons learned in combat in Vietnam provide a constant source of changes to the program of instruction at Fort Sill. Even so, today there still exists a transitionnal gap from training conditions on the ranges of Fort Sill to the battlefields of Vietnam. Understandably, safety procedures within CONUS preclude the use of such procedures as aerial observation over the impact area, close in forward observer adjustment by sound, close in adjustment of defensive targets around friendly positions, and application of fire direction techniques that involve the use of ICM (Improved Conventional Munitions), beehive rounds, and danger close procedures. These areas are critically important to the young officer being assigned to a combat unit. Add to these the required clearance-to-fire procedures used in Vietnam, and the need for transitional training is obvious.

In Military Region 1, the accurate determination of friendly locations and the obtaining of clearance to fire are made more complex by the numerous hamlets interspersed throughout the low lands and in the Piedmont. Emphasis on joint US and allied operations, supported by isolated fire support bases, serves to vastly complicate the clearance problem. These are but a few of

FDC Instructor

the obstacles the newly arrived field artillery officer must face. For the company grade artilleryman, Vietnam becomes a challenge which, in order to be met successfully, requires that the field artilleryman supplement his formal schooling with as much instant combat experience as he can get.

XXIV Corps Artillery continues to recognize the need for building the confidence and competence of junior leaders facing a myriad of new and unexpected situations. To close the gap between formal schooling and combat experience, corps artillery sponsors three schools for officers and noncommissioned officers. These schools encompass fire direction techniques, forward observer procedures, and firing battery procedures.

All schools are of one-week duration and are located at the Dong Ha Combat Base. Within artillery range of the DMZ, the location emphasizes to the students, should any emphasis be needed, that they are no longer in a CONUS school situation. The schools are conducted by the 8th Battalion, 4th Artillery, under the supervision of the 108th Artillery Group.

The fire direction course, after a brief introduction, focuses on an intense and comprehensive review of fire direction procedures for the first 3 days. Attention is then turned to the Vietnam environment, with emphasis on communications networks, rules of engagement, artillery incidents and lessons learned from past incidents, fire support coordination, defensive fire planning, heavy artillery combined operations, fire clearances, the use of the situation map, organization for 24-hour operation, artillery raid techniques, target analysis, ICM restrictions and danger close procedures.

The fire direction course emphasizes techniques applicable to heavy artillery, although all types of artillery, are touched on. A high quality of instruction is insured by maximum use of ex-Field Artillery School instructors.

To date, over 100 officers have successfully completed the course. The challenge offered by the program of instruction is evidenced by the fact that not all attendees successfully complete the course.

Eyes of the Artillery

The forward observer course provides training for the "eyes of the artillery." Again, a review of fundamentals initiates the course. Following this the attention focuses on the particular skills and tools required by the forward observer in Military Region 1. Instruction in this phase covers junior officer leadership, responsibilities of the FO with in his new unit, map reading, attack of targets with multiple fire support means, safety considerations, ICM, adjustment by sound and at night, aerial observation, fire planning at company level, the use of TOE equipment, field expedients, and characteristics and capabilities of NVA weapons to include crater analysis.

In recognition of the enemy's ability to monitor and react to our communication, particular attention is accorded to the various means of communication. The forward observer student is imbued with the fact that success or failure of a fire mission may depend on his skillful use of available communications. The course affords the opportunity to observe these various means in operation.

During the classroom periods, observer techniques are explained by classroom adjustments, using a remoted radio and blackboard techniques. Once thoroughly indoctrinated, the students trek to one of the northernmost fire bases for a chance to tackle combat adjustment procedures. The "new" observers fire missions on valid targets from either strongpoint A-4 on the Demilitarized Zone or at Camp J. J. Carroll. These missions are supported by South Vietnamese light and medium artillery batteries within range and by the heavy guns of corps artillery.

Completing the artillery team of forward observer, fire direction center and firing battery is the firing battery course, which is open to officers and non-commissioned officers.

Training for the Heavies

It is realized that new arrivals, though having just completed training at Fort Sill, are not sufficiently knowledgeable in 8-in/175-mm battery operations. The course concentrates on all aspects of the firing battery, including direct fire techniques, maintenance, and safety procedures. The instructors for the course make every effort to quickly prepare new chiefs of section with "hands on" training. Two weapons, an 8-inch howitzer and a 175-mm gun, are moved into position at Dong Ha Combat Base, where the students first learn proper maintenance and operation of the weapons system. Live firing then becomes the order of the day as students learn to "cannoneer" in the conduct of live missions.

Though each school attempts to ease the new arrival's transition from a CONUS school environment to "the situation as it really is," the tried and proven technique of examinations is not forgotten. Each day in each course the students are subjected to quizzes. Each course culminates with a final examination. Each student who receives a Certificate of Completion leaves the school knowing that the certificate has been earned. More importantly, the student's parent unit knows that it is receiving a replacement who is ready to step in and contribute.

The schools discussed represent one aspect of XXIV Corps Artillery's implementation of the corps SOP which reads: "Key personnel, such as fire direction officers, forward observers, and chiefs of sections, will be trained and tested before being permitted to perform duties without fulltime supervision."

What do these schools mean to the artillery commander? He knows that his direct representative to the maneuver units, i.e., the forward observer, is trained to support and advise the ground commander.

He knows that his officers supervising technical fire direction activities are imbued with an understanding of and have the ability to apply the standards for producing accurate, timely, and safe artillery fires for the ground commander.

He knows that his firing battery executive officers and chiefs of sections are prepared to complete the work of the artillery team by placing steel where it is requested by the forward observer, directed by the fire direction center, and, most importantly, needed by the ground commander.

Enlisted Evaluation Sytem

by

MAJ Alan H. Byrne

As today's army gears itself to the concept of the modern volunteer army, there is a rapidly growing need for meaningful data which we can readily use to determine a soldier's present and potential value to the service. The Enlisted Evaluation System is one of the primary tools which are now available for accomplishing this difficult task and which can be expected to serve as the basis for expanding our management data.

The Enlisted Evaluation System provides an objective and comparative measure of the military occupational specialty (MOS) competence of eligible enlisted personnel on a worldwide basis. This system serves to identify and recognize the quality soldier, to encourage the soldier's achievement through the Army's promotion and proficiency pay programs, and to provide greater flexibility and versatility in the assignment and utilization of enlisted personnel.

The system makes use of two measuring devices—the MOS evaluation test and the enlisted efficiency report (EER). A third measuring device, the performance test, has been developed for use in conjunction with the evaluation test and is presently being used in a few MOS's, such as clerk typist and bandsman. The evaluation system is a major contributor to many phases of personnel management and is beginning to take on even greater significance as Department of the Army implements its current centralized career management plan for enlisted men, which is similar to that long in use for officers. For example, the Enlisted Evaluation System provides important information for review whenever an enlisted man is considered for promotion, schooling, reassignment, classification, retention, and other actions bearing on his career.

MOS Testing

With the exception of those individuals serving in Vietnam, and some other specific categories of personnel, annual primary MOS (PMOS) and alternate year secondary MOS (SMOS) evaluation testing is mandatory for all Active Army enlisted personnel in pay grades E-3 through E-8 who have completed 24 months of active service or who are in Regular Army status, have completed 18 or more months of continuous active duty, and have a commitment obligating them for 4 or more years of active service. Evaluation testing of personnel in pay grade E-9 is mandatory only for the initial evaluation or if so directed by the unit commander because an E-9 has failed to maintain his MOS proficiency; however, these individuals frequently take annual MOS evaluation tests in order to qualify for proficiency pay (superior performance pay). Since 1964, when the evaluation system was expanded, enlisted personnel assigned to active units of the National Guard and Army Reserve in grades E-4 and higher have been subject to evaluation testing in their duty MOS (DMOS).

The MOS evaluation cycle formally begins with the publication of the Department of the Army Quarterly Test Announcement Circular, which announces those MOS codes to be evaluated during a given test period (MOS tests are administered in February, May, August, and November of each year). This circular normally reaches the field approximately 150 days prior to the test month. Upon receipt of this document, the personnel officer screens his records to determine which individuals should be scheduled for evaluation.

The test control officer administers the system for his installation or command and is the local authority on the Enlisted Evaluation System. He further coordinates with the personnel officers of the units he serves and requisitions the appropriate test aids from the US Army Enlisted Evaluation Center (USAEEC), Fort Benjamin Harrison, Indiana, 120 days prior to the test period.

Approximately 90 days prior to the test period, the soldier receives his test aid ("Study Guide for Maintaining MOS Proficiency"). This document lists the study references for the soldier's MOS, available nonresident courses, job requirements for each MOS as indicated by subarea and major area breakdown and encourages the soldier to develop a year-round study program to increase MOS proficiency. Occasionally, reports received from the field indicate that soldiers are receiving their test aids late. To preclude this from happening, the adjutants general, test control officers and personnel officers should make every effort to insure that the distribution of test aids is not delayed at the unit level.

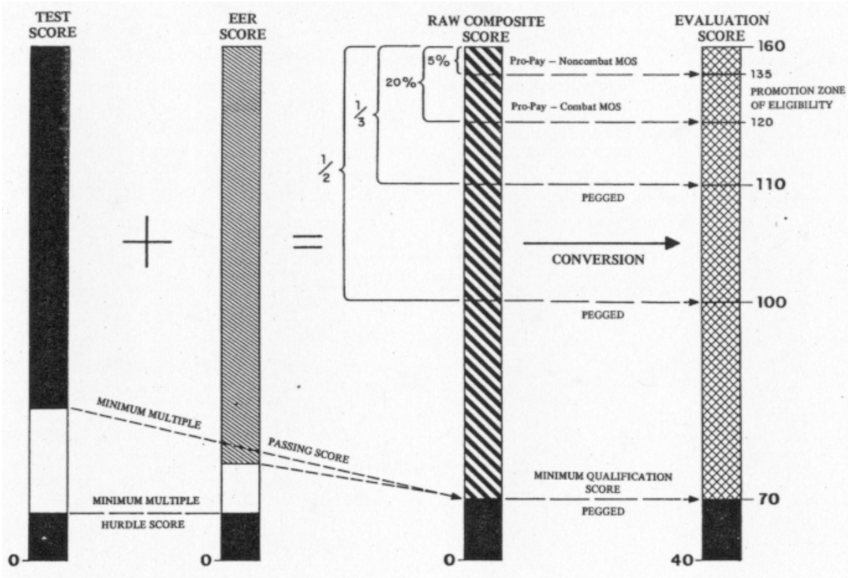
Approximately 60 days prior to the test period, the test control officer requisitions the appropriate MOS evaluation tests from USAEEC, and, as the test month approaches, notifies the units of the testing schedule. Once the MOS evaluation test has been administered, the test answer sheets are forwarded to USAEEC, where they are individually scored. The enlisted efficiency reports, which have already been forwarded by the personnel officers, are individually scored at USAEEC as they are received.

Exam Scores

A single evaluation score is developed for each soldier. The raw test score is statistically combined with the enlisted efficiency report weighted average (EERWA) and the performance test score, when applicable, to obtain a raw composite score for each MOS, pay grade, and skill level. The composite score is then converted to the MOS evaluation score. This process is similar to that used in transforming centigrade temperature to fahrenheit or knots to miles per hour. In other words, the relative values of the composite scores are simply converted to a measurement score similar to the Army standard score scale. The secondary MOS (SMOS) evaluation score is developed in much the same manner except that the EER score is not used in the computation.

Evaluation scores for an MOS code reflect the relative capabilities of enlisted personnel (by MOS, skill level, and pay grade) to perform the total job requirements of the MOS. These scores may range from a low

MOS EVALUATION SCORE



of 40 to a high of 160. In order to be qualified in his MOS, skill level, and pay grade, an individual must make a score of at least 70, which denotes that his performance is minimally acceptable. A score of near 100 means than an individual is about average, and a score of 110 or more places an individual in the top one-third of his group. A score of 120 places the individual in the top 20 percent, and a score of 130 places him in the top 10 percent.

A qualifying score of 70 is the only evaluation score which has any "absolute" relationship to verification of the MOS. Evaluation scores below 70 are failing scores. The minimum verification score of 70 is based upon a specific minimum number of questions answered correctly in each test and a specific minimum score attained on the enlisted efficiency report.

The MOS evaluation scores are meaningful only when used to compare the relative ranking of proficiency levels of individuals within the **same** MOS, skill level, and pay grade. One cannot compare the scores of personnel in different skill levels, in different pay grades within the same MOS, or in the same skill level in different MOS's.

Multiple-hurdle scoring is employed by establishing an absolute minimum score for each of the measurement instruments—the evaluation test, the enlisted efficiency report weighted average, and the performance test, when used. A soldier who fails to exceed the minimum score on any one of the instruments is declared unqualified and receives an MOS evaluation score of 40.

After the scoring has been completed, an enlisted evaluation data

<table>
<tr><td colspan="6">ENLISTED EVALUATION DATA REPORT
(AR 600-200 and AR 135-205)</td><td colspan="3">TCO NUMBER</td><td colspan="2">ROSTER NUMBER</td></tr>
<tr><td colspan="11">SECTION I – IDENTIFICATION</td></tr>
<tr><td colspan="6" rowspan="2">THRU: COMMANDING OFFICER
UIC:

TO:</td><td colspan="3">EVALUATED IN</td><td colspan="2">EVAL PERIOD</td></tr>
<tr><td colspan="3">SSAN</td><td colspan="2">GRADE</td></tr>
<tr><td colspan="11">SECTION II – SCORES</td></tr>
<tr><td colspan="2">a. EFFICIENCY REPORTS</td><td colspan="2">b. MOS TEST-WRITTEN</td><td colspan="4">c. MOS TEST-PERFORMANCE</td><td colspan="3" rowspan="4">d. MOS EVALUATION SCORE</td></tr>
<tr><td rowspan="2">Average EER Score</td><td rowspan="2">Average for Grade</td><td rowspan="2">Number Correct</td><td rowspan="2">Average for Grade</td><td colspan="2">PT 1</td><td colspan="2">PT 2</td></tr>
<tr><td>Score</td><td>Average Score</td><td>Score</td><td>Average Score</td></tr>
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</table>

SECTION III – MOS TEST RATINGS Major Areas (See MOS Test Aid DA PAM 12-	% of Test	Very Low	Low	Average	High	Very High

SECTION IV – CAREER MANAGEMENT INFORMATION	
a. MOS VERIFICATION	b. PROFICIENCY PAY ELIGIBILITY

SECTION V – COMMANDER'S/SUPERVISOR'S REVIEW

I HAVE REVIEWED THIS REPORT AND HAVE DISCUSSED WITH THE INDIVIDUAL THE REPORT'S MEANING AND IMPACT ON CAREER DEVELOPMENT.

☐ AVERAGE EER SCORE (SEC IIa) is BELOW the average for individual's grade. I have recommended actions to improve duty performance.

☐ EVALUATION SCORE (SEC IId) is BELOW 70 and I have taken action in accordance with para 2-35, AR 600-200.

☐ MOS TEST RATINGS (SEC III) show LOW or VERY LOW results. I have suggested methods to improve job knowledge.

________________ DATE

________________ SIGNATURE OF COMMANDER/SUPERVISOR

PERSONAL IN NATURE – USE PROTECTIVE COVER & ENVELOPE!

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Enlisted evaluation data report

report (EEDR) is prepared and forwarded to the individual through his unit commander. The new EEDR, which became effective with the February 1971 test period, provides the soldier with a wealth of information never previously reported. The new report shows the soldier the number of questions he answered correctly on his MOS evaluation test and the average number answered correctly for his MOS, skill level, and grade; his average EER score, based on all reports that have been submitted on him since 1 July 1970, and the average EER score for his grade; his MOS performance test score (if applicable) and the average performance score for his MOS skill level and grade; and an analysis of his test performance in terms of how well he did in each of the major job-requirement areas of the test and the percentage range for the number of questions he answered correctly in each area. The column "% of Test" indicates the proportionate weight of each major area of the MOS test. An X, placed in one of the adjectival rating blocks (Very Low through Very High), indicates how well the soldier did in each of the major areas. This rating is based on a percentage obtained by dividing the number of questions in that major area of the test into the number of questions he answered correctly. A rating of "High" indicates that he answered at least 76 percent of the questions correctly. If this percentage had been 91 percent or higher, he would have received a rating of "Very High." The ranges for the other ratings are: 0-29 percent—Very Low; 30-45 percent—Low; and 46-75 percent—Average. In addition, there is a new section which informs the soldier as to whether or not he verified his MOS and his eligibility for proficiency pay, and also a section in which the commander indicates that he has reviewed the enlisted evaluation data report with the soldier. The reverse side of the EEDR provides detailed information concerning interpretation of each section of the report.

Test Development

The US Army Enlisted Evaluation Center continuously strives to develop MOS evaluation tests which produce a high correlation between test scores and job performance. Personnel psychologists at USAEEC analyze AR 611-201 and coordinate with 42 supervisory and item writing agencies (IWA) located within DOD and DA organizations and at the US Army Service Schools, in order to carefully determine the duties and scope of an MOS. A test plan is then developed which outlines each major area and subarea that the MOS evaluation test will cover. The test plan is forwarded for coordination to the appropriate IWA, which is staffed by well qualified military and civilian MOS experts. (The US Army Field Artillery School is the proponent for all MOS evaluation tests within the FA field). The item writers furnish basic reference lists for the test aid and compose 200 multiple-choice questions, of which 125 will eventually be selected for each test. Upon completion, the reference lists and test questions are forwarded to USAEEC, where they are further processed. Each question is reviewed, edited, and checked for currency. The best questions are selected for the MOS evaluation test.

While this test can best be described as a device for measuring what the soldier knows about his job, the second measurement instrument, the enlisted efficiency report, measures how well the soldier actually performs his job.

Submitting Reports

The current enlisted efficiency reporting system became effective on 1 July 1970. In order to minimize the administrative workload in the field, the EER reporting system was modified, effective 1 January 1971, to reduce the frequency of reports.

With the exception of those individuals serving in Vietnam, EER's are required every 6 months for soldiers in pay grades E-5 and above who have more than 3 years active federal service. This requirement is in accordance with a schedule outlined by pay grade in paragraph 8-8, AR 600-200. Special reports may be prepared any time that a soldier's duty performance has been so outstanding or so deficient as to warrant submission of a report. A report is also required when a soldier (E-5 or above) departs on a permanent change of station (PCS) and it has been more than 90 days since his last report was submitted. The requirement for reports on a change of duty" and "change of rater" have been eliminated.

Only one annual EER, to be cycled with the annual primary MOS evaluation test, is required for all other soldiers in pay grades E-3 and above who are eligible for MOS evaluation. The provisions for special EER's as stated earlier also apply. A report is also required when a soldier (E-3 and above) departs on a PCS and is scheduled for MOS evaluation within the next 90 days.

The modified enlisted efficiency reporting system for soldiers serving in Vietnam remains unchanged. Two EER's are prepared for soldiers in pay grades E-5 and above who are credited with 3 or more years of active Federal service. The first EER is prepared not earlier than 3 months and not later than 6 months after the individual's arrival in country. The second EER is prepared prior to the individual's departure from Vietnam. Special reports may also be prepared under the provisions previously stated. Only one EER is required for all other soldiers in pay grades E-3 and above who will be eligible for MOS evaluation upon departure from Vietnam.

In summary, the Enlisted Evaluation System is an important part of the Army's overall personnel management system. **MOS tests administered under the system determine how much a man knows about the duties of his MOS. Efficiency reports reflect how well he applies this knowledge to his job**. The results of these two measurements are combined to produce an evaluation score which may entitle the individual to additional pay and place him in line for promotion. Similarly, the evaluation score is important to those responsible for the individual's career, for it gives them a meaningful yardstick by which to guage the man's present and potential value to the service.

Contact Team

In 1962 the then CONARC Commander, General Herbert B. Powell, stated in a letter to the Commandant of the US Army Artillery and Missile School that he looked upon the School as his principal advisor and representative for organization, doctrine, training, tactics, and techniques of field artillery. In this connection all views and recommendations were to reflect a worldwide consideration of user opinion. The US Army Artillery and Missile School was authorized direct contact within CONARC command elements and contact through normal channels to Department of the Army, Headquarters US Army Combat Developments Command, US Army Materiel Command, and overseas commands.

Realizing that to obtain information from field artillery organizations it was also necessary to provide information, the US Army Field Artillery School started a two-way program of soliciting information from CONARC organizations and providing them with on-the-spot assistance. This approach has proved beneficial to all concerned. The responsibility for coordinating the visits of the Field Artillery Contact Team is delegated to the Office of Doctrine Development, Literature and Plans (DDLP) of the US Army Field Artillery School.

The primary mission of the contact team is to assist the host organization with the equipment and problems that currently exist. The assistance theme of the team is the point to remember. Team members provide assistance where and when requested and the only report made by the team is an after action report to the Office of Doctrine Development, Literature and Plans. This report is used to improve the performance of the contact team on future visits and to permit follow-up on any unfinished business.

USAFAS does not maintain a standing contact team. Instead, teams are tailored to fit the requirements of the host organizations, and team members are provided by any or all of the following elements of the School, as required.

Office of Director of Instruction
Office of Doctrine Development, Literature and Plans
Artillery Transport Department
Communications & Electronics Department
Guided Missile Department
Gunnery Department
Tactics/Combined Arms Department
Target Acquisition Department
Nonresident Instruction Department

Contact teams may vary from 3 or 4 NCO's to 13 or 14 officers and NCO's, with a 12-man team being the norm. The flexibility in composition and orientation of teams is illustrated by a comparison of the last team sent to Fort Bragg and a team sent to Fort Carson. The team sent to Fort Bragg, at the request of the 82d Airborne Division, consisted of three NCO's who provided 1 week of FADAC instruction to members of the division. The team sent to Fort Carson, at the request of the

4th Infantry Division Artillery, consisted of one colonel, three majors, three captains, and four NCO's. The activities of members of this team ranged from a 1-hour presentation on nonresident instruction (by NRID) to 8-hour blocks of instruction (by the Gunnery Department) on 155-mm and 8-inch howitzer firing battery and FDC operations and Honest John FDC procedures. In addition, representatives of the Tactics/Combined Arms Department presented formal instruction in fire support coordination and artillery fire planning, and the Artillery Transport Department visited several units of division artillery. Representatives of the departments also gave presentations on trends and future developments in the field artillery.

Normally, requests for assistance in the form of a contact team are received through one of the departments of the School and forwarded to the Office of Doctrine Development, Literature and Plans for action. If the School receives no request for a contact team during a quarter, DDLP contacts S3's of the various CONARC major artillery organizations and offers assistance. If an organization indicates it desires a visit by a contact team, the organization is requested to state the specific areas in which assistance is requred. From this information, USAFAS will draft a proposed schedule of presentations and instruction and submit it to the host organization.

Four contact team visits are programmed each year. Ideally, one visit will be made each quarter; however, scheduling difficulties experienced by the host organizations in the past have caused deviations from this schedule. Efforts are made to visit the major CONUS artillery organizations every other year. Again, scheduling difficulties and host organization requirements have interrupted this distribution of contact team services.

Now, how do you make arrangements for a team visit and, secondly, what must your organization provide? In answer to the first question, you only have to call the Office of Doctrine Development, Literature and Plans, USAFAS, AUTOVON 639-2401 or -3197. In answer to the second question, the team will require only appropriate messing and billets, classrooms or work areas, TOE equipment, and on-post transportation as required. Training aids, such as slide projectors and Vu-Graphs will be coordinated in advance. The presentations will be tailored to the facilities and equipment available. The USAFAS Contact Team is available to your CONUS organization!!! Why not use it?

Managing Ammunition

by

MAJ Paul Kearney

Artillery ammunition demands the most efficient management possible at all levels. Much has been written about the planning, control, and management of ammunition at division and higher levels. However, at the division artillery, artillery battalion, and artillery firing battery levels, specific guidance is almost non-existent. Accordingly, the purpose of this article is to present a method of managing artillery ammunition that was tried and proved effective by the 1st Infantry Division Artillery in the Republic of Vietnam (RVN).

RSR/ASR Modified

Before we proceed, the ammunition required supply rates (RSR) and available supply rates (ASR) and their application in RVN must be considered. The RSR was not a factor in determining the ASR except when additional allocations were requested. The ASR from higher headquarters was expressed as a total quantity rather than as a rate per weapon per day. This was a departure from established ammunition management policy. In effect, the ASR placed a greater limitation on ammunition that could be drawn than on that which could be expended.

Ammunition stockage objectives and reserves peculiar to RVN were established. Because of the widespread deployment of artillery units on fire support patrol bases (FSPB) plus the fact that most FSPB's were relatively isolated, the basic load of artillery ammunition for each firing battery was substantially increased Further, because many FSPB's were accessible only by air, pre-Vietnam concepts of resupply proved to be obsolete. In addition to increasing the basic load and establishing battery stockage objectives, ammunition reserves had be to maintained at battalion and division artillery levels for immediate use in the event of unforseen enemy actions. Thus, three levels of stockage objectives and reserves were established to assist in the management and resupply of artillery ammunition in RVN—battery stockage objectives, battalion ready-reaction reserves, and the division artillery operating reserve.

Stockage Levels

Battery stockage objectives consisted of four types, or levels, each with a specific application. They were—

- Maximum Stockage Objective (MAXSO)—the maximum allowable level in a battery position. This level was dictated by the safe storage capacity at the particular FSPB.
- Optimum Stockage Objective (OPTSO)—the desirable, or optimum, level in a battery position. Daily resupply operations were aimed at maintaining this level.
- Minimum Stockage Objective (MINSO)—the lowest desirable or acceptable in a battery position under normal circumstances. Whenever stockage fell below this level, combat-essential resupply was considered. Also, in preparation for

unit redeployment, ammunition stockage was reduced to the minimum level by curtailing resupply or by backhauling.

- Combat-Essential Stockage Objective (CESO)—the lowest allowable level in a battery position. Combat-essential (CE) resupply was automatically requested whenever stockage fell below this level. Requests for CE resupply missions were forwarded by the most rapid means through S3/G3 channels and required the approval of each commander from battalion to field force (corps).

The types of artillery ammunition controlled by battery stockage objectives included high explosive (HE), illumination (ILL), white phosphorous (WP), beehive (BH), and improved conventional munitions (ICM). Ammunition for all calibers of artillery weapons under the division artillery was controlled. The 4.2-inch mortar platoons, attached from infantry brigades, were organized under the division artillery.

Table 1 shows battery stockage objectives used in the 1st Infantry Division Artillery in RVN.

Battalion ready-reaction reserve ammunition was maintained in a ready-to-go configuration to provide immediate support for such contingencies as the rapid deployment of ready-reaction forces requiring artillery support, combat-essential resupply missions, and other requirements for ammunition when the required reaction time was not sufficient to allow for drawing and handling. Ready-reaction reserve ammunition was prepared in helicopter sling loads for immediate liftout. These battalion-level reserves were colocated with each battalion headquarters at a base camp. Table 2 shows types and quantities of ammunition included for each battalion.

The division artillery operating reserve consisted of sufficient ammunition of each primary type and all calibers to support all division artillery units for a 5-day period. Computations were based on past

CALIBER	TYPE	MAXSO	OPTSO	MINSO	CESO
105-mm	HE	2,000	1,600	1,300	1,000
	ILL	400	320	250	150
	WP	100	60	50	20
	BH	50	36	24	10
	ICM	90	60	45	30
155-mm	HE	1,400	1,200	1,000	600
	ILL	500	400	250	150
	WP	64	48	36	24
	ICM	24	18	12	6
8-inch	HE	800	600	400	200
	ICM	16	12	8	4
4.2-inch	HE	1,600	1,200	1,000	800
	ILL	500	300	200	150
	WP	100	50	40	25

Table 1

TYPE	105-mm	155-mm	8-Inch
HE	800	600	300
ILL	160	200	NA
ICM	100	18	6

Table 2

TYPE	105-mm	155-mm	8-Inch	4.2-Inch
HE	10,000	2,400	500	2,500
ILL	700	300	NA	400
ICM	100	50	6	NA

Table 3

expenditures. This ammunition was stored in division artillery-operated handling and storage areas or ammunition supply points (ASP) located at two base camps where no logistics command ASP had been established. Table 3 shows quantities and types of ammunition included in the operating reserve.

Examples

Now that some of the management tools have been explained, it should be evident that explicit controls and procedures were established at battery and battalion levels. These tools and control procedures may now be employed to show how artillery ammunition was managed in the 1st Infantry Division Artillery in RVN. Since 105-mm HE ammunition represented the greatest expenditures, it will be used in the following example.

Assume that field force (corps) artillery allocated 60,000 rounds of 105-mm HE ammunition to division artillery for a 31-day ASR period. The simplest and most obvious way to compute the number of rounds per weapon per day (ASR) allowed by the allocation would be as follows:

$$\frac{\text{Rds allocated for ASR pd}}{(\text{no of days in pd}) \times (\text{no of wpns})} = \text{ASR}$$

or

$$\frac{60{,}000 \text{ rds}}{(31 \text{ day}) \times (54 \text{ wpns})} = 35.8 \text{ rds}$$

In this example the ASR is 36 rounds per weapon per day. However, one of the fallacies of this method is that it does not take into consideration the amount of ammunition on hand at the start of the ASR period or the stockage objectives and reserves. These factors can seriously affect the quantity of ammunition that is actually available for expenditure. For example, if the amount on hand is less than the total stockage objectives, the quantity available for expenditures will be less than the allocation. Conversely, if the amount on hand exceeds the stockage objectives, the excess can be added to the allocation to increase the quantity available for expenditures. Let us take as an example total stockage objectives and reserves to include OPTSO at battery level at 26,800 rounds of 105-mm HE ammunition. Assuming that the total on hand at the start of the ASR period was 23,400 rounds, the effect can be shown as follows:

Total SO & Reserves	26,800	
Total OH at start of pd	23,400	
Difference	3,400	rds
Allocation for ASR pd	60,000	
Less difference	3,400	
	56,600	rds

Now the basic computation may be repeated using more accurate data:

$$\frac{56{,}600 \text{ rds}}{(31 \text{ days}) \times (54 \text{ wpns})} = 33.8 \text{ rds}$$

The ASR can now be correctly stated as 34 rounds per weapon per day for the ASR period. Thus, the amount of ammunition on hand must be considered in ASR computations when stockage objectives and reserves are maintained.

Implementation

The computations in the preceding examples are used to determine the quantities available for expenditure. However, to determine the quantity required for expenditure during a given period, the average expenditures for the period immediately past—usually 30 days—must be included. This technique was employed in RVN to compute requirements (RSR) for additional allocations. In addition to past trends, such programmed expenditures as defense against rocket and missile attack (DARMA) and planned operations were carefully considered in determining ammunition requirements.

The types of artillery ammunition most commonly controlled by ASR were HE, ILL, and ICM of all calibers. Whenever these types of ammunition were not controlled by higher headquarters, ASR's were self-imposed by division artillery to provide better control of subordinate units and to conserve Army assets. From the battery and battalion points of view, therefore, these types of ammunition were always controlled by ASR.

By use of the techniques discussed earlier, the exact quantities of ammunition available for expenditure during each ASR period were computed separately for each subordinate battalion. The available supply rates expressed as rounds that may be expended per weapon per day were published by the division artillery S3. The division artillery S4 suballocated the ammunition to each battalion in quantities designed to allow firing at the rate established by the S3.

Daily ammunition expenditures were monitored and controlled through operations and logistics reports. Daily resupply requests and periodic reports from the division ammunition officer allowed the S4 to monitor and control the amount of ammunition drawn by each unit. Checks and recomputations were made throughout each ASR period to insure that the ammunition plan was always responsive to changes in the tactical situation.

Although the requirements for various quantities and types of ammunition as well as the concept of deployment will certainly differ from theater to theater, the basic management concepts presented herein may be useful in improving guidelines and controls for artillery ammunition worldwide. Artillery ammunition is an essential dimension of firepower and maneuver and must be managed accordingly. The techniques and methods presented were used successfully to manage approximately 100,000 rounds of artillery ammunition expended monthly by the 1st Infantry Division Artillery in the Republic of Vietnam.

Octofoil

In February 1971, at Fort Belvoir, Virginia, the 9th Infantry Division's Octofoil Association was reactivated. This association would like to establish contact with all former "Old Reliables" who served with, were assigned to, or were attached to the 9th Division from February 1966 through November 1970.

The purpose of the association is to perpetuate the history and accomplishments of the 9th Division and to foster a spirit of comradeship and fraternity among former members of this division.

Local chapters and those individuals interested in forming local chapters of the association are encouraged to contact chapter organization chairman Colonel Ray Smith, Chief, USA Nuclear Weapons Surety Group at Fort Belvoir.

Current projects planned for the association include a summer publication, a quarterly newsletter, and a reunion in the spring of 1972.

For additional information, contact Major Tommy B. King at the US Army Engineer Center, Fort Belvoir or Captain Jay B. Martin, Fort Belvoir Information Office, 664-3356/2821, Fort Belvoir, Virginia 22060.

Artillery Helped Win the West

by
COL (Ret) Robert M. Stegmaier

Gatling Gun similar to the ones available to the Seventh Cavalry Regiment at the Little Big Horn

The written history of the United States stresses the roles played by the cavalry and the infantry during the Indian Wars. But what is often not described is the important part played by the artillery in these wars.

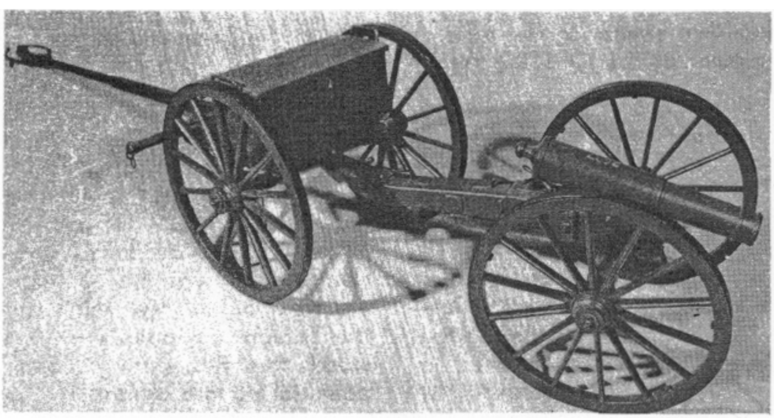
For example, in 1876 Major General Nelson Miles (later to become Chief of Staff of the United States Army) was in command in the war against the Sioux. His forces were outnumbered three to one. But in a parley with Sitting Bull, he gave the famous chief 15 minutes to decide whether to capitulate or to fight. And true to his word, 15 minutes after his ultimatum, he gave his troops the command to charge. What gave General Miles the confidence to order this charge? It was his artillery. He was one of the few commanders in the Indian campaigns who understood the devastating power and potential of this supporting arm. The Indian foe under Sitting Bull broke under the artillery fire and the cavalry pursued relentlessly for forty miles. The combination of artillery and cavalry resulted in a significant victory.

On the other hand, when the Seventh Cavalry Regiment journeyed toward its fatal meeting at the Little Big Horn, there was no accompanying artillery. Even an offered Gatling Gun platoon had been turned down. The outcome of that en counter was, of course, annihiilation.

Guns Which Fire Twice

The Sioux were not alone in their mortal dread of artillery. Francis Parkman in his **Oregon Trail** describes an artillery demonstration staged by Colonel (later Brigadier General) Stephen Watts Kearny to impress the Arapahoes. The Arapahoes had "lately committed numerous murders and COL Kearny threatened that if they killed any more white men he would turn loose his dragoons upon them and annihilate their nation. In the evening, to add effect to his speech, he ordered a howitzer to be fired and a rocket to be thrown up. Many of the Arapahoes fell flat on the ground, while others ran away screaming with amazement and terror. On the following day they withdrew to their mountains, confounded at the appearance of the dragoons, at their big gun which went off twice at one shot, and at the fiery messenger which they had sent up to the Great Spirit. For many months they remained quiet and did no further mischief . . ."

Artillery proved effective on the plains early in our history. In a journal kept on the Lewis and Clark expedition in 1804, the following account of an encounter with the Sioux is recorded: "To their (the Sioux's) astonishment the so greatly outnumbered Americans manifested an instant readiness to fight. Clark drew his sword, companions paddled furiously to his rescue and the cannon on the keelboat were brought to bear . . . They possessed the military superiority to annihilate the American force, but it had been made clear that any attack would be met by a resistance that would inflict serious Indian losses . . . By



Twelve-pound field gun in use during the Indian Wars

their unwavering firmness, Lewis and Clark had succeeded in the first of their main missions. They had broken the Sioux blockade and opened the Missouri to American use. The Sioux were to remain difficult for the next three-quarters of a century but never again were they to deny the navigation of the river."

Delivering the Chief

In 1809, Thomas James, on the Missouri River, reported the Arikaras as being difficult. His party was charged with returning Chief Shikara of the Mandans to his nation after a trip to Washington to see the "Great White Father." The year before, Captain Nathaniel Pryor, with 40 men and no artillery, had been denied passage through the Arikara nation. James' story is as follows: "On approaching their village, we took precautions against attack . . . When within half a mile of the village we drew up the cannon and prepared to encamp. The whole village came out in a body, as it seemed, to meet us. They had not come far toward us when an old chief rode out at full speed and, with violent gestures and exclamations, warned and motioned back his countrymen from before our cannon . . . He supposed we were about to inflict a proper and deserved punishment for the attack on Captain Pryor's troops and the murder of eight or ten of them the year before . . . They agreed to come to us and hold a council if the company's force would lay aside their arms and turn the cannon in the opposite direction." Chief Shikara was safely delivered to his people.

A dramatic example of the use of artillery to save a wagon train occurred on the Santa Fe Trail in 1829. Surrounded by Indians, the wagon train had to summon immediate aid. Charles Bent (later to become governor of New Mexico) asked for volunteers to go for help and furnished them the fastest horses in the train. He also loaded a small cannon with powder and small shot. At twilight a match was touched to the cannon fuze, and with the resulting roar the Indian ponies bucked and ran uncontrollably in all directions. Bent's volunteers chose this moment to make their dash through the circle of Indians and successfully rode to obtain help from troops stationed on the Arkansas River.

Opening the Waterhole

It was during the Civil War, however, that the artillery was most dramatically and effectively employed in the west. At Apache Pass, Arizona, Brigadier General James H. Carleton's California Legion was met by hostile Apaches, who were entrenched around the only water available for miles. The Legion was accompanied by two mountain howitzers, which "at 5-degrees elevation could hurl a 6.9-pound shell 1,000 yards as well as firing spherical case (shrapnel) and canister at ranges of 800 and 250 yards, respectively." These howitzers were brought up and fired. The Apaches, facing artillery for perhaps the first time, scattered; and the waterhole was opened to the Californians. An Apache warrior later reported: "We were doing all right until you begin firing wagons at us."

In 1862, Kit Carson went to the Texas Panhandle to punish the Kiowas and Comanches. He had a force of 350 volunteers and 72

Apache and Ute scouts. Near Bent's Fort, Carson's troops attacked a Kiowa village and, after overrunning it, headed for a neighboring group of Comanche lodges. Suddenly, Carson discovered that his small force was facing 1,500 aroused warriors. Retreat was essential. The artillery skillfully covered the retreat. Later, the Indians said "that if the whites had not had 'the guns that shot twice,' they would never have allowed a single white man to escape."

Saving Ft. Ridgely

It was in Minnesota, however, that artillery won one of its greatest victories. The year was again 1862; the site was Fort Ridgely, which at one time had been an ordnance post. In its arsenal there were "one six-pounder, two 12-pounder mountain howitzers, and several 24's, with ample ammunition and equipment." On August 22, Little Crow assembled his warriors for an overwhelming onset. The senior officer at the fort, Lieutenant Timothy Sheehan, rallied his troops for a last stand on the parade ground.

Then the "wagons that shoot," as the Indians called the artillery, went into action. A Sergeant Jones, who had trained some of the fort's troopers as cannoneers to break up the routine of normal garrison life, wheeled around a 12-pounder and raked the flank of the Sioux onrush. Shattered, the attack recoiled. As the Sioux massed in other quarters, gunners spun elevating wheels and laid on targets. Shells set afire a barn full of warriors. Blasts of canister scoured the ravines, one of the spreading balls gouging a gash in the scalp of Little Crow himself. A 24-pounder dropped a shell into the Indian camp. With its burst, panic erupted and squaws, ponies, and dogs scattered in wild flight.

But despite the artillery, the Sioux furiously continued the attack. Sheehan's infantry fell back, their ammunition running low. Artillery came to the rescue again when canister shells were opened and their ball served out to the infantry.

The Sioux put the torch to a big haystack. The fort's woodpiles began to burn. Yelping warriors emerged from the dense yellow smoke. They charged Jones' barricaded gun. Under heavy fire, the sergeant depressed the muzzle and gave them a pointblank blast and then elevated the gun to shell snipers in the stables, stores, and ravines. A 24-pounder was positioned beside Jones' piece and double-charged with canister. When the Sioux launched their main assault with a strong supporting column, both guns crashed into rapid fire. The 24-pounder was loaded with shell. The projectile, well-fuzed and aimed, screeched down to split the Indian van from its support. With that mighty detonation, Fort Ridgely was saved.

Destroyed Confidence

In 1873, an artillery dud brought an even quicker end to the Modoc War. The Modocs had taken refuge in the caves and crannies of the lava beds. Their medicine man, Curly Headed Doctor, had promised that no Moduc would be killed by a soldier's weapon. Through several days of combat, the prediction proved true. The Army suffered defeat after defeat but there were no deaths among the Modocs. Finally, little coehorn mortars, their barrels only 30 inches long, were brought into the attack. One shell dropped into an Indian trench but did not explode. A warrior picked up the shell and tried to pull out the fuze with his teeth. The shell exploded killing him and two companions. With Curly Headed Doctor's spell finally broken, the confidence of the Modocs disintegrated and they soon surrendered.

INTERIM CHANGE TO ATT's

Inquiries received from the field indicate that scoring procedures specified in ATT 6-157, 9 July 1970, Field Artillery Battery Light (Medium) Howitzer, Towed (SP) and in ATT 6-358, 20 April 1971, Field Artillery Battery, Heavy Towed (SP) for a nonorganic observer furnished the tested unit are not clearly understood. To insure uniformity of testing procedures, the following changes to the above ATT's have been forwarded to CONARC with a recommendation for expeditious publication by TAG:

ATT 6-157, page 20, paragraph 21d(7)(b) and note are rescinded and the following substituted: "If, during the conduct of an area mission, the nonorganic observer makes an error which will result in a faulty fire for effect (i.e., misspotting for range, moving the wrong way or ignoring obvious deviation upon entering fire for effect), the umpire should announce to the FDC the proper correction so that the observer's error will not result in penalties to the battery (see paragraph 7e)."

ATT 6-358, page 29, Appendix A, note to Table 3 is rescinded. Substitute the following note: "*On area adjustment missions, it is possible for an observer to follow proper observed fire procedures and still go into FFE up to 50 meters (100 meters when the range probable error of the weapon is 38 meters or larger) from the target. This possibility is compensated for as follows:

(1) When the MPI (mean point of impact of single adjusting piece or mean point of impact of adjusting pieces in FFE) plots less than 50 meters (100 meters when range probable error of the weapon is 38 meters or larger) radial distance from the surveyed location of the target, the center of the rectangle is placed over the MPI keeping the rectangle oriented in the same relationship to the GT line.

(2) When the MPI falls more than 50 meters (100 meters when range probable error of the weapon is 38 meters or larger) radial distance from the surveyed target location, the center of the rectangle is placed on the MPI-target line 50 meters (100 meters when the range probable error of the weapon is 38 meters or larger) from the surveyed target location keeping the rectangle oriented in the same relationship to the GT line.

(3) If, during the conduct of an area mission, the nonorganic observer makes an error which will result in a faulty fire for effect (i.e., misspotting for range, moving the wrong way or ignoring obvious deviation upon entering fire for effect), the umpire should announce to the FDC the proper correction so that the observer's error will not result in penalties to the battery (see paragraph 7e)."

Air Observer Tips

Observation has been a key role for military aircraft, ever since their earliest adoption as military tools. The advantages of speed, range, and altitude which aerial surveillance provides can be deciding factors to the combatant who exercises air superiority. As aerial observation has become more and more widespread in World Wars I and II, in Korea, and in Vietnam, a wealth of information on techniques has accumulated. It seems that every old soldier who has served as an air observer has something to offer those who are less experienced. The problem is to pass on this useful information to those who need it most. It appears that unknowing young observers may remain unknowing unless they are lucky enough to meet and talk with a more experienced "eye." The purpose of this article, therefore, is to pass on to field artillerymen some tips on the techniques of aerial observation which have been learned by air observers in the past. They are techniques which should prove to be of interest to all field artillerymen, whether they are prospective air observers or are commanders who must be familiar with the advantages and limitations of this very useful tactical tool.

Low-intensity conflicts

These techniques were developed by successful air observers in the Republic of Vietnam and other areas of conflict (notably Korea and the South Pacific). Consequently, they reflect some of the specific problems presented by the Vietnamese situation. For example, in Vietnam there is no certain way of distinguishing enemy from friendly personnel before actual hostilities break out. There may not be distinctive enemy uniforms, there are no front lines, and there is no clear division into enemy and friendly territory. There is triple-canopy jungle which is virtually impossible to see into; there are rice fields and water which reflect the sun or are obscured by rain and fog; and there is an enemy skilled at camouflage and at escaping detection (aerial or otherwise). The techniques in this article are, as a result, particularly relevant to low-intensity warfare.

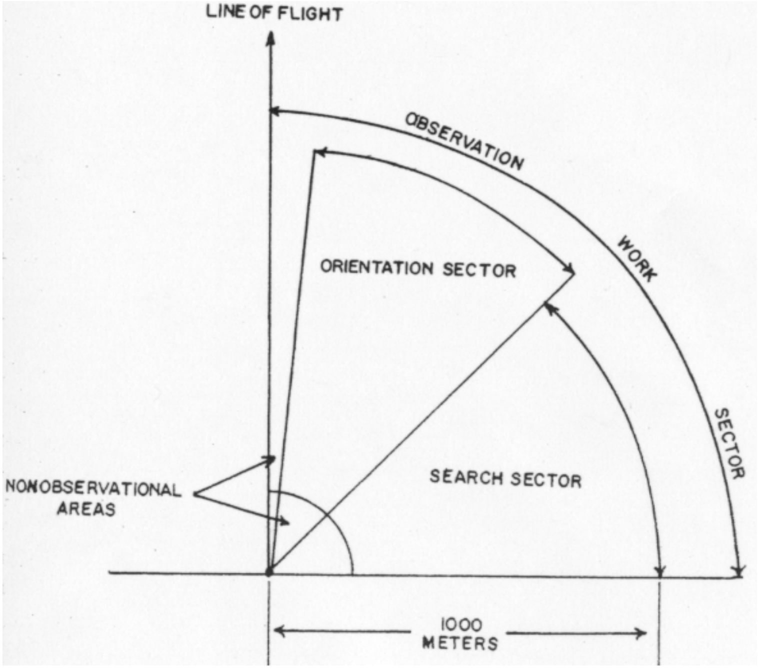
No matter what the intensity of the conflict, the aerial observer's mission remains the same—to adjust fire and to collect timely, accurate information—and aerial observation is still performed by the same observer-pilot team. While the pilot may be of some assistance, his main job is flying the aircraft. This leaves one man, the observer, to perform the various tasks which his mission demands. The success of his efforts depends on his equipment, the tactical situation, the experience of the pilot-observer team, and, most of all, on the observer himself—his desire to do the job and his alert, inventive attitude.

The observer's capability for detecting and identifying targets is influenced by terrain, cover, available light, aircraft speed and altitude, and target movement, as well as by the deception practiced by the enemy. Because of these variables, the observer will not always be able to identify an activity as friendly or enemy. In such cases, he must be able to provide a detailed description of that activity, to include the strength, actions, and disposition of the target and a good, accurate location. An intelligence-gathering agency may be able to combine this data with enough additional information to identify the activity or object.

Visual location of targets

Because of the limitations of the human eye, the task of visually searching the ground without a systematic means of observing can be a demanding one. A random effort seldom yields targets or usable information. The observer must adopt a method which will allow him to take full advantage of the eye's capability to detect fine detail, without lapsing into a haphazard search that does not thoroughly cover the ground.

The methods used by aerial observers will differ from individual to individual, but should generally follow certain guidelines. The aerial observer should conduct his search to one side of the aircraft, and should confine it to a limited portion of his total field of vision. This limited portion is defined as the observation work area and is divided into two subsectors—the orientation sector and the search sector.



Limit search area to a small sector

The observation work area is that area on the ground to the right or left side of the aircraft, but never on both sides simultaneously. It is further defined as being covered by an arc 90° forward of a line perpendicular to the line of flight.

The search sector is that sector on the ground which the aerial observer systematically scans during his visual search. As a rule, lines of sight are not fixed, or well defined, but are dependent on altitude and regularity of terrain. Over most types of terrain, the observer systematically looks toward the horizon and starts his search approximately 1,000 meters from the aircraft. He focuses his attention on the ground, searching in toward the aircraft until the aircraft restricts his vision of the ground. He then repeats the process by halving the distance (500 meters, 250 meters) for each succeeding scan. The speed with which the observer can search the area depends on the speed of the aircraft and other factors previously mentioned.

The orientation sector is used by the observer primarily to locate terrain features for in-flight orientation. As an aid in this, a map reconnaissance of the terrain during preflight planning will prove invaluable. The observer's familiarity with the area, including recognition of landmarks, old or potential targets, and friendly positions (fire bases or other easily recognizable positions), will make his job easier both in his secondary role of locating himself accurately, and in his more important function of locating targets and adjusting fire. When the observer sights a target he should pass the information immediately to the appropriate collection agency, take action based on SOP guidelines, and, after recording the information for his own reference, continue the search.

These standard techniques are prescribed in FM 1-80 for use by an observer in searching an area. However, operations in a low-intensity environment have brought about the development of many other legitimate aerial observation techniques. These new ideas can supplement the prescribed methods.

Know the terrain

The importance of familiarity with the search area cannot be stressed enough. An evaluation of the experience of observers has shown that repetitive observation of the same area by the same observer is a productive technique. An observer can become so familiar with the area which he is accustomed to searching that he can discern even the smallest deviations within that area. For example, recently in Southeast Asia an air observer searching over a familiar jungle area noticed a rope hanging from a small tree and recognized this as a possible indication of the enemy's presence. An observer unfamiliar with the area probably would not have seen the rope nor recognized its significance. In this particular incident the aircraft made a second pass over the area, during which the observer sighted a trail and an apparent storage area. He relayed this informtion back to his collection agency, and the ensuing operation resulted in the neutralization of an enemy regimental headquarters.

Familiarity with the search area is enhanced by the use of appropriate maps, both before flight and in the aircraft. In choosing maps for use within the aircraft, many observers fail to consider the importance of good ground detail. A 1:100,000 map is a good navigational tool and can also be employed as a primary map in areas where the terrain is flat and has few conspicuous features. However, 1:50,000 maps, with their easier to read detail and contours, may be more useful to the observer in plotting or identifying targets. Also, good aerial photographs (1,20,000, etc.) can be useful if employed at angles of observation relatively similar to those at which the photoraphs were taken.

Any method the observer may employ to organize his maps and make them readily available for identification and orientation will help in target location and navigation. Some observers use a notebook-type series of maps which can be flipped quickly out of the way as the aircraft passes each successive mapped area, but any workable system is acceptable.

Multiple aircraft

Due to the high demand on aircraft resources in RVN, many operations must be flown by a single aircraft. However, the techniques of using multiple aircraft can be advantageous. A method of employment often used is called the "hi-lo" method, in which one aircraft flies low (approximately 50 feet above the terrain) and the other flies 1,500 to 2,000 feet above the terrain. The usual difficulty of plotting targets from a low-flying aircraft, due to the speed of the craft in relation to the ground, is solved by using the two-aircraft method. The first aircraft flies low over the area, spots the targets, and relays them to the second aircraft, which is flying at a higher altitude. This second plane plots the targets found by the low-flying plane. Another multiple-craft method is the use of gunships at medium and high levels in support of a low-flying observer, with one or both of the support craft functioning as plotters as in the previous example.

Observation from altitudes above 4,000 feet allows an air observer, using binoculars, to scan an area slowly and to look for the smallest detail. This procedure, of course, is applicable only to open terrain. Flying above 4,000 feet also makes it less likely that the enemy will hear the noise of the aircraft and take cover. Extended use of binoculars in a vibrating aircraft does tend to result in vertigo and nausea and therefore limits the effectiveness of the air observer in the accomplishment of his mission. This problem can be alleviated by the use of the XM76 antioscillation sighting system. The system has, in addition to the antioscillation device which counteracts aircraft vibration within the eyepiece, a "zoom" capability that is very useful when observing from higher altitudes.

One method which was used in earlier conflicts and has proved equally valuable in Vietnam is that of positioning the aircraft between the sun and the area to be observed. This not only makes visual observation easier, but also makes it difficult for the enemy to sight and fire on the observation aircraft.

A good observation technique to employ in areas where the enemy is accustomed to escaping aerial observation is the "after-thought" method. The enemy will often do most of his evasive maneuvering after the observation aircraft has passed over his position. The observer can often see this movement by looking back on his area with binoculars while the pilot is making a false departure from the area.

Tricks of the trade

The following comments are tips on what to look for in an area of observation and some practical ideas that have been offered by observers who have served in Southeast Asia. An insurgent enemy can be extremely deceptive, and the only countermeasures to his stealth are redoubled alertness and perhaps the experiences of others who have dealt with him. The air observer can profit by the "tricks of the trade" learned from his fellows and predecessors.

1. Trenches in or near villages can indicate current or previous enemy occupation, depending on the apparent age of the trenches.

2. Old foxholes or trenches as well as new ones can hold insurgents and should be reconnoitered thoroughly. Look for recently used paths and trails. Don't be misled by water standing in holes, since the enemy often digs tunnels into the sides of holes.

3. Check clumps of vegetation in open fields very carefully, even if they exist naturally and are not recent; they may conceal a target.

4. Most canals have slow currents, depending on the tidal action. Clumps of vegetation should move in the direction of the current. Any deviation in the current or any movement contrary to the flow should be checked out thoroughly.

5. Although terrain takes on a generally more uniform appearance from the air, keep in mind that regularity of form suggests something man-made. Especially in remote areas where terrain is natural, any conspicuous shape, regular outline or inharmonious color may require further investigation.

6. When searching forested areas, concentrate on the bases of trees, looking into the forest on a slant angle. It is usually impossible to see anything when looking straight down into heavy canopy.

7. All haystacks or piles of stalks in fields should be reconnoitered fully. A haystalk with any type of opening should be approached warily and treated with suspicion.

8. While flying over tidal swamps, remember that tracks made in the mud fade with every cycle of the tide. New tracks can be distinguished from old ones.

9. If a camouflaged house, hut or person or any other suspicious thing is discovered, its location should be recorded immediately, as it is often impossible to relocate such objects by sight later.

10. Cleared areas along canals in apparently uninhabited districts are often used as loading and unloading points for supplies. These should be searched carefully for stored materials.

11. The enemy sometimes follows groups of water buffalo or drives them before him. Apparently unattended water buffalo that appear to be moving in a definite direction should be checked closely to insure that insurgents are not driving the buffalo or hiding among them. Any

group of animals with young men riding on them should also be examined very closely.

12. When searching an area, plotting a target, or investigating a suspicious event or appearance, do not duplicate the previous flight path over the target. Approach from a different direction at a different speed and/or altitude. If a longer study becomes necessary and you are compelled to hover or circle above the target, do so at high altitudes and use the XM76 or binoculars to zoom in for a closer look at the area of interest. This will protect you from enemy small-arms and anti-aircraft fires. Remember your mission, and protect yourself so that you may accomplish that mission.

13. Attempt to insure good communication security. Violations of communication security, such as repetition and employing insecure nets for clear transmissions, can endanger both the aircraft and friendly ground units. If the aviator is not aware of the importance of communication security, remind him.

Neutralize the target

These tips may aid the air observer in finding his elusive target and staying in the air long enough to engage it. However, besides having a keen eye and using the right techniques, the observer must know how to neutralize the target after he finds it.

Field artillery is a very effective means available for engaging a target, although the observer should be capable of calling for and adjusting any other type of fire support. Field artillery properly employed is rapid, accurate, and devastating. The observer must be well versed in calling for fire and acutely aware of the destructive power of field artillery both because of its effectiveness against enemy forces and because of the hazard to friendlies. He must also be aware of the tactical situation when making use of field artillery, and must keep abreast of battlefield developments. He must always be aware of his location and heading, and he must have a good idea of the ground distance in relation to his altitude so that he is prepared to adjust fire on a moment's notice. He should know the positions of available batteries in the area and know the location of the gun-target line. A good observer learns to use altitude, speed, and the aircraft's instruments to orient himself, and to use various combinations of these readings to determine distances (for example, by time conversion).

Orientation is a constant necessity, but it doesn't have to be a problem for the well-prepared observer. Familiarity with the area of observation, as previously discussed, is one good way to combat misorientation. Most units assign the same area to an observer as often as possible for many good reasons. But even if it is your first flight over the area, good planning and ample map reconnaissance will familiarize you with otherwise foreign terrain. Orientation can be achieved by using readily recognizable features, especially fire bases and familiar installations, as references. If your map doesn't include a detail or position, plot the position yourself, to scale, for use as a future reference. One problem that can be remedied by knowing these locations is the problem of discerning right from left for adjustment purposes. The telltale sign of a "Right 200" followed by a correction of "Left 400" happens all too frequently with inexperienced aerial observers.

Experience has provided many new ideas for the conduct of fire by air observers. Like the tips on observing presented earlier, the following tips on the conduct of fire are based on experiences of observers in Southeast Asia.

1. The observer must insure that the ground commander is informed of the beginning and the end of the mission.

2. When adjusting field artillery in close proximity to friendly troops, the observer should make certain that the first rounds impact at a safe distance from the nearest friendly position. Then he can "walk" the rounds in, without establishing a bracket, until the target is engaged. This method is slower than the conventional method, but it offers a margin of safety and permits greater control by the observer.

3. The observer should at all times be aware of the location of the gun-target line and the flight path of the artillery projectiles. While it is common procedure to fly under the arc of the rounds at a specified altitude, crossing the gun-target line near the weapons or the target can be dangerous.

4. In the adjustment of fire in heavy jungle, initial rounds should be white phosphorous (WP) to enable the observer to see them. However, too frequent use of this technique could jeopardize the mission, since the enemy would soon learn what to expect after a high burst of WP.

5. There is a problem of visualizing the gun-target line in the jungle. This problem can be overcome by firing two rounds of white phosphorous at the same deflection with a range spread of 400 meters. By visualizing a line connecting the two rounds, the observer can make a good approximation of the gun-target line.

6. Another method of determining the gun-target line is to request that the fire direction center announce the direction of the line in degrees. Having this knowledge will enable the pilot to fly parallel to the gun-target line and will enable the observer to rapidly determine the location of the line on the ground. However, security may be a consideration in the use of this method in that flying the gun-target line may disclose the direction from which the weapons are firing, thus making it easier for the enemy to locate the battery position.

7. The problem of target location in jungle terrain can be eased by using a team consisting of an air observer and a ground observer on the same radio frequency. The air observer can walk the fires in to a point where the ground observer can assume control of the mission. This type of coordination calls for teamwork between the air observer, the ground observer, and the controlling field artillery headquarters. The air observer must often serve as a communications link between the ground element and the controlling fire direction center. He may be in the best position to see rapidly changing situations in the battle area and to relate these developments to the ground forces and the fire direction center.

8. In a mission supporting a landing zone, some predetermined signal is required to insure that no aircraft approach the landing zone before the artillery fires have been lifted. For this reason, it is common practice to make the last round of the mission a white phosphorous round. When the WP round hits, the landing zone is then presumed safe for aircraft to enter. The disadvantage of this practice is that the enemy soon becomes familiar with the procedure and takes advantage of the lapse of time following the WP round to move around in the landing zone without fear of field artillery fire. He is often able to position himself in a place from which he will be able to engage the landing force. This tactic has been countered by the use of what is called a "field artillery doubletake." To accomplish the doubletake, the artillery fires one WP round and then an aircraft approaches the landing zone but breaks off the approach. The artillery then fires a specified number of additional rounds, which often catch the enemy in the open. This technique has proved quite effective.

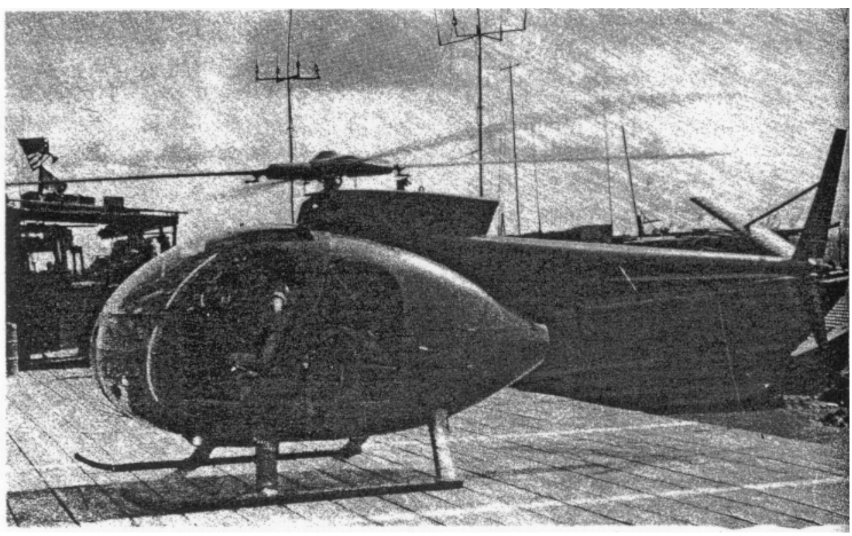
9. Another feinting action that has been developed involves the delaying of fire. During an aerially conducted fire mission, the enemy initially seeks cover but leaves this cover when the observation aircraft leaves the area. The air observer can achieve greater neutralization of a target by requesting VT IN EFFECT, AT MY COMMAND and then departing the area temporarily. As the enemy emerges from his hiding place, the observer gives the command to fire. Frequently the enemy is caught in the open.

When a mission has been completed, the air observer should inform the ground commander and the firing battery which conducted the mission of the effect of the mission on the target. Of course, the air observer should never fly directly over a target for the purpose of ascertaining damage, without first firmly establishing that firing has ceased. This precaution will protect the observer from friendly fires and will also decrease his chances of receiving fire from remaining enemy troops. If any aircraft enter the target area during a fire mission or if any situation potentially dangerous to friendly forces becomes apparent, the air observer should call for a check fire. The pilot as well as the air observer must be aware of the forces in the area, the field artillery covering the area, and the radio frequencies of both, to insure that the artillery's fire will cause enemy casualties without endangering friendly troops.

An alert air observer, equipped with the basic techniques of his job, can tailor his methods to the terrain and the situation. This discussion has touched on some of the basic principles and a few of the innovations developed for aerial observation in low-intensity environment. Each observer, as he gains experience, will develop his own ideas and techniques. Hopefully he will remember the problems he encountered on his first aerial missions and will not hesitate to make his experience and techniques available to the inexperienced observers who follow him.

Aircraft Presently in Use For Air Observation

O-1 Bird-dog



OH-6A

OH-23

OH-13

Safety Notes

Would a cannoneer in your unit throw a fiber container in front of a firing howitzer? No one would do that, right? Let's stop and look at what happened in one battalion in Vietnam.

At about 1130 hours, the battalion received a contact mission from a forward observer. Two guns adjusted the mission. As this mission was also danger close, both the battery commander and executive officer were acting as safety officers. When number one gun fired its ninth round, an explosion occurred about 25 feet from the muzzle.

Investigation of the incident revealed that prior to the ninth round a cannoneer had thrown two used fiber containers into a burning pit just outside the parapet. Number one howitzer was firing a low quadrant (249) directly over the pit. The cannoneer threw a third container toward the burning pit in time to intercept—and detonate—the ninth round. The results were nine injured soldiers.

This may have been a freak incident, but why is it that this type of accident happens? Why is it that the obvious hazards aren't obvious?

Look at another incident in Vietnam where an 8-inch howitzer platoon was collocated with an infantry company. In a dense growth of trees one hundred meters southwest of the base was a suspected mortar position. The platoon leader elected to try and clear the area by direct fire, charge five. One gun was used. The first rounds for the mission were adjusted at ranges greater than 1000 meters. Each consecutive round was adjusted closer to the perimeter. The sixth round detonated on a tree top about 300 meters from the gun, killing one crew member.

The subsequent investigation established that the minimum quadrant had not been computed to include a vertical clearance or two forks. The vertical angle to the trees was two mils. The elevation for charge five, at 300 meters, is 8.6 mils. Adding these together one gets a quadrant of 10.6 mils. The sixth round fired by the section was fired at a quadrant of 11 mils; or instead of firing minimum quadrant, the section fired did hit data.

In both incidents the battery personnel were not conscious of the dangers from early detonations. These incidents reflect why every artilleryman must stay alert, watch for unsafe practices, and insure proper procedures are followed. If sloppy work is tolerated, the familiar epithet "the greatest killer on the battlefield" may take on a new meaning.

INSTRUCTIONAL DEPARTMENT NOTES

DIRECTOR OF INSTRUCTION

New Training Films

The USAFAS is producing four new training films during FY 72. The films will cover Fire Support Coordination, Defense of the Field Artillery Battery, Reconnaissance, Selection and Occupation of Position, and Crater Anaylsis. All four films are expected to be in distribution by the end of the fiscal year. While films are under consideration, readers should note that the School is always soliciting suggestions for new field artillery training films. If you have noted an instructional area which could be supported or augmented by a film, why not forward your thoughts to Commandant, USAFAS, ATTN: Office of the Director of Instruction, TV Division (ATSFA-DI-TV), Fort Sill, Oklahoma 73503.

COMMUNICATION/ELECTRONICS DEPARTMENT

Whiz Wheel

The CIRCE numeral code, commonly known as the "whiz wheel," is being used extensively in Vietnam by US Army units. The code was originally designed and produced by the US Air Force for use by Air Force and Army units engaged in air-ground operations to encode numerals for transmission over nonsecure radio nets. Army commanders were quickly impressed with its speed and simplicity of operation. This lead to a rapid spread of the system to Army ground use. The Air Force believed that high unit density and use would rapidly compromise the system and, as a result, the US Army Strategic Communications Command developed a similar system for Army use.

The present system is used for encrypting TOT (time on target) times, coordinates, altitudes, radio frequencies, and other numerical information in areas where the threat of the enemy's breaking the code is minimal. Its use is presently restricted to Southeast Asia. Use of the code in other areas must be approved by the National Security Agency on a case-by-case basis. In addition to its use as a numeral code, the system may be used for challenge-reply authentication.

The device is called a wheel because of the circular arrangement of three alphabets, one of which is movable, on a plastic circle. The wheel is mounted on a 4- × 5¼-inch plastic sheet with a series of five scrambled alphabets below the wheel. Operating instructions are printed on the back of the plastic insert sheet. This sheet is inserted into an unclassified plastic holder which has a rotating plastic numerical dial.

The code is highly popular because of its simplicity and speed of use in encoding numerals. However, this very simplicity limits the system's security. The system is good for a 24-hour period without change of insert sheets. Information which requires protection for more than 24 hours should **NOT** be encoded in this code. A cryptanalyst could reconstruct the system in 2 hours provided he had a minimum of 200 six-digit messages with which to work. Personnel desiring to use the CIRCE system for either an authentication system or a numeral code must first consider the security protection afforded by the CIRCE system. REMEMBER, it has a limited security capability.

Since the CIRCE system is in wide usage in Southeast Asia, instruction in the system has been incorporated into programs of instruction taught by the Communication/Electronics Department of the Field Artillery School.

GUIDED MISSILE DEPARTMENT

Pershing

With the completion of Project SWAP in the spring of 1970, the field artillery made the transition from the track-mounted Pershing missile system to the improved Pershing 1a missile system, mounted on wheeled vehicles. Modern technology and state-of-the-art improvements have resulted in the development of a new improvement program, referred to as the Pershing Missile and Power Station Development Program.

What exactly is this program and how will it affect the Pershing 1a system? The program, as implied by its name, involves major changes in the Pershing missile and a major redesign of the Pershing power station. Many of the components of the guidance and control (G&C) section of the Pershing missile will be renovated through the use of transistors, electronic cards and modules, and printed circuitry. Many of the bulky, failure-prone parts will be replaced with more durable solid-state parts. The G&C will be improved not only in internal design but also in reliability and maintainability. There are three major changes to be accomplished within the missile improvement portion of the program. Each change pertains to a component of the guidance and control section. These changes are summarized below:

- Digital computer: The G&C sections presently in the inventory utilize both a guidance computer and a control computer. These computers operate on an analog data principle and have contributed to about one fourth of all Pershing missile failures. A digital guidance and control computer (G&CC) in one solid-state unit has been developed to replace the two analog computers. The digital computer will provide a higher reliability factor and an improved on-board fault isolation capability and will be easier to maintain. The computer will have the capability of shutting off all missile power if an in-flight malfunction occurs. This will prevent an inadvertent nuclear detonation over friendly terrain.

- Main distributor: The centralized point within the missile for distribution of electrical signals, AC and DC power throughout the missile, and return of supervision and monitoring signals to the ground support equipment (GSE) is the main distributor. The current main distributor, which has undergone numerous modifications, will be replaced by a newly designed main distributor.

- Static inverter: The G&C section presently uses a rotary inverter to convert the DC power into AC power. The rotary inverters have experienced a high failure rate and have required frequent depot level maintenance. A solid-state static inverter, utilizing printed circuits and transistors, will replace the rotary inverter. The static inverter, without any moving parts, converts 28-volt DC power into regulated 115-volt, 400-hertz, 3-phase power. The static inverter provides a greater missile reliability factor and, in addition, can be maintained at the direct support unit (DSU) level.

The capabilities of the Pershing power station will not change; however, several of its components will be relocated within the power station structure. The purpose of the changes is to provide greater accessibility and ease of maintenance for the operator. Engineering studies have resulted in relocation of the nickel-cadmium batteries, redesign of the fuel tank, repositioning and redesign of the electrical control panel, and relocation of the air purification unit. To achieve a longer life for the power station air compressor, the rpm ratio is to be reduced. The primary reason for power station failures has been the loss of the air compressor or one of its stages due to wear and tear. These changes will increase the height and width of the power station but will not change its overall length.

Also included in this improvement program is the development of the power station test set. This device will allow the general support unit to perform checks and measurements of the high-pressure air and conditioned-air systems. At the present time the unit has no means of checking the air output of the power station to insure that the missile is receiving the required pressure and temperature of air.

The trajectory accuracy prediction system (TAPS) is an independent project which will be included in the overall Missile and Power Station Improvement Program. Through the use of on-board telemetry and ground receivers, the personnel within the battery control central will be able to compare events along the trajectory with the computer predicted printout. This will enable the unit to ascertain how close to the programmed trajectory actual events occurred.

The improvement program also contains necessary instructions for operators, instructors, maintenance personnel, and equipment technicians. The training programs have been scheduled to coincide with completion of work on the equipment (FY 72-73). Prior to beginning the worldwide improvement program, both the improved guidance and control section and the repackaged power station will undergo field testing by the U. S. Army Test and Evaluation Command to include actual Pershing missile firings at White Sands Missile Range.

GUNNERY DEPARTMENT

Status of Firing Tables and FADAC Tapes

The use of the correct and current firing data source is essential for the accurate and safe delivery of artillery fires. Numerous materiel developments and product improvements have been introduced in recent years which have vastly expanded the possible weapon/ammunition combinations. Many of these combinations are ballistically dissimilar, resulting in a large number of different firing tables. In addition, published tables and tapes are subject to frequent changes which must occur with each materiel or procedural improvement.

The list of GFT's and TFT's on the following pages is published to assist personnel in the selection of the correct and current firing table. Unless otherwise noted, tabular firing tables are requisitioned through normal AG Publication channels. Graphical firing tables are requisitioned as authorized by each applicable TOE.

CURRENT GRAPHICAL FIRING SCALES

WEAPON	BASED ON TFT	DESCRIPTION	FSN	NR OF RULES
105H				
M101A1	105-H-6, w/C7	*GFT HEM1 (LA)	1220-937-8279	3
	105-H-7	*GFT HEM1 (HA)	1220-151-4155	1
	105-H-6, w/C2	GFT ILL M314	1220-978-9585	2
	105-H-6	GST HEM1	1220-815-6190	1
M102/M108	105-AS-2, w/C1	*GFT HEM1 (LA)	1220-937-8280	3
	105-AS-2	*GFT HEM1 (HA)	1220-151-4154	1
	105-AS-1	GFT ILL M314	1220-764-5418	2
	105-AS-1	GST HEM1	1220-764-5422	1
155H				
M114A1	155-Q-4, w/C2	*GFT HEM107 (LA)	1220-937-8281	3
	155-Q-4	*GFT HEM107 (HA)	1220-168-5545	1
	155-Q-3	GFT ILL M118	1220-898-4212	2
	155-Q-4	*GFT ILL M485	1220-133-6219	2
	155-Q-3	GST HEM107	1220-789-2986	1
M109	155-AH-2, w/C4	*GFT HEM107 (LA)	1220-937-8282	3
	155-AH-2	*GFT HEM107 (HA)	1220-133-7435	1
	155-AH-1	GFT ILL M118	1220-764-5420	2
	155-AH-2, w/C1	*GFT ILL M485	1220-442-2444	2
	155-AH-1	GST HEM107	1220-764-5421	2
8″H				
M110/M115	8-J-4	*GFT HEM106 (LA)	1220-937-8283	3
	8-J-4	*GFT HEM106 (HA)	1220-168-6026	1
	8-J-3	GST HEM106	1220-898-6786	1
	8-O-4	*GFT HESM424	1220-937-8284	2
	8-O-3	GST HESM424	1220-876-8573	1
175G				
M107	175-A-O(REVII)	*GFT HEM437 (LA&HA)	1220-937-8285	2
	175-A-O(REVII)	GST HEM437	1220-937-9522	1
**14.5 MM Trainer		*GFT	1220-442-2446	1

* Denotes 18″ GFT

** Requisitioned through local Training Aids Support Center

STATUS OF CANNON TABULAR FIRING TABLES
105MM

M101A1	M102 & M108
CURRENT	**CURRENT**
FT 105-H-6 (Nov 61) BASIC FT C2 (Apr 62) subzone M89, M314 ILL, M327 HEP C6 (Jun 66) M314A2E1 ILL w/Fuze MT, M565 C7 (Dec 67) Fuze MTSQ M564 C8 (Feb 69) Fuze VT, M513 Series w/Cap XM5 C9 (Jun 69) Beehive XM546 w/Fuze XM563E2, E3 & E4 [1]PROV SUPP 1 (Nov 67) CS XM629	FT 105-AS-2 (Nov 67) BASIC FT C3 (Jun 69) Beehive XM546 w/Fuze XM563E2, E3 & E4 C4 (Aug 70) FZ VT, M13 Series w/Cap XM5, and CTG, SMOKE, HC, BE, M84A1 [1]PROV SUPP 1 (Nov 67) CS XM629
FT 105 ADD-B-2 (Nov 68) M444 C1 (Nov 68) close-in support card	FT 105 ADD-F-1 (Aug 68) M444 C1 (Sep 68) close-in support card
FT 105 ADD-A-O (REV) (Mar 68) M413	[1]FT 105-AU-O (REV 1) (Jun 70) RAP XM548E1
[1]FT 105-AV-O (REV 1) (Jun 70) RAP XM548E1	
TO BE PUBLISHED	**TO BE PUBLISHED**
FT 105-H-7 (1st Qtr FY 72) BASIC FT C1 (4th Qtr FY 72) XM546E2 w/Fuze XM563E4 C2 (4th Qtr FY 72) XM622 HEAT-INTERIM FT	FT 105-AS-2, C5 (1st Qtr FY 72) Corrected per data, additional velocity data C6 (4th Qtr FY 72) XM546E2 w/Fuze XM563E4 C7 (4th Qtr FY 73) HEAT, XM622 INTERIM FT
FT 105-AV-1 (2d Qtr FY 73) RAP XM548-INTERIM FT	FT 105-AU-1 (2d Qtr FY 73) RAP XM548 INTERIM FT

[1]Requests for these tables should be made to:

Commanding Officer
US Army Aberdeen Research and Development Center
ATTN: AMXRD-BEL-FT
ABerdeen Proving Ground MD 21005

STATUS OF CANNON TABULAR FIRING TABLES
155MM

M114A1

CURRENT

FT 155-Q-4 (Mar 68) BASIC FT

C2 (Apr 69) Prop Chg M3A1 & M4A2

FT 155-AI-2 (May 69) XM454 NUC

FT 155-ADD-F-1 (Jul 70) M449A1, M449, M449E1

C1 (Jul 70) Close-in support card

TO BE PUBLISHED

FT 155-Q-4, C3 (1st Qtr FY 72)

M114A1 w/M107, w/3A1 and M4A2 Propelling Charges (Final Table)

C4 (1st Qtr FY 73) XM396

BEEHIVE

M109

CURRENT

FT 155-AH-2 (Jul 65) BASIC FT

C1 (Jun 67) M485 Series Illum

C2 (Oct 67) Fuze MTSQ M564 & MT M565

C4 (Apr 69) Prop Chg M3A1 & M4A2

FT 155 ADD-E-1 (May 70) M449A1, M449, M449E1

C1 (Jul 70) Close-in support card

FT 155-AJ-2 (May 69) XM454 NUC

[1]Aiming Data for RAP XM549 (Nov 68) (C)

TO BE PUBLISHED

FT 155-AH-2, C5 (1st Qtr FY 72) M109 w/M107, w/M3A1 and M4A2 Propelling Charges (Final Table)

C6 (1st Qtr FY 73) XM396

BEEHIVE

FT 155-AL-1 (2d Qtr FY 72)

RAP XM549-INTERIM FT

FT 155-AL-2 (2d Qtr FY 73)

RAP XM549-FINAL FT

FT 155-AK-1 (4th Qtr FY 72)

XM483E1-INTERIM FT

FT 155-AK-2 (4th Qtr FY 73)

XM483E1-FINAL FT

FT 155 ADD-G-1 (4th Qtr FY 72)

XM483E1/XM483E1-INTERIM FT

FT 155 ADD-G-2 (4th Qtr FY 73)

XM483E1/XM483E1-FINAL TABLE

FT 155 ADD-H-1 (4th Qtr FY 72)

M107/XM483E1-INTERIM FT

FT 155 ADD-H-2 (4th Qtr FY 73)

M107/XM483E1-FINAL FT

FT 155-AM-1 (4th Qtr FY 72)

M109A1 w/CANNON

XM185 w/Proj M107

FT 155-AJ-2, C1 (1st Qtr FY 73)

M109A1 w/CANNON XM185, w/PROJ, XH454

STATUS OF CANNON TABULAR FIRING TABLES 8 Inch & 175MM

M110

CURRENT

FT 8-J-4 (Jun 67) BASIC FT

FT 8-O-4 (Jun 67) M424 HES & M422 NUC

C1 (Jun 70) M424A1 HES

FT 8 ADD-A-1 (Nov 67) M404

C1 (Nov 67) Close-in Support card

TO BE PUBLISHED

FT 8-P-1 (2d Qtr FY 73) RAP XM509-INTERIM FT

FT 8 ADD-B-1 (2d Qtr FY 73) RAP XM509/XM509-INTERIM FT

FT 8 ADD-C-1 (2d Qtr FY 73) M106/RAP M509-INTERIM FT

M107

CURRENT

FT 175-A-1 (Jan 70) BASIC FT

C1 (Sep 70) Corrected Erosion Data

TO BE PUBLISHED

FT 175-A-1, C2 (3d Qtr FY 72) WP, XM510E1

FT 175-B-1 (4th Qtr FY 72) XM484E1

FT 175-ADD-A-1 (4th Qtr FY 72) XM484E1/XM484E1

FT 175 ADD-B-1 (4th Qtr FY 72) M437A2/XM484E1

STATUS OF HONEST JOHN TABULAR FIRING TABLES 762mm Rocket, MGR-1A (M31) Series

FTR AND CHANGES	LAUNCHER	WARHEAD	REMARKS
762-E-1 (Apr 59) Change 1 (Sep 59) Change 2 (Jul 60) Change 3 (Feb 61)	M386	 M27 M47 M48	C1—Corrects FTR errors. C2—E1, E2, and LLW tables C3—Conversion of NATO Met to US format.
762-F-1 (Apr 59) Change 3 (Mar 67)	M386	M6A1 M38 M144 M186	C3—Conversion of NATO Met to US format.
762 ADD-A-1 (Nov 60) Change 2 (Mar 67)	M33 M289 M386	M144 M186	Applicable to FTR 762-A-2, FTR 762-D-1, and FTR 762-F-1. Instructions for use and an illustrated example are inclosed in the introduction. C2—Adds warhead M186
762 ADD-B-1 (Feb 61)	M33 M289 M386	M6A1	Applicable to FTR 762-A-2, FTR 762-D-1, and FTR 762-F-1. Instructions for use and an illustrated example are included in the introduction.

762mm Rocket MGR-1B (M50) Series

FTR AND CHANGES	LAUNCHER	WARHEAD	REMARKS
762-G-1 (Jan 64) Change 1 (Jan 68)	M386	M27 M47 M48 M190	C1—Adds propellant weight correction factor table.
762-H-1 (Jul 63) Change 1 (Apr 66)	M386	M6A1 M144 M186 M38	C1—Makes certain corrections and adds M186 and M6A1 warheads to table and changes fuze setting correction table.
762 ADD-C-1 (Aug 63)	M33 M289 M386	M186 M144	For an example illustrating procedures, refer to 762 ADD-A-1. C1—Adds M186 warhead
762 ADD-D-1 (Oct 64)	M33 M289 M386	M190	Applicable to FTR 762-G-1, FTR 762-I-1, and FTR 762-K-1. Instructions for use are contained in the introduction.
762 ADD-E-1 (Nov 66)	M33 M289 M386	M6A1	Applicable to FTR 762-H-1

STATUS OF FADAC PROGRAM TAPES

The following items are contained in Revision 4, Cannon Machine Program Tape Kit, Federal stock number (FSN) 1290-466-0140. The set of addendum tapes is packaged separately and may be requisitioned as a set identified by FSN 1290-466-0142. The basic cannon program tape is packaged separately and may be requisitioned as a separate item identified by FSN 1290-466-0141. The basic cannon program tape incorporates the ballistic data for the 105mm howitzers M102 and M108 and the 155-mm howitzer M109.

Item	Part Number
Basic cannon program tape	8213330-80
Addendum tapes:	
105mm How M101A1/105mm How M102, M108	8213315-81
105mm How M101A1/155mm How M114A1	8213315-82
105mm How M101A1/155mm How M109	8213315-83
105mm How M102, M108/155mm How M114A1	8213315-84
105mm How M102, M108/155mm How M109	8213315-85
155mm How M109/155mm How M114A1	8213315-86
8-in How M110/155mm How M114A1	8213315-87
175mm G, M107/155mm How M114A1	8213315-88
155mm M109/8-inch How M110	8213315-89
155mm M109/175mm G, M107	8213315-90
8-in How M110/175mm G, M107	8213315-91
105mm How M101A1/8-in How M110	8213315-93
105mm How M102, M108/8-in How M110	8213315-93
105mm How M101A1/175mm G M107	8213315-94
105mm How M102, M108/175mm G M107	8213315-95
Clear hot storage tape	8213315-96
Tape, repetitive test routine	8213315-97
Tape, mechanical tape reader test	8213315-98

TARGET ACQUISITION DEPARTMENT

Meteorology Messages

A longstanding debate among artillerymen revolves around the use of an artillery meteorological message that is exactly 24 hours old and the use of a message for more than the 2-hour period specified by artillery doctrine. In tropical climates weather changes are small and slow and each succeeding day's weather appears to be the same as that of the preceding day. Many "redlegs" feel that in such a climate a met message current at 0800 today could be effectively used at 0800 tomorrow. Some feel that if an average 0800 sounding were determined, it could be used at 0800 daily for long periods of time. Some also feel that an average daily sounding could be used all day for a number of days, thus eliminating the need for additional soundings until a monsoonal change occurs.

Most of these ideas are based on personal experience. Until recently because of the lack of a set of controlled experimental data, no actual tests had been conducted to verify or refute these ideas.

Upon request from USAFAS through command channels, the met sections supporting the 1st Battalion, 92d Artillery, and the 7th Battalion, 15th Artillery, at Pleiku and LZ Two Bits, RVN, respectively, consented to conduct a limited experiment in time validity of a ballistic met message. During the period 7 through 14 May 1970, each section sounded the atmosphere every 3 hours. Balloons from each location were released at identical times starting at 2400 hours Greenwich mean time. The data were forwarded to the Target Acquisition Department, USAFAS, where a thorough check was made on the accuracy of each sounding. Time validity computations were then made, using the IBM 1620 computer.

Met corrected data for representative cannon, charges, and ranges computed from the current met were compared with met corrected data for the representative cannon, charges, and ranges computed from the average met. The Target Acquisition Department constructed numerous tables and graphs to aid in this comparison, which are too voluminous for inclusion in this article; however, the magnitude of errors which artillerymen would experience can be summarized by picking a mid-range and a charge for each of a number of weapons and computing the miss distance caused by errors in each of the averaged meteorological parameters. To illustrate these results, let us assume that during the 8-day period 7-14 May 1970, the artillery met section at Pleiku or LZ Two Bits had used the average values of ballistic temperature, density, and wind speed, averaged over the 8-day period for each hour, 3 hours apart, and at each NATO line number, instead of making actual soundings at these times; 32 percent of the time an FDC would run the risk of being in error by as much as the values shown below for specific gunnery problems. These examples were not selected to maximize the error. Also it should be borne in mind that these errors are indeed smaller than those that would occur in temperate latitudes. As is illustrated later in this article, in CONUS these errors may double or triple because of frontal weather activity.

105-mm Howitzer Charge 5 Range 7,200 meters

WIND	TEMPERATURE	DENSITY	TOTAL
23.9 meters	3.9 meters	10.6 meters	38.4 meters

155-mm Howitzer Charge 5 WB Range 9,900 meters

WIND	TEMPERATURE	DENSITY	TOTAL
71.3 meters	25.1 meters	19.3 meters	115.7 meters

8-inch Howitzer Charge 5 Range 9,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
68.2 meters	20.9 meters	15.0 meters	104.1 meters

175-mm Gun Charge 2 Range 14,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
51.8 meters	13.8 meters	47.8 meters	113.4 meters

Five percent of the time, FDC's run the risk of errors double the amounts shown. If the met sections had elected to broadcast only one message per day (24 hr) using each day's average values for wind speed, temperature, and density for each NATO line, 32 percent of the time the errors could have been as great as those shown below.

105-mm Howitzer Charge 5 Range 7,200 meters

WIND	TEMPERATURE	DENSITY	TOTAL
24.8 meters	2.6 meters	8.8 meters	36.2 metehs

155-mm Howitzer Charge 5 WB Range 9,900 meters

WIND	TEMPERATURE	DENSITY	TOTAL
73.9 meters	15.1 meters	16.0 meters	105.0 meters

8-inch Howitzer Charge 5 Range 9,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
70.7 meters	14.0 meters	12.5 meters	97.2 meters

175-mm Gun Charge 2 Range 14,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
46.5 meters	9.3 meters	39.7 meters	95.5 meters

Once again, 5 percent of the time the risk would be double the amounts shown.

As was mentioned earlier, the errors in higher latitudes could be several times larger than the above errors because of frontal passages, which do not occur in the tropics. To illustrate this, an experiment identical to the ones conducted in RVN was performed by the Target Acquisition Department of the Field Artillery School at Fort Sill, Oklahoma. The weather during this experiment was clear, calm, and warm, very similar to RVN weather, since no fronts or strong winds occurred. Under the same assumptions used to present the Vietnam data, errors which would be experienced or exceeded in 32 percent of the instances using average hourly data at Fort Sill, 16 to 26 May 1971, are as follows:

105-mm Howitzer Charge 5 Range 7,200 meters

WIND	TEMPERATURE	DENSITY	TOTAL
64.8 meters	8.7 meters	23.9 meters	97.4 meters

155-mm Howitzer Charge Sub Range 9,900 meters

WIND	TEMPERATURE	DENSITY	TOTAL
193.1 meters	44.7 meters	43.2 meters	237.8 meters

8-inch Howitzer Charge 5 Range 9,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
184.8 meters	41.4 meters	33.7 meters	260.0 meters

175-mm Gun Charge 2 Range 14,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
121.3 meters	27.5 meters	107.4 meters	256.3 meters

Use of one average met message per day at Fort Sill resulted in the following errors 32 percent of the time:

105-mm Howitzer Charge 5 Range 7,200 meters

WIND	TEMPERATURE	DENSITY	TOTAL
45.2 meters	5.0 meters	14.8 meters	66.9 meters

155-mm Howitzer Charge 5 WB Range 9,900 meters

WIND	TEMPERATURE	DENSITY	TOTAL
134.5 meters	28.5 meters	26.8 meters	189.8 meters

8-inch Howitzer Charge 5 Range 9,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
128.8 meters	26.4 meters	20.9 meters	176.0 meters

175-mm Gun Charge 2 Range 14,000 meters

WIND	TEMPERATURE	DENSITY	TOTAL
84.6 meters	17.5 meters	66.5 meters	168.5 meters

It can be readily seen from the above examples that, in many instances, errors can get too large to be acceptable by artillery, especially in close or unobserved fire. Failure to account for these errors could create a hazard to friendly troops or could cause hits in no-fire zones. In addition, such a failure could negate the application of surveyed data, the careful plotting and computations of the fire direction center, and the accurate settings of the gun crew. The artilleryman must remember that the weather he experiences at the surface may not indicate the conditions in the atmosphere aloft, where the projectile must travel.

In 1951 Project CRYSTAL BALL, a joint Army and Air Force experiment, was conducted at Fort Sill to determine requirements for ballistic meteorology. An interesting comparison can be made between the results of the recent tests and the mean meteorological accuracy rquired for artillery as determined by Project CRYSTAL BALL.

The table below shows the number of times the test data exceeded CRYSTAL BALL tolerances when hourly average soundings were used.

HOURLY SOUNDINGS

	PLEIKU	LZ TWO BITS	FORT SILL
WIND	52 out of 80	36 out of 80	80 out of 80
TEMPERATURE	6 out of 80	24 out of 80	80 out of 80
DENSITY	25 out of 80	68 out of 80	80 out of 80
	83 — 240	128 — 240	240 — 240

The table below shows the number of times the test data exceeded CRYSTAL BALL tolerances when only one average met message per day was used. This procedure is very similar to the experience correction procedure.

ONE AVERAGE MESSAGE PER DAY

WIND	29 out of 80	26 out of 79	72 out of 80
TEMPERATURE	16 out of 80	17 out of 79	45 out of 80
DENSITY	41 out of 80	50 out of 79	74 out of 80
	86 — 240	93 — 237	191 — 240

From the foregoing, it can be concluded that the confidence that many artillerymen have in average data or experience corrections is largely unfounded. Use of either procedure would have been unacceptable at Pleiku or LZ Two Bits during the period 7-14 May 1970 and would have been disastrous at Fort Sill during the period 19-26 May 1971.

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