March - April 1979

Field Artillery Journal

Too much blast? . . . page 9

Field Artillery Journal

the journal of fire support

Volume 47 March-April 1979

The *Field Artillery Journal* is published bimonthly at the US Army Field Artillery School for the same purpose stated in the first *Field Artillery Journal* in 1911:

> "To publish a Journal for disseminating professional knowledge and furnishing information as to the field artillery's progress, development, and best use in campaign; to cultivate, with the other arms, a common understanding of the powers and limitations of each; to foster a feeling of interdependence among the different arms and of hearty cooperation by all; and to promote understanding between the regular and militia forces by a closer bond; all of which objects are worthy and contribute to the good of our country."

Funds for the printing of the publication were approved by the Department of the Army, 31 May 1978.

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The front cover shows various Field Artillery weapons firing. The back cover depicts the infantryman statue at Fort Benning to hail The Infantry School's 72d birthday.

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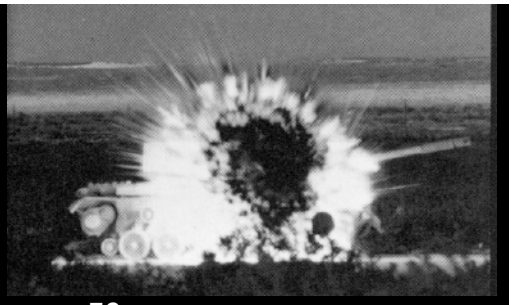
Articles

Features



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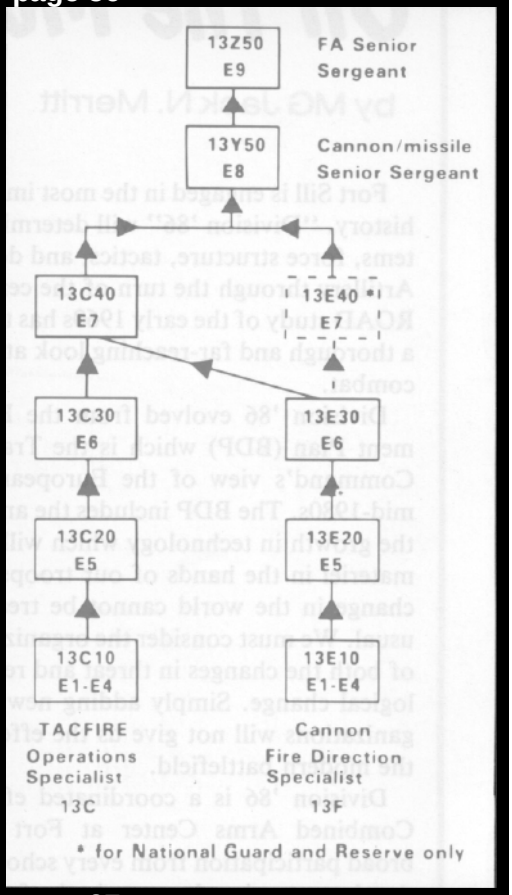

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On The Move. . .

by MG Jack N. Merritt

Fort Sill is engaged in the most important study in our history. "Division '86" will determine the weapons systems, force structure, tactics, and doctrine for the Field Artillery through the turn of the century. Not since the ROAD study of the early 1960s has the Army taken such a thorough and far-reaching look at its organization for combat.

Division '86 evolved from the Battlefield Development Plan (BDP) which is the Training and Doctrine Command's view of the European battlefield of the mid-1980s. The BDP includes the anticipated threat and the growth in technology which will place sophisticated materiel in the hands of our troops by that time. This change in the world cannot be treated as business-as-usual. We must consider the organizational implications of both the changes in threat and revolutionary technological change. Simply adding new systems on old organizations will not give us the effectiveness to win on the modern battlefield.

Division '86 is a coordinated effort headed by the Combined Arms Center at Fort Leavenworth with broad participation from every school and Army agency that have any involvement in the functioning of a combat division. A major aspect of this study is that the logisticians are being considered full partners from the start instead of designing a combat force and then turning to the combat service support people and saying, "Support it!"

The familiar terminology of "maneuver, fire support, and combat service support" is out. The battle involves "the central battle" and "force generation." This new division carries functions of "target servicing, counterfire and interdiction, air defense, C^3/EW and C^3, logistical support and reconstitution, force mobility, and surveillance/fusion." The Field Artillery has representation on the study groups for all these subjects and I chair the study effort for counterfire and interdiction.

The test vehicle for Division '86 is the heavy armored division. Later studies will address other type divisions and echelons above division. The constraint we at Sill are working with is a rough figure of 3,300 personnel in a 19,300-soldier division. With those 3,300 people we must provide direct support, counterfire, and interdiction plus perform command and control functions, operate our target acquisition battery, conduct remotely piloted vehicle missions, service the General Support Rocket System, plan for nuclear and chemical fires, etc.

It is interesting to look at the analysis of battlefield functions that came out of the BDP and went into the formulation of Division '86. The Field Artillery has three basic responsibilities under this new concept—counterfire, target servicing indirect fire, and interdiction.

Counterfire is basically unchanged and is the attack of enemy indirect fire means. Target servicing indirect fire is Division '86 terminology for direct support or fires delivered in the main battle area against the enemy maneuver formations and related targets. Interdiction is an essential mission we have always *wanted* to perform but never had the target acquisition nor cannon range to reach—the enemy's second echelon. Listed under the heading of "force generation" in the Division '86 study, interdiction will concentrate on acquiring and attacking the second echelon formations before they get into the main battle area and become a force the division commander must worry about. Even with GSRS, extended range weapons, Copperhead, etc., we do not delude ourselves (or our study partners) that we can destroy the second echelon. We do know we can delay, disorganize, and disrupt the Warsaw Pact forces which depend heavily on march tables and detailed pre-contact plans.

If this study leads to the anticipated conclusions, we as a branch will be faced with major challenges. Not only are current doctrine, organization for combat, and relationships with maneuver going to be totally revised, but entire MOS and grade structures may be rebuilt, training approaches vastly modified, and even revisions of branches of the Army are not out of the realm of possibility. That is how important this study is.

Actions required of a division for success on the battlefield of the mid-1980s as defined by the Battlefield Development Plan:

The central battle	**Force generation**
Target servicing	Interdiction
Counterfire	Reconstitution
Air defense	Force mobility
Command, control, and communication/EW	Command, control, and and communication
Logistic support	Surveillance/fusion

You will be hearing and reading more about Division '86. The major milestones include the first decision briefing for the Chief of Staff in October 1979, DA staffing in the summer of 1980, and study completion in December 1980.

As with everything we do at Sill, your comments are invited. Those of you on active duty have a major interest as there *will be* some new division structure resulting from this study—a division you will spend your career in. We'd be glad to hear from you.

letters to the editor

"There are improvements to be made in nearly everything we do, if we will but exploit all the resources available to us, including soliciting the ideas of all soldiers, from private to senior general." –GEN Bernard W. Rogers, 17 Aug 76

What's in a name?

In the January-February 1979 ***Journal*** *we solicited suggestions for a name for the four-gun elements of the eight-gun battery. The response was great and the interest was appreciated. The School has determined that each four-gun element will be called a "platoon" in doctrinal literature and official references. "Platoon" was also the most prevalent suggestion from* ***Journal*** *readers. The following are a few representative letters received.—Ed.*

A choice of names

I suggest the four-gun elements be called "platoons," each with four sections. That's what we called School support elements when I was at Sill in 1944-45.

If the firing battery itself is called a platoon of the entire battery, "section" could be used for the four-gun element and "squad" for the single weapon and its crew. Squad was used to refer to a single weapon crew in the old French 75-mm days.

Joseph M. Ambrose
COL, USA
Framingham, MA

How about "team"?

Reference page 56 of the January-February *Journal,* I submit the name "team" to be used for the four-gun element. This name is currently in the military vocabulary and the meaning, "to unite in shared work," applies to the new concept.

Tom W. Cookson
MAJ, FA
Fort Sam Houston, TX

Sketch accompanying this letter showed an 8-gun battery of two teams (A and B), four platoons, and eight sections.—Ed.

SABRE/SABLE

One possibility for the four-gun element is SABRE (I and II) which stands for Separate Artillery Battery Reconnaissance Element. Another interpretation for that acronym could be Separate Artillery Battery Rear Element, but that would have to be joined by SABLE (Separate Artillery Battery Lead Element).

Robert P. Dumais
1SG, FA
Franklin, NH

Lieutenant likes "quad"

I propose we name the four-gun elements "quads." This name is short, easy to remember, and actually means a grouping of four.

Jack Crafton
1LT, FA
Fort Lewis, WA

Let's call them platoons

Search no further, for we already have names for all of the elements of the Field Artillery system. Although not particularly useful or meaningful in days gone by, the sections of a firing battery have been identified as being in the center, left, or right platoon of two howitzers each. We really do not need another fancy sounding acronym or a new term. Platoon sounds fine. That's what it is—a major subdivision of a battery (company). Look at our TOEs. We have already used the term "platoon" in identifying other elements of the battery. If we are going to divide the firing battery in tactical operations, the only way to do it is by *platoons.*

Please! (Also note that "fire unit" is an Air Defense term.)

Hardy R. Stone
COL, FA
Fort Sill, OK

Platoon or section

Reference your request for the name for the four-gun element, why not "platoon"?

If we retain the name "section" for the gun crews, the name "platoon" is a natural. By doctrine and tradition, the formation between a section and a company or battery is a platoon.

If we should want to retain the term "firing platoon" [for the guns and FDC], then let's change the name of our individual gun crews to "squad" or "crew," and call the split battery elements "sections."

Robert E. Naborney
1LT, AR
Tacoma, WA

Use the old names

My suggestions are not original, but there seem to be only two choices:

• "Troops" (1st and 2d), from the traditional British system.

• "Platoons" (1st and 2d), from the traditional American system which we've always used.

George Ruhlen
MG (Ret), USA
San Antonio, TX

"Platoon" is the answer

A great effort has been made to tear down the "little red fence" around our Artillery home and to promote the combined arms team as a viable concept throughout the Army. Our sister branches designate their major company subordinate elements as platoons, and this designation is understood throughout the military. Our own branch has used this term to designate similar units in the past.

With a view to minimizing confusion while enhancing the combined arms spirit, I strongly recommend adoption

of the term "platoon" to designate the four-gun element of the proposed eight-gun battery.

I compliment you on the current issue of the *Journal*. It is one of your finest efforts. You folks are doing an absolutely outstanding job, and our publication makes me proud to be a Redleg!

Ronald B. Stevens
COL, FA
Fort Carson, CO

Another vote for "platoon"

As a former commander of the 1st Battalion, 77th Field Artillery (1970-72), I read Captain Knight's article on DRS (January-February 1979 *Journal*) with great interest. It brought back fond memories of when we were an airmobile battalion.

Many of the problems Captain Knight had were identical to the problems we had when conducting airmobile operations, to include command and control, advance party, battery defense, communications, mess, and maintenance.

Because of periodic problems with helicopter availability and weather, we were forced to conduct some split battery operations. When our firing batteries were split, we referred to the elements—regardless of how many howitzers were in each—as the 1st and 2d firing platoons. Everyone knew that a platoon was larger than a section but smaller than a battery so there was no confusion. "Firing platoon" may not be a very original name, but I suggest that it would be the most appropriate name and would be understood by all.

Alan R. Stern
COL, FA
Arlington, VA

Hot times at the DRS test

The daytime temperatures during the DRS battalion test, which CPT Darrell Morgeson alluded to in his article *(FA Journal* Nov-Dec 78), have implications for Artillerymen operating in hot environments or wearing the full CBR protective uniform.

Although putting up the lightweight screening system (LWSS) camouflage in bright sunlight is a hard, hot job, it quickly pays for itself by providing shade in which to cool off (not to mention its value in reducing the chance of precipitation of an explosive kind). The actual Fahrenheit temperatures measured about noon on top of the LWSS at OP Armstrong, Fort Hood, were: 139° on the black globe-covered (BG) thermometer, 113° on the shaded dry-bulb (DB) thermometer, and 82.5° on the wick-covered wet-bulb (WB) thermometer. This gave a WBGT index (usually called "the wet bulb") of 95.6°.

At the same time, the readings in the shade under the LWSS were BG 106°, DB 98°, and WB 79°, for a WBGT of 85.3°.

The WBGT is the best indicator of how difficult it is for a sweating man to keep his body temperature at a safe level. The risks of heat exhaustion and heat stroke go from negligible at 85.3° to "just a matter of time" at 95.6° for well acclimatized men performing only moderate work if they can't rest and cool off.

As the DRS continued, we observed that, with each move, units took longer to erect the LWSS, and some stopped using it altogether. There is a common tendency for tired or hot men to neglect self-initiated tasks while they continue to respond well to calls for fire and other "mission" actions. To the extent that these self-initiated tasks have a significant influence on individual and unit survival, their satisfactory accomplishment must be made virtually automatic during training and reinforced by reminders (perhaps as SOP when batteries report "ready to fire"). Finally, sufficient TOE personnel must be available to accomplish these essential secondary tasks while still carrying out the primary tasks of shooting, moving, and communicating around the clock.

When men must work in full CBR gear, they can't cool off by sweating and can overheat to the point of exhaustion or heat stroke just from the heat their muscles generate while working. As a rule of thumb, wearing the full ensemble adds about 10° to the wet-bulb temperature, so the LWSS's shade can make a critical difference in how fast, and for how long, men can load and shoot even on a cool, bright day.

Normally during the DRS test, the shade provided by the LWSS and the vehicles' hulls kept the daytime WBGT temperature inside the M109s and M577s in the low to mid 80s as long as the hatches were open—no problem for a sweating man. The radios and computers in the FDCs also generated heat, and since those don't "sweat," they sometimes shut off from overheating. Vehicles in bright sunlight got very hot and those which remained buttoned up at night (to maintain light discipline) stayed like sweat-boxes throughout the night even though outside temperatures were in the 70s. Electric fans which some FDC teams improvised in their M577s made a significant difference.

At the time mentioned in Captain Morgeson's article, the WBGT reading measured in the sun at OP Armstrong was 95.6°. This was above the cutoff point of 90° WBGT at which the Post's policy calls for all nonmission-essential training to cease and for commanders performing mission-essential work to take special precautions. The DRS battalion commander could continue the essential DRS test with confidence because the unit was well acclimatized to the heat, both physically and mentally. The unit had spent several five-day exercises in the field in June and July, and the troops knew how to pace themselves. Special measures were taken to get sufficient water to the batteries, detached elements, and outposts. The men had learned not to rely on thirst as an indicator of heat danger but, rather, to drink small amounts of water often. They had been instructed to use extra salt with their meals, and to get more salt if needed from the medics. A unit policy of unblousing fatigue shirts and trousers when the WBGT reading reached 84° had been instituted. Even with these precautions, four men were evacuated during the five-day test for heat-related illnesses. The important point is not to underrate this achievement or the importance of physical acclimatization, training, and command emphasis. A less-prepared unit in the same environmental conditions could have been unable to complete the test satisfactorily and might have had men permanently disabled, or even killed, by heat stroke.

If anyone wishes more information on any of these subjects, call me at AUTOVON 955-2822/2813.

For the record, USARIEM (US Army Research Institute of Environmental Medicine) is part of the Medical Research and Development Command, Office of The Surgeon General. As a medical institute, we are very different from ARI (Army Research Institute of the Behavioral and Social Sciences) under the jurisdiction of DCSPER. As Captain Morgeson demonstrated, USARIEM is frequently confused with ARI.

James W. Stokes
LTC, MC
Director, Health &
Performance Division
Natick, MA

Incoming

Angle T can be fatal

Using current fire direction procedures, the location of a firing battery can be replotted by the enemy under the following conditions:

• An observer's location and radio frequency become known to the enemy.

• The observer calls three missions from this location.

• The firing element does not change locations while firing these same three missions.

• Angle T is announced to the observer for all three missions.

By backplotting a series of three rays from the observer's location, intersection will pinpoint the fire unit.

Two possible solutions are to report "Angle T greater than 500," or to encode the value of angle T. The latter method allows the observer to locate his supporting indirect fire for such purposes as getting maximum use of the directional antenna or adjusting rounds along the gun-target line.

Robert G. Beard
2LT, FA
Fort Riley, KS

What you say is geometrically correct; however, since angle T is only announced to the nearest 100 mils, a plus or minus 50-mil error is introduced into each backplot. Enemy counterbattery radar is good enough to locate us faster, more accurately, and with less trouble. Also, it is reasonable to assume that the enemy will be too busy trying to avoid being killed by our artillery that such elaborate efforts would be out of the question.

Your point is well taken and your interest is appreciated.—Ed.

Rare books and the Morris Swett Library

One of the unusual features of the Morris Swett Library is its collection of rare books dating from 1702. What makes the section unique is that the books may be used by Library patrons on the premises in keeping with the "open-stack" principle of the Library.

The special collection numbers some 750 volumes, developed over a period of 80 years. Criteria for inclusion in the collection depend on such things as the subject, the likelihood that a work will never be reissued in the same format, date and/or circumstances of writing, accuracy or inaccuracy of content, quality of the work, or who the author is. The fact that a work is "old" or is a first edition is not enough. Some 16th century books may still be purchased for about $20, whereas one 1973 work is worth more than $700. Collectors are invited to discuss their interests with the Library staff.

Obviously, our collection should be enlarged. Donors of exotic and unusual items are encouraged to share their collections with the knowledge that their gift will be appropriately respected. One *caveat* applies—if there are heirs, they should be respected first. If not, the Field Artillery School Library would like to be considered.

Representative titles from the collection include the following:

Defence of Lt. Col. Fremont before the Court Martial, January, 1848.

Las Cases. *Mémorial de Sainte-Hélène* (Journal of Napoleon), I-VIII, 1823.

Ramsay, David. *The History of the American Revolution*, Trenton, James J. Wilson, 1811.

Report of Board of Officers (Westervelt Board), Washington, DC, 5 May 1919.

U.S. 10th Congress. *Appendix to Senate Debates Trial of Aaron Burr*, (1807).

Lester L. Miller
Supervisory Librarian
Morris Swett Library
Fort Sill, OK

The tie that binds

I saw an item in *Army Times* which speaks well for the unit spirit and personal attachment associated with our branch.

The item reported that 57-year old Lou Shirey of Birdsboro, PA, is one of those World War II soldiers who took his buddies at their word—albeit belatedly—when they told him "Look me up after the war."

Shirey spent three months and $3,500.00 looking for about 25 friends from the 313th Field Artillery, 80th Division. The trip took Shirey through 23 states. He found most with the aid of the 80th Division Association and wartime addresses.

"You couldn't believe how glad they were to see me," he said. "Even the wives thanked me for looking up the guys."

Numa P. Avendano
COL (Ret), FA
Lawton, OK

Small unit with a big job

The 260th Field Artillery Detachment's mission is to provide the Army Aviation Center with all indirect artillery support. To accomplish that mission, the Detachment consists of three M101A1 howitzer sections and a fire direction center. It is a small detachment, yet quite a busy one. In 1978, the Detachment fired 4,841 rounds. In addition, the Detachment provided illumination for the night firing of the AH-1G Cobras.

The importance of artillery is ever increasing, and the Army Aviation Center has not ignored that fact. Upon graduation from the aeroscout track of the Initial Entry Rotary Wing Course at Fort Rucker, aviators get live-fire experience in calling for and adjusting artillery rounds.

John W. Ogren
CPT, FA
Fort Rucker, AL

It is important to be reminded occasionally that there are Redlegs performing essential jobs outside of the division/corps structure. —Ed.

What *is* fire support?

In reviewing new Army literature and discussing fire support with Field Artillerymen, I am amazed at the differing opinions on *what fire support is*. This is difficult to understand. Army Regulation 10-6, in defining the responsibilities for the several branches of the Army, charges the Field Artillery with developing fire support doctrine for the Army.

The Army dictionary says that fire support includes fires from "artillery, naval gunfire ships, and aircraft strafing and bombardment." FM 6-20, Fire Support in Combined Arms Operations, adds mortars to that definition.

Total fire support may also include considerations to separate conventional fires from toxic chemical fires and from nuclear fires. A fire support plan may reflect these subdivisions, when appropriate.

Like a pie, *total* fire support, subdivides into multiple pieces based on the means available and the level of concern. Each piece concerns a means of fire support. FA fires are but one means of fire support.

Fire support is most effective when centrally managed by one individual for the supported commander. Currently, the senior Field Artilleryman at all

levels—company through corps—has this responsibility. To do his job properly, he must know the means available and manage them in concert.

A new definition for fire support should be developed and be standardized throughout Army literature so both supporting and supported elements are aware of what fire support is.

Anyone who serves in the role of fire support coordinator should concern himself with *all* means—not FA fires only. To win, the total fire support effort must be orchestrated.

Charles W. Montgomery
LTC (Ret), FA
Lawton, OK

Fuze setting training aid

Inclosed is a training aid for setting the M564 fuze. The device was developed by SSG Thomas R. Padilla, a member of Battery C, 3d Battalion, 133d Field Artillery, Texas National Guard, in Big Spring, Texas.

After making a sample, this finished product was made at Fort Bliss Training Aids. I think other Redlegs may benefit from this training aid and am passing it on to you for possible dissemination in your outstanding publication.

Robert J. Soltis
SFC, FA
3d Battalion, 133d FA (TXARNG)
El Paso, TX

Thank you for sharing your unit's training aid. Units wishing to have their TASO provide a similar slide rule-type aid should correct the slight discrepancy in tick marks.—Ed.

ARTEP—yesterday, today, or tomorrow

The Army Training and Evaluation Program (ARTEP), which has been in the field for the past three years, highlights what a unit's training should include. The ARTEP, if used correctly, is the book of answers for a unit to survive on the battlefield. The ARTEP *does not* do the training manager's job for him, but instead provides him with those critical tasks his unit must be able to do to survive.

At first, and even now, the ARTEP was seen just as a replacement for the age-old Army Training Test (ATT) which each unit was required to pass each year. The reason for this was because the ARTEP was new and it was not understood. Maybe this dynamic change from the old to the new was not explained as well as it should have been. Had the explanation been perfect, the changeover would not have taken place overnight. Too many of the "old timers" who like the old way, the way we have always done it before, would be reluctant to change.

It is a shame that such a modern concept of training has to wait so long to be accepted. It *will be* accepted, though, because the ARTEP concept is a good one. We in the Army no longer have the "blank check" of money and time to stay with the old way. We must recognize *what* our units *cannot* do well and train them to do these things well. The ARTEP lists what they must do and how well "good enough" is. ARTEP does away with hours of classroom instruction, followed by field exercises which reveal the shortcomings that we already knew were there. ARTEP, which is based on performance-oriented training, reveals units' weaknesses and highlights areas where we must focus our training. We will be able to win with ARTEP, but only when we realize that we do not do everything right all the time, but we must keep trying until we do.

If war comes tomorrow, a unit that is not afraid of making a mistake in training will have a better chance than those who train just enough to get by and look good. Commanders who turn training mistakes into educational experiences, rather than OER/EER highlights, will be the winners in combat.

James A. Dunn Sr.
CW4 (Ret)
Fort Sill, OK

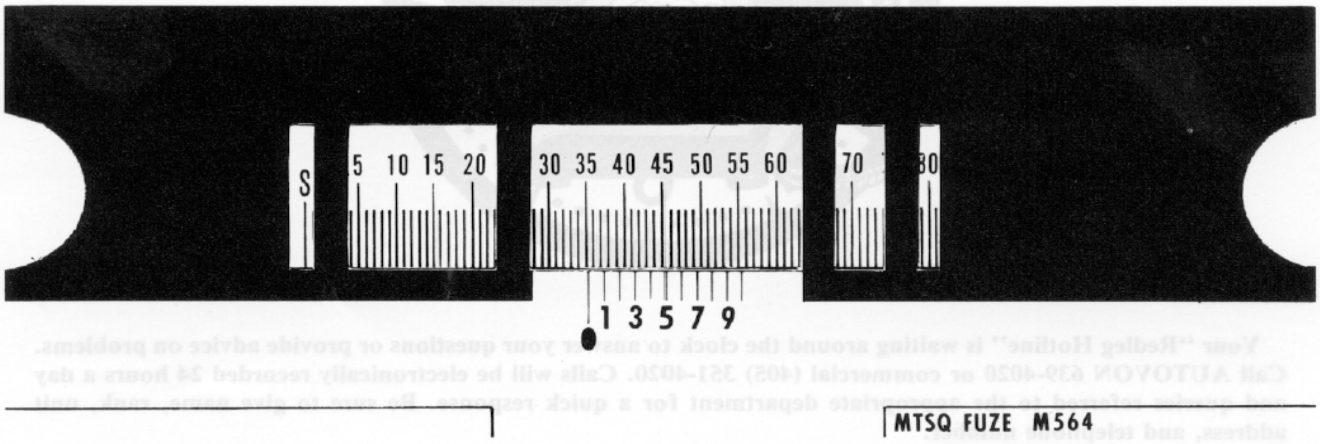
Reunion

The 87th Armored Field Artillery Battalion Association will hold a reunion 13-15 July 1979 at the St. Anthony Hotel in San Antonio, TX. Write Bill Hardy, 107-A Brightwood, San Antonio, TX 78209 for reservations.

Mr. Hardy's letter to us included a note that the 87th lays claim to the record for number of rounds fired by one battalion in Europe in World War II—191,762 rounds. Any challenges?—Ed.

Reunion

The 65th Armored Field Artillery Battalion of World War II will hold a reunion 20-22 April at the Quality Inn South, 2200 South Interregional Highway, Houston, TX. Contact Dudley O. King, 2402 Vance Lane, Austin, TX 78746.



Incoming

Red fence rebuilt?

What a great step forward in reestablishing the "red fence" around Fort Sill. The recent realignment of the procedures for inducting deserving Field Artillerymen into the Order of Saint Barbara (November-December 1978 *FA Journal)* smacks of the perception which prevailed some years ago of "not thought of at Fort Sill—not good" or "if not assigned to Fort Sill, you are a second class Artilleryman."

While realizing that perhaps the administrative burden of centrally awarding the certificates from Fort Sill should be eased, can the best solution be the creation of second class citizens of all of the Redlegs who man the guns in the field? Why can't all awardee's be in the "Ancient Order"? Why establish an "Honorable Order"?

Having been recently assigned to Fort Sill and now a part of a field unit, I have appreciation for the need of a coordinated and cohesive Field Artillery Community. The branch improves through the efforts of the *entire* Redleg group, not "Ancients versus Honorables."

Perhaps I will be accused of being emotional in writing this letter. You're damn right! The profession of the guns is emotional! Pride in our demanding job is mandatory. Anything that tears at that pride in the branch as a whole is damaging and should be eliminated. This current Saint Barbara policy falls in that category.

I'll see you around the dining table when we compare pewter and bronze medallions. It just may be that the "Honorable" will be promoted to the premier status since, to use an "Ancient" cliche, "they are where the rubber meets the road."

Bad move, Redlegs.

Carl S. Taylor
LTC, FA
Fort Hood, TX

There are two separate awards though there was absolutely no intention to create "first class" and "second class" status. The major reason for changing the previous policy was to remove dissatisfaction and eliminate administrative delays in approving awards in field units. This change was responsive to criticism from the field!

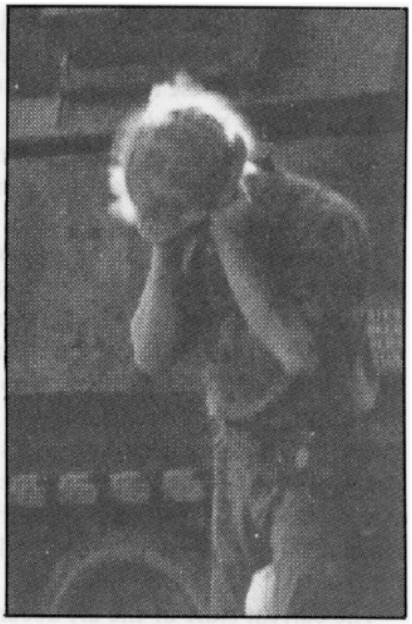
Previous methods of controlling entry into the Order varied from very detailed documentation of the nominee's performance to allowing any individual to order the medallion from the Fort Sill Post Exchange. The current system seems to meet the desire for minimum red tape while keeping membership in the Order at the degree of exclusivity all Redlegs want.

This delegation of authority to approve awards places great responsibility on field commanders for maintaining high standards for membership in the Order of Saint Barbara. The awards are coequal now, if field commanders apply the suggested criteria for nominations, the awards will continue to be coequal. If commanders can't "bite the bullet" then there will indeed be two classes over time. The School Commandant approves all nominations for the Ancient Order to insure compliance with the criteria.

The point you make of the differences in work done in the field and at Sill is valid and the wearer of each type medallion can feel well-deserved pride in either award, especially considering the many fine Artillerymen who have neither award.—Ed.

Your "Redleg Hotline" is waiting around the clock to answer your questions or provide advice on problems. Call AUTOVON 639-4020 or commercial (405) 351-4020. Calls will be electronically recorded 24 hours a day and queries referred to the appropriate department for a quick response. Be sure to give name, rank, unit address, and telephone number.

THE MEDICAL EFFECTS OF BLAST OVERPRESSURE



(Photo by SP4 Ron Cosens)

by COL Leslie B. Altstatt, MC;
MAJ Gary E. Sander, MC; and
CPT James J. Jaeger, MSC

Because of a greater awareness of the health hazards associated with various occupations, The Surgeon General (TSG) was given the task of investigating possible hazards associated with the blast overpressures generated by the firing of Army weapons systems. This task was placed upon TSG by the Deputy Chief of Staff for Research, Development, and Acquisition in October 1976 and was delegated by TSG to the US Army Medical Research and Development Command (Washington, DC) and the Division of Medicine at the Walter Reed Army Institute of Research (WRAIR) in Washington, DC. Hence the Blast Overpressure Program was initiated at WRAIR in July 1977 with the mission of defining the physiological effects of blast overpressure upon the human, to include—

- The physical characteristics of the pressure wave responsible for injury.
- The interaction between the wave and susceptible organs.
- The threshold for injury of the various organ systems.
- Potential means of prevention and treatment of blast overpressure injury.

The purpose of this article is to familiarize the Field Artillery Community with the efforts of this program. Potential medical effects of overpressure can be separated into two general categories—injury to hearing (auditory injury) and injury to body organs other than the ears (nonauditory). Included in the area of auditory injury are the problems of the physical measurement of pressure waves.

Auditory injury

Overpressure levels are most commonly measured on either the PSI (pounds per square inch) scale, which is linear, or the dB (decibel) scale, which is a logarithmic function of the PSI. Since the dB scale is logarithmic, it increases rapidly relative to the PSI at pressures greater than 180 dB. For example, as the pressure rises from 180 dB to 183 dB, the actual linear pressures have increased from 2.8 to 4.2 PSI. At these pressure levels, an increase of only one dB may represent a very significant pressure rise.

The graphic representation of the peak pressure as a function of time is referred to as a time history. Figure 1 depicts such a time history recorded in operator positions behind the M198, 155-mm towed howitzer. The peak pressure is the maximum pressure reached, the A-duration is the length of the initial pressure deflection, and the B-duration is the total length of time until all pressure fluctuations cease. The frequency content (the relative contributions of various frequencies to the total energy) is obtained by a Fourrier transformation of the time history. Blast overpressure and impulse noise are essentially identical terms.

As a general statement, it may be said that noise will cause significant permanent hearing loss even at levels which do not cause eardrum rupture, but adequate hearing protection will prevent this. What still remains to be determined is the maximum noise level for which adequate hearing protection can be provided. Single hearing protection consists of either an ear plug or an ear muff; double protection consists of both devices used together. Single protection provides about 25 dB noise

attenuation at high frequencies, and addition of the second protector provides only an additional 5 dB attenuation for a total noise reduction of 30 dB. Both types of protectors are much less effective in attenuating low frequency noise; it is currently unresolved whether or not low frequency noise can induce high frequency hearing loss.

A commercially made artilleryman's helmet, the DH 178, was used during the evaluation of the M198. This helmet not only provides ballistic protection but functions as an "active muff"—an ear muff modified by the addition of electronic circuitry so that it effectively transmits and amplifies speech, but "cuts off" impulse noise. By itself, the helmet provides only single hearing protection; to provide double protection, ear plugs must also be used. It is anticipated that this helmet or a similar one will be widely used by artillery crewmen in the near future.

The current state-of-the-art document for use in estimating safe levels of noise exposure is the MIL-STD 1474A (MI) dated 3 March 1975. This Military Standard (MIL-STD) is based on empirical data from small arms fire and a number of assumptions involving theorized mechanisms of hearing loss. It is not the ultimate damage risk criterion (DRC) for noise-induced injury, but it does represent the best existing document.

This document contains a DRC for impulse noise (figure 2) which attempts to assign a specific risk of injury for a given exposure. Once a particular blast wave is characterized by its peak pressure and B-duration, the location on the DRC may be determined, and thus allowable exposures per 24 hours can be calculated. The Z-line represents the maximum exposure level. Even single exposures above this line are not permitted because hearing protection has not been demonstrated to be adequate at these levels and because of the possibility of nonauditory injury. Exposures *under* the Z-line are permitted with double hearing protection. This limitation is designed to prevent 95 percent of the individuals exposed from incurring significant hearing loss.

The major thrusts of the auditory program are directed toward two goals:

1) The accurate and reliable measurement of the pressure wave.

2) The demonstration of the adequacy of hearing protection.

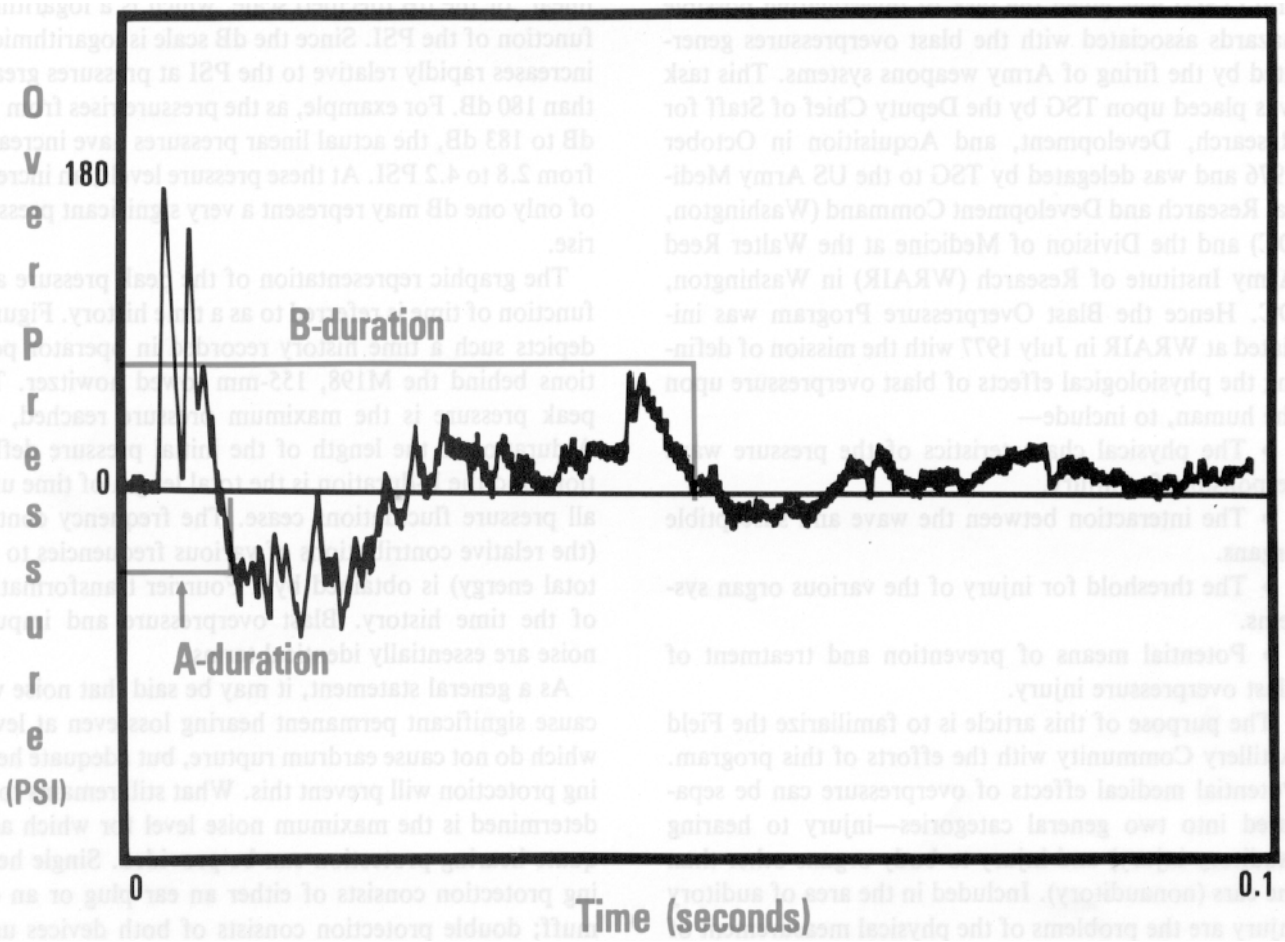


Figure 1. Time history for M198/M203 in operator position.

At present, measurement of pressure waves is neither accurate nor reliable, with significant disagreement among participating agencies over pressure measurements. Demonstration of the adequacy of hearing protection will require the exposure of human subjects wearing hearing protection to gradually increasing pressure levels and careful monitoring to prevent excess temporary hearing loss. Such data will be required to either validate the existing MIL-STD or to develop a more effective DRC.

The auditory portion of this program is centered at the US Army Aeromedical Research Laboratory, Fort Rucker, AL. Efforts have been directed primarily at field measurements of overpressures during M198 and M110 firings, bench testing of the DH 178 helmet, and preparation for a human volunteer study designed to test the double hearing protection concept. Critical evaluation of the methodology of data recording has revealed several possible deficiencies which are now being investigated. These include the importance of microphone height and microphone orientation.

Extensive mapping of the pressure field in operator positions around the M198 revealed that the M203 zone 8 charge produced pressures above the Z-line in crew positions. Examination of the pressure contours demonstrated a complex pressure pattern, with apparent reflections from weapon appendages (such as the trails), producing significant localized pressure elevations. To allow the M198 test to proceed safely and on schedule, several safety precautions were recommended. These included the use of a 25-foot lanyard when firing the M203 charge and also limitations on the number of other charges fired in a 24-hour period. The M198 operator's manual lists these safety recommendations in detail. Such restrictions are designed to apply only to training situations and have no application in wartime. At this time specific safety recommendations have been applied only to the M198. It is possible that in the future such recommendations will be extended to other weapons for training exercises.

The 1st Battalion, 73d Field Artillery soldiers used the DH 178 helmet to provide a degree of hearing protection during M198 testing.

(Photo by Charles Ray)

Nonauditory injury

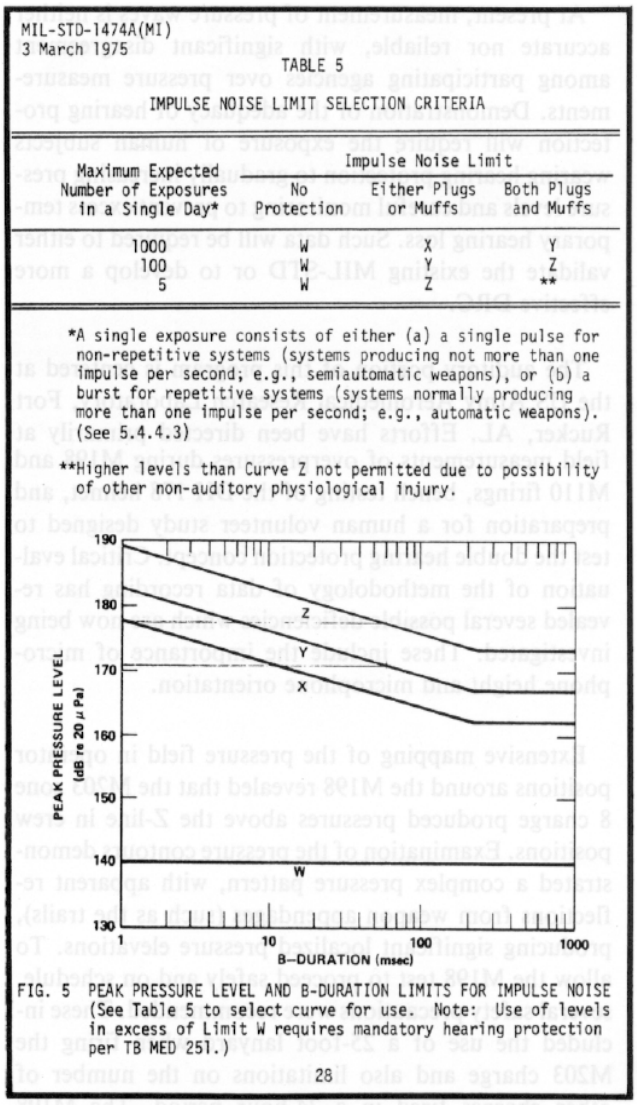
Blast overpressure-induced injury occurs primarily in air-containing organs, specifically the nasal air sinuses, the lungs, and the gastrointestinal tract. Of these, lung injury (consisting primarily of hemorrhage and emphysema) is the most critical in that significant disability and even death may result. Investigators at Lovelace Foundation in Albuquerque, NM, have developed much of the existing information on blast injury. This work was largely supported by the Atomic Energy Commission and was directed at studying the effects of nuclear blasts. These investigators observed a rough correlation between the size of a particular species of animal exposed to the blast and its tolerance to blast-induced injury. However, determination of the earliest evidence of injury—small, pinpoint hemorrhages—is difficult and requires an autopsy and a visual inspection of the animal's lung surfaces soon after exposure. Thus, this method of detecting injury is obviously quite limited in its application.

The ultimate goal of the Blast Overpressure Program is the development of a dose-response curve for nonauditory injury, where the dose is the magnitude of the overpressure and the response is the biological injury (or absence of injury). Once such a dose-response curve is established, then a risk assessment may be made for specific exposures—both in terms of the risk of a particular injury and the potential severity of that injury. This would allow the responsible commander to make the final decision as to whether a particular risk is warranted. The construction of this curve will require both a much more accurate knowledge of which parameters of the pressure wave are important (e.g., peak pressure, frequency content) and a much improved methodology

of evaluating biological injury. Both of these requirements are under investigation at WRAIR. An additional requirement is the ability to create a simulated blast wave which will allow manipulation of the waveform in an experimental environment without depending on weapon, range, and ammunition availability, which has been a problem thus far.

The blast tube facilities at Lovelace Institute were used to produce a blast wave appearing very similar to that of the M198 with regard to time history and frequency content for peak pressures of 180 dB, 185 dB, and 190 dB. Sheep were exposed to this waveform at these pressure levels, solely in preparation for the human volunteer hearing protection study, to provide safety assurances. Prior Lovelace studies had estimated that human lung injury would not occur at pressure levels below 30 PSI (200 dB). However, several unexpected injuries or physical abnormalities were noted in sheep exposed to 185 and 190 dB. No such injuries were noted in animals exposed to 180 dB. These areas of hemorrhage and emphysema are currently undergoing further investigation in an attempt to determine whether they are indeed due to the blast wave or whether they may be secondary to some aspect of the experimental design. It is essential to keep in mind that sheep provide only a rough estimate of man's tolerance to blast, and thus these results are not directly applicable. The potential significance of such injuries on the long-term physical well being of the animal are not clear at this time. The results of the sheep study meant only that the human volunteer study could not proceed until this apparent injury was better defined and either proved or disproved. Also, these results had no effect on the safety recommendations for the M198 testing—those safety recommendations stemmed entirely from MIL-STD 1474.

In summary, overpressures generated by firing extended-range weapons present a definite hazard to hearing unless adequate protection is worn and may present a greater hazard to such organs as the lung and nasal sinuses than has been appreciated in the past. Double hearing protection (plugs *and* muffs) can prevent permanent hearing loss during most exposures under the Z-line; however, there is as yet no empirical data available for demonstrating effectiveness at pressures over the Z-line of the MIL-STD. Animal studies carried out to explore the possibility of nonauditory injury are as yet inconclusive. There is no evidence that exposures under the Z-line pose any threat at all to these organs. Safety recommendations have been made for training situations involving the M198 to insure that all operator exposures are within those limits suggested by the MIL-STD, thus presenting minimal, if any, risk for the crew.



MIL-STD-1474A(MI)
3 March 1975

TABLE 5

IMPULSE NOISE LIMIT SELECTION CRITERIA

Maximum Expected Number of Exposures in a Single Day*	Impulse Noise Limit: No Protection	Either Plugs or Muffs	Both Plugs and Muffs
1000	W	X	Y
100	W	Y	Z
5	W	Z	**

*A single exposure consists of either (a) a single pulse for non-repetitive systems (systems producing not more than one impulse per second; e.g., semiautomatic weapons), or (b) a burst for repetitive systems (systems normally producing more than one impulse per second; e.g., automatic weapons). (See 5.4.4.3)

**Higher levels than Curve Z not permitted due to possibility of other non-auditory physiological injury.

FIG. 5 PEAK PRESSURE LEVEL AND B-DURATION LIMITS FOR IMPULSE NOISE (See Table 5 to select curve for use. Note: Use of levels in excess of Limit W requires mandatory hearing protection per TB MED 251.)

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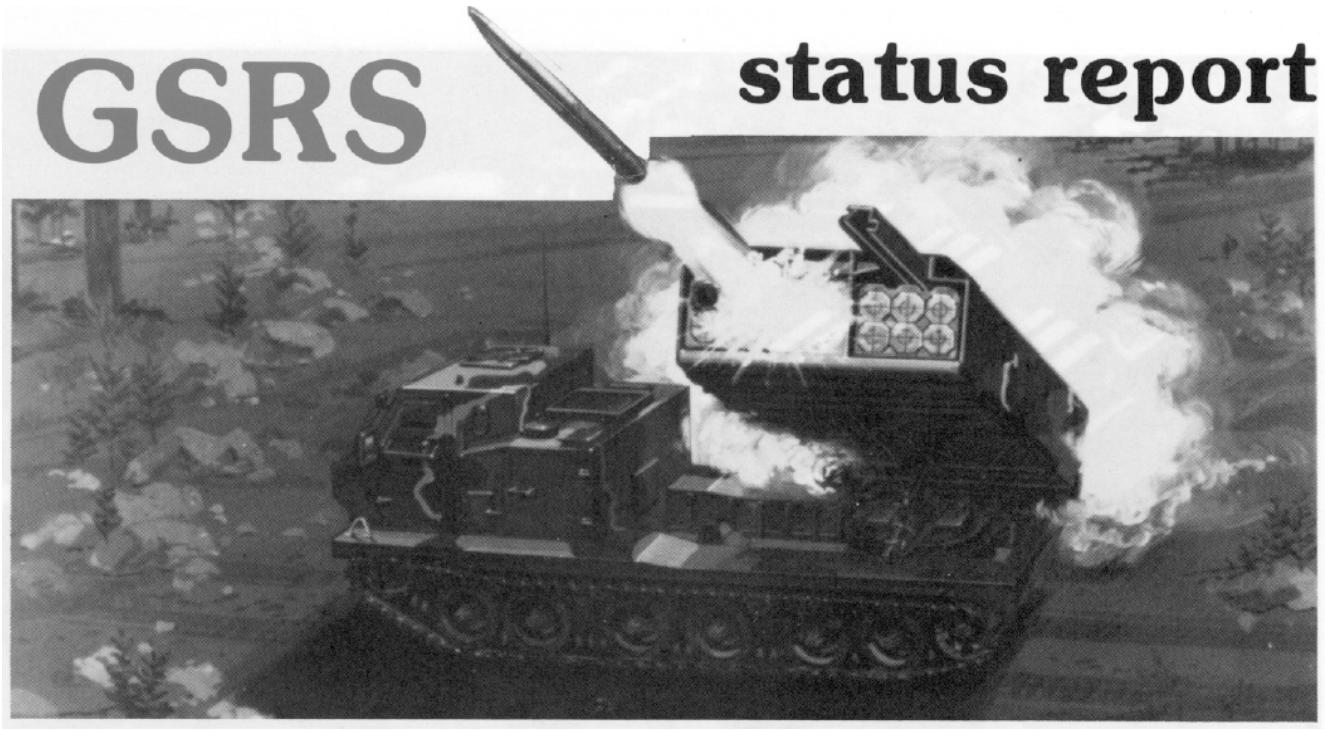
Figure 2. Extract from MIL-STD 1474 showing impulse noise limit selection criteria.

Evaluators at the Field Artillery School believe the recommended safety precautions and the DH178 helmet provide a safe and fairly comfortable firing environment for the crews during M198/M203 firings without incurring any operational handicap. Troops at Fort Bragg, NC, have been firing the top zone propelling charges since 1 November 1978. Additional testing to provide a larger data base to better assess the potential hazards of blast overpressure is scheduled during the next 18 months.

COL Leslie B. Altstatt (Program Manager for Blast Overpressure), MAJ Gary E. Sander, and CPT James J. Jaeger are assigned to US Army Medical Research and Development Command, Walter Reed Army Institute of Research, Washington, DC.

GSRS status report



by COL Charles J. Buel and CPT Gary R. Miller

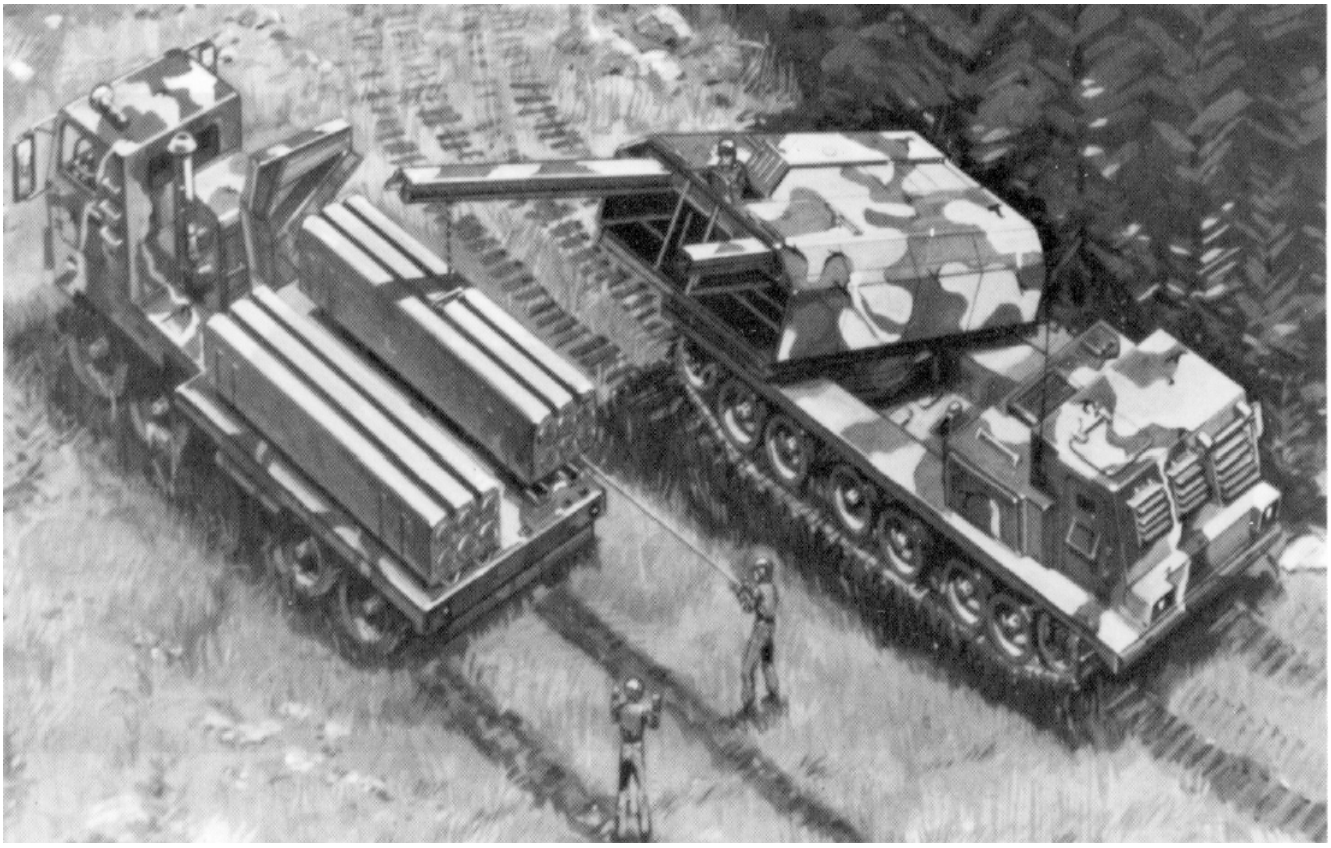
Today, when Warsaw Pact artillery outnumbers NATO artillery, it is not surprising that there is an urgent need for a multiple launch rocket system (MLRS). As an area weapon, the MLRS can provide a massive quantity of firepower on a target area in a short period of time.

Although rockets have been successfully used by the US Army since General Winfield Scott's siege of Vera Cruz in 1846, their use has been limited. Little work was done to develop or improve rockets until the Vietnam conflict, when the 2.75-inch rocket was used in the helicopter gunships. Then, a serious interest in rocket artillery began.

Events in the Middle East wars further fueled interest in an MLRS when battery counterfire and air defense systems became a serious threat and quickly took their toll of the Israeli close support aircraft. During the first four days of the 1973 war, the Israeli Air Force was used in the campaign of the Golan Heights to blunt the 1,000-tank Syrian assault. The first afternoon the Israelis lost about 35 aircraft to antiaircraft fire, amounting to one-third of their air losses during the entire 18 days of war. Rocket artillery was then employed against the enemy air defense systems, resulting in a drastic decline of air losses. This revitalized US interest in an MLRS and contributed to a desire to field a system which could defeat the growing counterbattery and air defense threat.

Demands on artillery are increasing in many other areas. There is a growing concern about our ability to meet these demands, especially against an enemy numerically superior in indirect and direct fire weapon systems.

Unnoticed by many, our ability to deliver large volumes of firepower quickly has eroded steadily. We will probably never again enjoy the luxury of routinely ordering massive B-52 strikes and having a surplus of tactical close air support—certainly not on the scale we had in Vietnam. The future battlefield will entail a target-rich environment of greater density than any action common to the 1973 Mideast War. Artillery will be in demand by everyone; however, large ammunition expenditure rates will be a thing of the past. Our artillery will have to be managed judiciously. Today we *must* focus on how we can destroy more targets cost effectively. This is why development programs for multiple launch rocket systems and terminally guided warhead (TGW) munitions are important. Terminally guided warhead munitions technology is available for inclusion in MLRS design. Effectiveness studies have shown the MLRS/TGW to be highly effective against maneuverable armored targets, and there is a well-reasoned operational scenario for using it in conjunction with other developmental systems such as Copperhead, our cannon-launched guided projectile. The MLRS offers a solution to offset our inability to deliver adequate volumes of firepower quickly. MLRS with the M42 improved conventional munition warhead will suppress direct, indirect, and air defense weapons; supplement the fires of cannon and tactical air; and reduce the burden on our



An artist's concept of the Boeing system shows the three-man GSRS crew during reloading operations.

cannon and tactical air systems. In short, the MLRS offers very significant advantages on the battlefield.

The Army plans to field an MLRS known as the General Support Rocket System (GSRS) in the 1980s. The system offers manpower savings, provides massive firepower and increased mobility, and features a tracked launcher, carrying 12 rockets which can be fired singly or in rapid ripple fire. Its range is in excess of 30 kilometers.

The carrier vehicle is a modification of the Army's new Infantry Fighting Vehicle, which will give GSRS a cross-country capability comparable to the new XM1 tank. This will allow GSRS to be part of the combined arms team. The carrier provides a stable launch platform without the use of outriggers, reducing the mission cycle time. The cab permits the three-man crew to remain inside during rocket firing. In addition to superb ground mobility, the self-propelled carrier is air-transportable aboard a C141 aircraft.

The rockets are stored, shipped, and launched from a container that holds six rockets. The rockets will be loaded at the factory and will require no maintenance or crew servicing before firing. After firing, the empty container will be discarded. The self-loading launcher, which is mounted on the carrier vehicle, features its own hoist assembly that can lift and load two 6-rocket pods from a resupply vehicle or ground storage. A microprocessor, coupled to an onboard gyroscopic system, will provide for continuous directional reference and will automatically correct for launcher cant and rocket temperature. The GSRS design includes the potential for development of three warhead types; dual-purpose antimateriel and antipersonnel, scatterable mines, and point targets by using a terminally-guided warhead.

The GSRS designers have stressed simplicity and automation in an effort to reduce manpower requirements. By using built-in test equipment and a rocket which requires no maintenance during its 10-year life cycle, maintenance requirements are reduced. The overall result is a very favorable personnel-per-launcher ratio. This results in a battalion-size organization that is small in relation to its firepower capability. Plans call for the GSRS to be part of division and corps artillery organizations.

To effectively incorporate the GSRS as a combat multiplier, the operational concept envisions "shoot and scoot" tactics, decentralized execution at launcher level, and automated firing battery operations. Firing sites are selected to enhance survivability and provide adequate coverage over the maneuver commander's entire zone of action. Vehicle mobility and launcher automation permit the launcher crew to process the fire mission, be resupplied, and return to a firing site and fire, all in approximately 15 minutes. In essence, area saturation

A six-rocket pod is being loaded into the Vought Company version of the GSRS launcher.

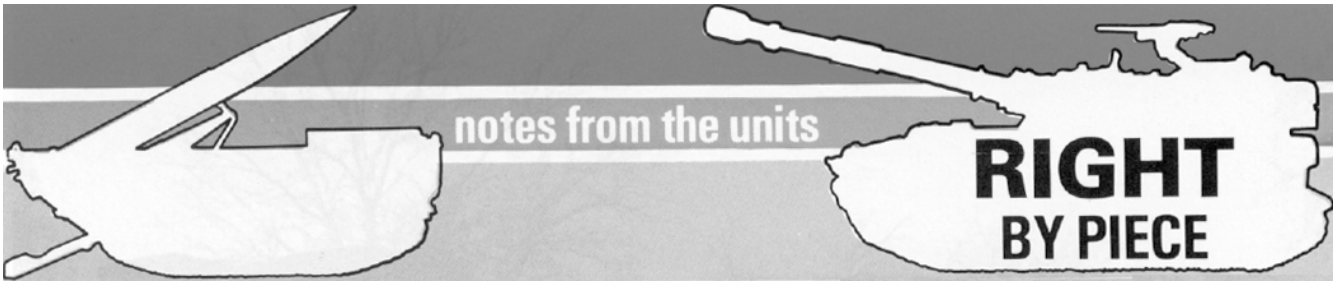
of critical counterfire and air defense targets can be accomplished responsively with a system that offers a high degree of survivability. Taking advantage of the system's capabilities of extended range, increased firepower, automation, and survivability, the GSRS will effectively supplement present cannon artillery.

The load on the logistics tail is no greater for the GSRS than it would be for any other system capable of equalizing the imbalance between Warsaw Pact and NATO firepower. In fact, the launch pod container in which the rockets are shipped and stored reduces the quantity of handling equipment and simplifies handling procedures.

Since the first contracts for developing an MLRS were awarded just over one year ago, this accelerated development program has made tremendous progress. The two prime contractors, the Vought Corporation of Dallas, TX, and the Boeing Company of Seattle, WA, are in a competitive validation phase where engineering designs are being tested and analyzed, prototype equipment is being manufactured, and test rockets are being fired. Recently, two prototype carrier vehicles were delivered to the competing contractors. Vought and Boeing are now in the process of fabricating the actual launcher/loader and integrating this component with the GSRS carrier vehicle. There will be an operational and development test from January to March 1980. In May of 1980, a single contract for low-rate initial production will be awarded to the prime contractor presenting the most convincing operational system.

The GSRS will give NATO forces in Europe more artillery firepower against a numerically superior enemy force. Early in the program, the US Army Missile Research and Development Command redirected the development program in a desire to field a NATO standard weapon. West Germany, the United Kingdom, France, and the United States are involved in discussions that could result in GSRS becoming the European Multiple Launch Rocket System, coproduced in the United States and Europe. The major payoffs of this agreement would include a decrease in development costs for all participating nations, shared economic benefits through coproduction, and enhanced future collective security. Finally, but perhaps most importantly, the increase in the operational capability through fielding the GSRS by several of the NATO nations will significantly reduce the disparity that exists between the Warsaw Pact and NATO direct and indirect fire systems.

COL Charles J. Buel is TRADOC System Manager for GSRS. CPT Gary R. Miller was assigned to the GSRS TSM office and is now assigned to the 3d Armored Division Artillery.



Shell swap supports STANAGs

GRAFENWOEHR, GERMANY—Standardization Agreements (STANAGs) among NATO countries provide for the interchange of ammunition in war, but peacetime interoperability is not covered. German and American field artillery units have been known to swap ammunition during partnership exercises, but official tests have never been conducted.

In 1977 GEN George S. Blanchard, Commander in Chief, US Army, Europe (CINCUSAREUR), ordered studies to find out whether ammunition mentioned in STANAGs really was interchangeable.

The Army Materiel Development and Readiness Command provided safety clearance of test ammunition after comparing specifications of US, West German, Canadian, British, Dutch, and Belgian ammunition from small arms calibers up through 175-mm howitzer projectiles and authorized interoperability checks on certain projectiles, fuzes, propellants, and primers.

In conjunction with the West German Ministry of Defense, CINCUSAREUR selected the 3d Battalion, 35th Field Artillery and its partnership unit, the 121st Artilleriebataillon, 12th (German) Artillery Regiment, to exchange and fire 20 complete 8-inch artillery rounds. In November, the 1st Battalion, 16th Field Artillery, exchanged and fired 155-mm ammunition with its partnership unit, the 115th Panzerartilleriebataillon. A 175-mm exchange firing has been scheduled, and US-British tests are also planned.

In the 155-mm exchange, a US M109A1 howitzer and a German M109G were used. After each gun fired a registration and a verification round using normal fire direction procedures, five rounds of high explosive ammunition (M107 from the Americans and DM21 from the Germans) were exchanged.

German and American artillerymen swap shells in a test of materiel interoperability. (Photo by SP4 Todd Kottmyer)

Propellant charges and point detonating fuzes were also exchanged (except for the German DM211 fuze which has not been cleared for interchange). American and German primers currently are not allowed to be traded.

Radar surveillance of the impact area proved the experiment a success: all 10 rounds were within test parameters.

These howitzer firing tests are major milestones in USAREUR's continuing program of German-American cooperation and are a vital step toward proving the viability of NATO's standardization agreements.

Div arties modernize and up-gun

FORT STEWART, GA—The 24th Division Artillery is in the process of modernizing their battalions by going from towed 155-mm and 8-inch howitzers to self-propelled M109A1s and M110A1s. The 5th Division Artillery is involved in a similar up-gunning procedure, though on a smaller scale.

"Operation Quickstep" is the name given to the activity at Stewart in which the entire Division is converting from infantry to mechanized. The TOE changes for Div Arty are effective in September 1979, with exact equipment delivery dates still unknown. In the interim, the Division's two 155-mm direct support battalions are training with M109A1s, borrowed from their affiliated Georgia National Guard "round-out" battalion.

At Fort Polk, the 5th Mechanized Div Arty has been authorized the self-propelled weapons since the Division was activated, but supply priorities have not permitted the 3d Battalion, 19th Field Artillery, to replace their M114 towed weapons. While waiting the imminent delivery of 18 M109A1s, the 3-19th has been training on self-propelled 155-mm howitzers borrowed from their affiliated Louisiana National Guard FA battalion.

1-16th FA furls colors

FORT HOOD, TX—The 1st Battalion, 16th Field Artillery, was inactivated in ceremonies here on 2 February after returning from its second Brigade '75 six-month tour in Grafenwoehr, Germany. The 1-16th FA was activated on 1 March 1975 solely to augment 2d Armored Division forces during the Brigade '75 program, which terminated with the assignment of the 2d Armored Division (Forward) to Garlstedt, Germany.

With eight campaigns in World Wars I and II to its credit—along with a Presidential Unit Citation and a citation from the Belgian Army—the unit has not suffered from a lack of recognition in the past. The Brigade '75 era, however, has been one of its proudest.

Most of the personnel have been reassigned to other 2d Armored Division Artillery battalions.

Conversion to new howitzers

WASHINGTON, DC—The National Guard Bureau has announced that the 1-158th FA Battalion of the Oklahoma Army National Guard is the first ARNG unit to complete conversion of M110 self-propelled howitzers to the M110A1. All ARNG units authorized the M110A1 are scheduled to be converted by June 1979.

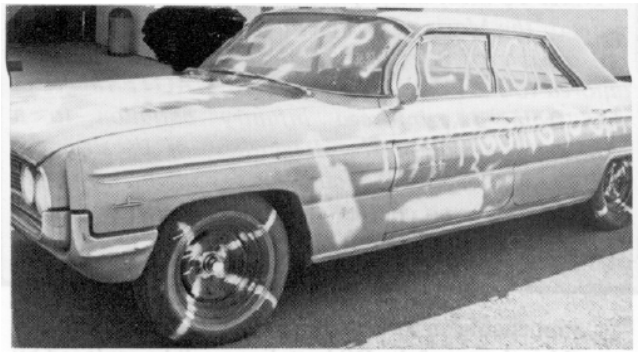
Field trip is "smashing" success

FORT ORD, CA—The 1st Battalion, 79th Field Artillery, has found a solution to the age-old problem of cannoneers, FDC personnel, surveyors, etc., never seeing the ultimate results of their labor. Now everyone in the battalion, and the 7th Division, can see the devastating power of the Field Artillery by simply passing the battalion headquarters building.

Prior to a recent field trip, the officers and NCOs of the battalion bought a junked 1962 Oldsmobile and had it towed to the impact area at Fort Ord. Before its trip "down range," the car was placed in the battalion area where soldiers of the battalion painted slogans and graffiti on the car.

During the field trip, the firing batteries were positioned to view the impact area while the 105-mm battalion fired a one-round TOT at the vehicle. The "trophy of the hunt" was then hauled through each battery area before being placed in front of the headquarters building as a daily reminder of the massive power of the Field Artillery.

Before



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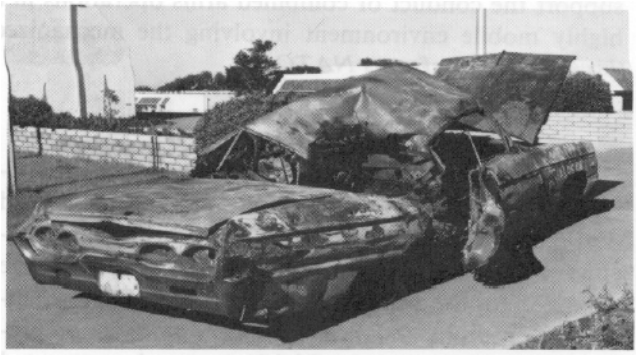


(photos by Lance Iversen)

Marine Corps Artillery—An Update

by Lt Col R. H. Moore, USMC

The primary naval mission of the US Marine Corps, our nation's amphibious force-in-readiness, is to project seapower ashore. The mobility and flexibility of Navy/Marine Corps amphibious task forces enable the accomplishment of a wide variety of general-purpose missions on a global basis, to include the NATO environment. The missions that could be assigned to the Marine Corps in support of NATO operations are to—

- Assist sea control efforts by seizing islands or coastal regions in order to dominate straits or other key sea areas.
- Support or reinforce the continental flanks of NATO.
- Secure a lodgment for a major counteroffensive.
- Fight in a conventional land force role.

This article will report on the status of the reorganization and modernization of Marine Corps artillery to support the conduct of combined arms operations in a highly mobile environment involving the mechanized threat which confronts NATO.

Reorganization

To upgrade its traditional force-in-readiness capability, the Marine Corps has recently reorganized the 2d Marine Division, Fleet Marine Force (FMF), Camp Lejeune, NC. This reorganization in part called for the dissolution of the 2d Field Artillery Group, FMF Atlantic. The medium and heavy artillery assets, not previously organic to the 2d Division, were incorporated into the division's 10th Marine Regiment. This regiment provides organic artillery support to the division, similar to an Army division artillery. As a result of this reorganization, the division has a significant increase in range, accuracy, and lethality capabilities.

The 10th Marine Regiment previously consisted of a headquarters battery and three direct support (DS) artillery battalions. Each battalion normally provided direct support, general support, and reinforcing fires for an infantry regiment. With the reorganization, the 10th Marine Regiment now consists of the same three DS battalions plus two general support (GS) battalions to support combat operations of the Marine Air/Ground Task Force (MAGTF) in the amphibious assault and subsequent operations ashore (figure 1).

Note: To meet the requirements of flexible response, units of the Marine Division and Marine Aircraft Wing are capable of being deployed in MAGTFs which are tailored to the mission assigned. An MAGTF ranges in size from a reinforced infantry battalion to a multidivision/wing force. Regardless of its size, the MAGTF will include the following four major elements: command, ground combat, aviation combat, and combat service support.

Commencing in late 1980, the 105-mm and 155-mm towed howitzers of the DS battalions will be replaced by

the M198 155-mm towed howitzer on a one-for-one basis, producing a quantum jump in combat effectiveness. The battery configuration of the 24 M198s per DS battalion, i.e., four six-gun batteries or three eight-gun batteries, is yet to be determined. The GS battalions consist of three six-gun batteries of M109A1 and M110A1. The addition of the GS battalions to the divisional artillery provides the commander with much more organic long-range medium and heavy caliber conventional and special fires to support combat operations.

Other selected Marine units will be reorganized at a later date if analysis of the 10th Marine Regiment's "new look" so dictates.

Modernization

• **Target acquisition:** Current planning and analysis are underway to provide the Marine Corps a coordinated system of target acquisition. A decision to establish a target acquisition agency within the regimental headquarters battery appears likely. This target acquisition agency will be equipped and organized to some extent along the lines of the Army divisional target acquisition battery. The system will eventually consist of the latest weapons locating radar (AN/TPQ-36) and sound and flash equipment. To support the regiment's subordinate units when deployed on less than division-sized operations, composite target acquisition sections will be attached to the artillery unit's headquarters.

The Marine Corps is closely monitoring the Army's development of passive target acquisition systems, such as the Passive Artillery Weapons Locating System (PAWLS) and Passive Artillery Locating System, Ground Based (PALS-G).

The Marine Corps counterfire operations are centralized at the lowest artillery echelon capable of effective counterbattery and countermortar efforts. In the division, counterbattery operations will normally be centralized at the artillery regimental fire direction center (FDC) and countermortar operations at the DS artillery battalion FDC. When small landing operations are planned, the artillery battalion or battery, as appropriate, will assume responsibilities for both counterfire missions.

• **Weapons:** The Marine Corps is participating in the extended range, increased lethality, and new capabilities programs of the Army. In particular, it is involved in the M109A2/A3 conversion program and the modification of the M107 and M110 weapons systems to the M110A2 howitzer. All of the Corps' M109 series and M110 series howitzers have been modified to the M109A1 and M110A1, respectively. The extended range M109A2/A3 and M110A2 weapons systems will be added to the Marine Corps' cannon artillery inventory in the near future.

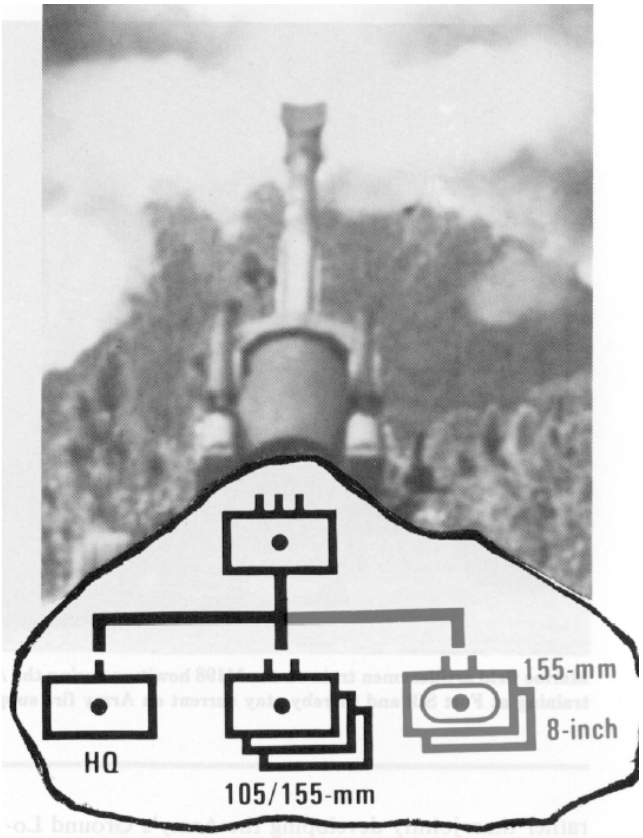


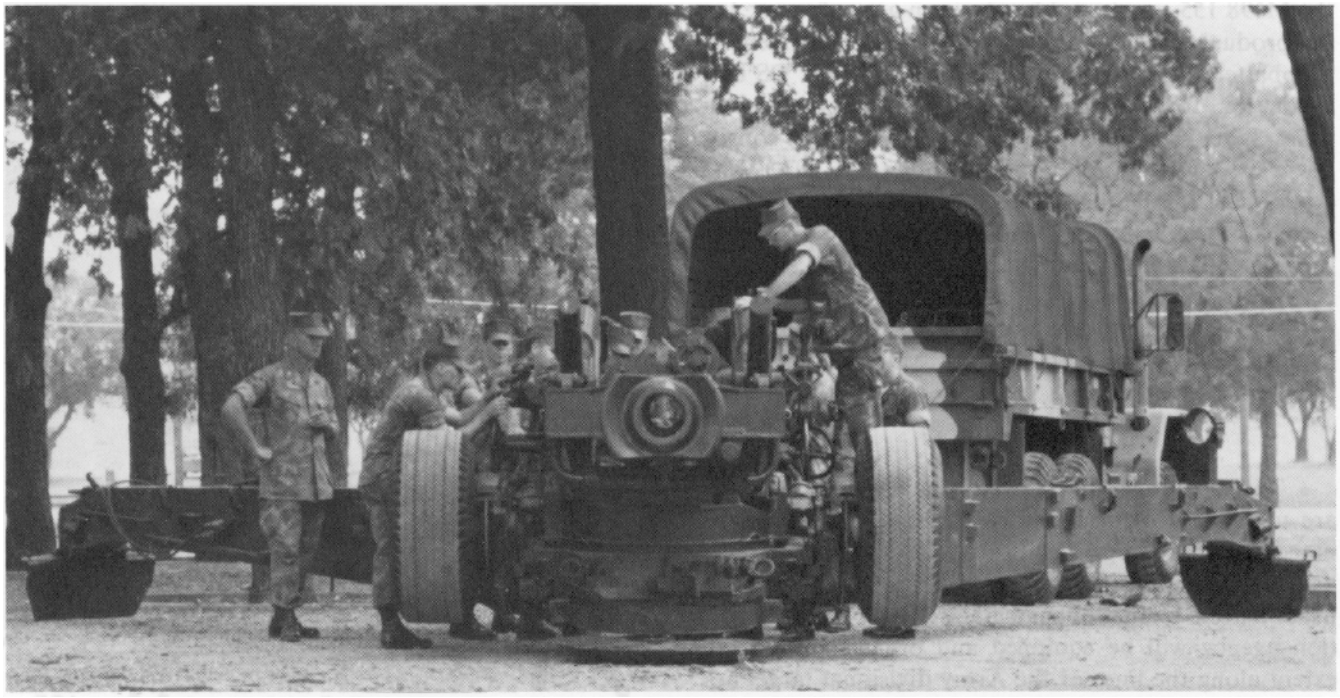
Figure 1. Organization of the 10th Marine Regiment. Before reorganization (black portion), each of the three assigned battalions had 18 105-mm weapons and six 155-mm howitzers, all towed. The extra two battalions after reorganization (colored portion) offer an additional 18 155-mm howitzers and 18 8-inch howitzers, all self-propelled.

All US cannon artillery ammunition either fielded or under development will be procured by the Marine Corps on the basis of need to carry out its fire support requirements.

• **Miscellaneous:** The Marine Corps is also keeping abreast of other developmental efforts underway in the Army. The Position Azimuth Determining System, the Field Artillery Meteorological Acquisition System, the Remotely Piloted Vehicle, the Battery Computer System, and the velocimeter are items which the Corps intends to procure to further modernize its field artillery system.

The Marines are also involved in some unilateral studies and developmental actions.

• **Modular Universal Laser Equipment (MULE):** Due to weight-bearing limitations of its foot-bound forward observers, forward air controllers, and naval gunfire spotters, the Marine Corps is developing the MULE



Marine field artillerymen train on the M198 howitzer during the Advanced Course. Marine Redlegs of all ranks receive their in-residence training at Fort Sill and thereby stay current on Army fire support developments.

rather than jointly developing the Army's Ground Locator Laser Designator (GLLD). The MULE is man-portable by two men and interfaces with our AN/TAS-4 Night Sight and the Digital Communications Terminal. The MULE can determine target range to ± 10 meters and azimuth to ± 3 mils; it can designate both moving and stationary targets for all laser-guided ordnance in the inventory or under development.

• **Lightweight Multiple Rocket Launcher System (LMRLS):** The Marine Corps is determining whether a requirement exists for a lightweight, highly mobile, rocket system to provide rapid, high volume, area saturation fire as a supplement to cannon systems. The system will be helicopter transportable. Adaptation of the Navy's 5-inch Zuni rocket to a surface-to-surface mode is being analyzed. The Army's General Support Rocket System is considered too heavy and costly to satisfy Marine Corps requirements.

• **Command and control:** In the command, control, and coordination area, the Marine Corps is independently developing the Marine Integrated Fire and Air Support System (MIFASS) to support its unique air/ground team concept. Basically, MIFASS consists of the personnel, equipment, and procedures for the command, control, and coordination of supporting arms, to include mortars, naval gunfire, artillery, and aircraft in support of ground combat operations. Joint efforts are taking place between the Army and Marines to achieve interoperability between TACFIRE and MIFASS.

Conclusion

Although quantitatively small compared to the Army, the Marine Corps' reorganization and modernization efforts, together with the Marine fighting spirit, will significantly enhance the Marine Corps' fire support system's effectiveness. The MAGTF will be a highly competitive force to contend with on the modern battlefield.

The PAWLS referred to in this article is a conceptual system that will consist of the PALS-G (an infrared flash ranging system) and the Passive Artillery Sound Acquisition System (PASAS). The PASAS is currently in a draft requirements document stage which should be finalized during the second quarter of FY 79.

The PAWLS will tie PALS-G and PASAS together through a common computer which will correlate the sound and flash data received at the PAWLS central.—Ed.

Lt Col R. H. Moore, USMC, is the US Marine Corps Development and Education Command's liaison officer at Fort Sill.

Development of
Point Detonating Fuzes

by CPT John R. deTreville

If asked which came first, the time fuze or the point detonating fuze, most people would likely choose the latter, because of its apparent simplicity of operation and construction. The truth is, the time fuze preceded the point detonating fuze by several hundred years. There were a number of major technological problems that had to be solved to make the impact fuze practical.

One of these problems was that for the first 500 years of the artillery's existence, there was only one explosive, black powder, which though very sensitive to flame, was not sensitive to crushing or friction. This was not a problem for time fuzes, since in that era they were ignited by the action of the propellent gases when the gun was fired.

Even if there had been proper percussion or friction explosives, the round projectiles, fired from smoothbore weapons, could not be relied on to impact on a particular part of the shell or fuze. If a point detonating device were to be developed, some means had to be devised whereby the projectile would always land on its nose, or a fuze had to be designed that would detonate the shell regardless of which part struck the target.

Thus, in spite of the need for something other than a time fuze, it was not until the late 1830s that technology had advanced enough to begin development of a practical impact fuze. Fulminate of mercury, a very sensitive explosive initiator, had been invented in the late 18th century, but the earliest experiments were still based on modifications of the time fuze, since the problem of making shells land on the nose had not been solved. These early experiments, conducted in Prussia and Belgium, relied on compressed black powder to keep an inertial weight in place to block the flash channel of the fuze when the gun was fired. The firing of the weapon ignited the compressed powder, which burned away and allowed the inertial weight to move on impact and open the flash channel between the remainder of the burning compressed powder and the explosive charge in the shell. If the inertial weight were not dislodged, the compressed powder would continue to burn until it exploded the projectile as in a normal time fuze. Fuzes of this type worked about 80 to 90 percent of the time; but, since they were not boresafe, a small percentage also burst at the muzzle.

These fuzes were first used in the United States during the Civil War, when a small number of McIntyre fuzes (figure 1) were employed on an experimental basis by the Union forces in battles around Yorktown and Petersburg.

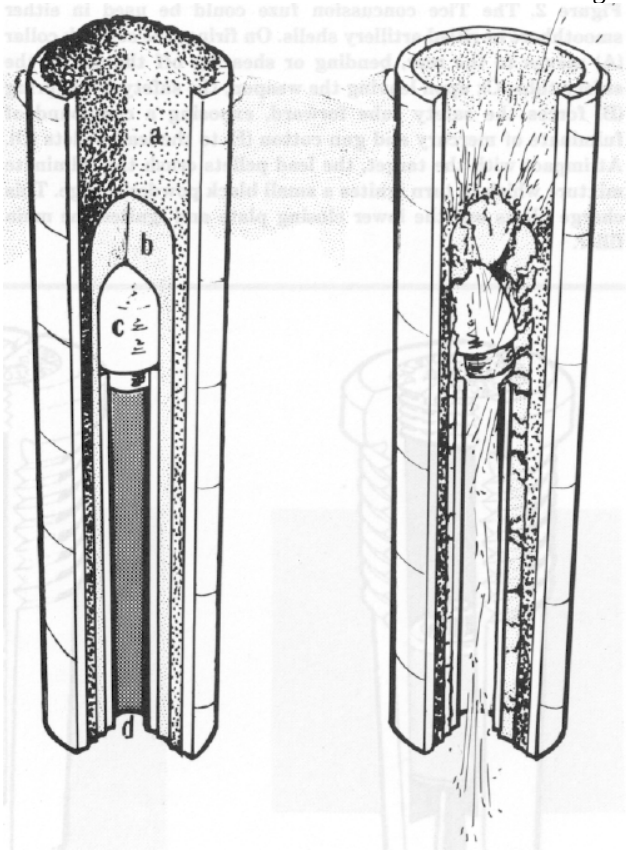


Figure 1. The McIntyre concussion fuze was almost a direct copy of the Belgian Splingard fuze of the 1830s. When the gun was fired, its propelling charge ignited the compressed black powder (a), which burned away leaving an inertial weight (c), supported only by a thin covering of plaster of paris (b). When the shell impacted, the weight was thrown aside, unblocking the brass flash channel (d), permitting the flame to reach the charge of the shell. If the weight did not open the flash channel on impact, the shell was exploded like a normal time fuze when the powder burned completely to the bottom. The use of this fuze, which was over 7-inches long, was limited to heavy artillery and mortars since "arming" required several seconds time of flight. (Illustrations by John Hooper)

The Tice concussion fuze (figure 2) illustrates a second type of percussion fuze for use with smoothbore cannon. When a shell was fired with this fuze, a spring-loaded safety device moved away and exposed a glass vial of fulminate. On impact, lead balls, propelled by inertia, crushed the vial and the projectile detonated. The Tice fuze had the advantage of being somewhat more boresafe and could also be used with rifled shells, but it was considered too expensive and complicated for wide use and smoothbore projectiles exploded prematurely if they tumbled in flight. It was employed to a limited extent in the Civil War, most notably at Dutch Gap and Petersburg.

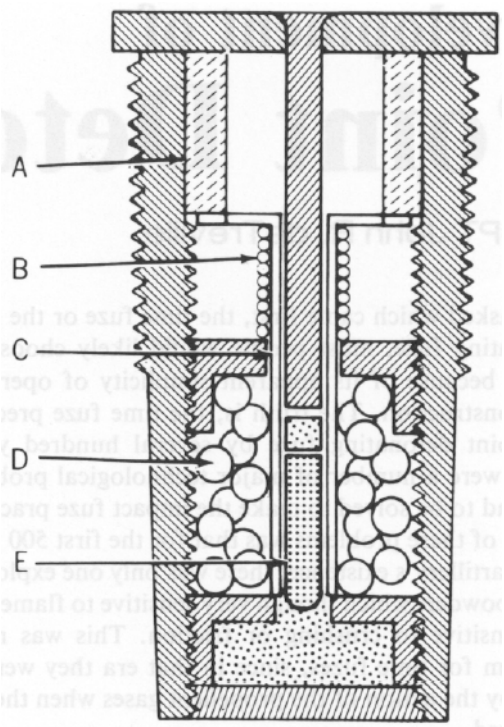


Figure 2. The Tice concussion fuze could be used in either smoothbore or rifled artillery shells. On firing, the setback collar (A) moves to the rear, bending or shearing off the top of the safety tube (C); upon leaving the weapon, the safety tube spring (B) forces the safety tube forward, exposing a compound of fulminate of mercury and gun cotton (E) to the lead pellets (D). At impact with the target, the lead pellets crush the fulminate mixture which in turn ignites a small black powder charge. This charge blows out the lower closing plate and ignites the main filler.

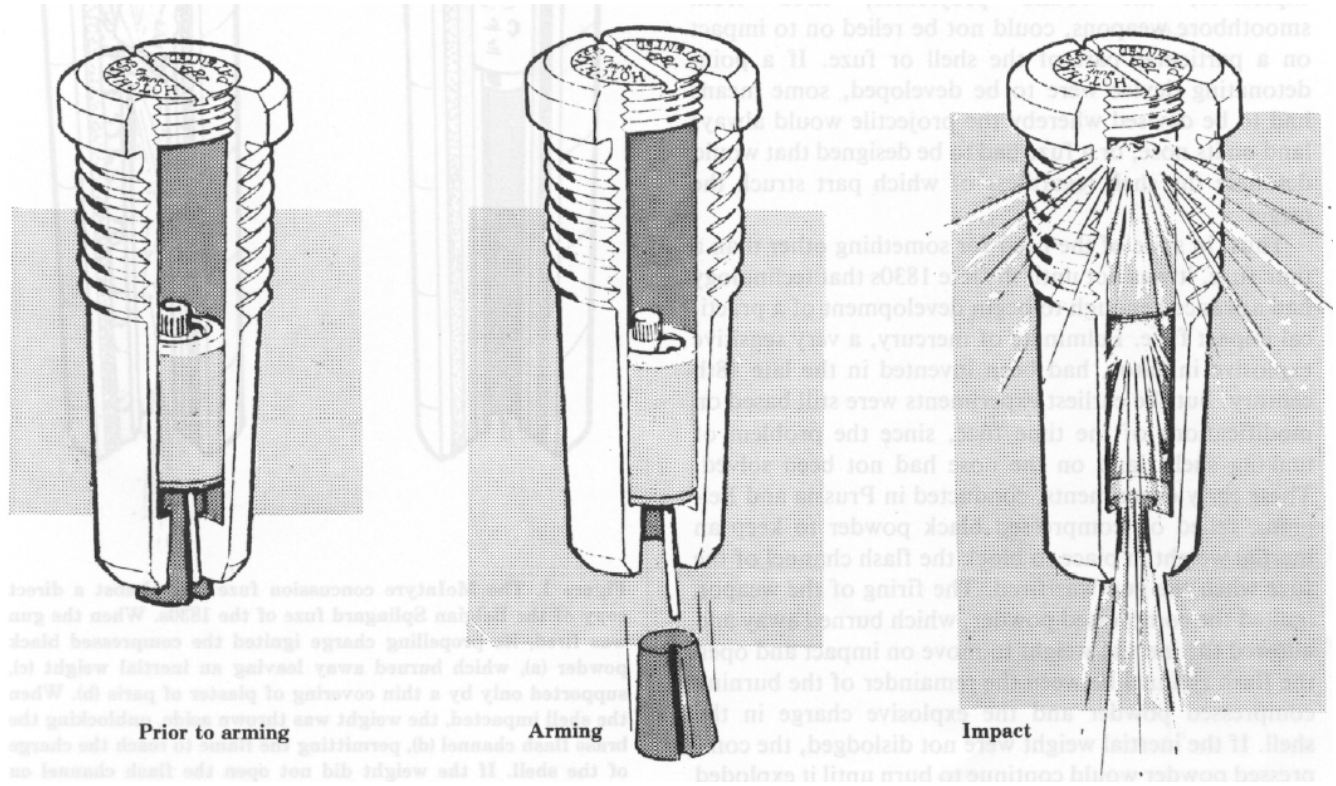


Figure 3. The Hotchkiss fuze is typical of percussion fuzes for rifled artillery during the Civil War. When the gun was fired, the lead plug at the rear of the fuze was forced backward out of the fuze, freeing the inertial plunger, which had been held in place by a safety wire. On impact, the plunger moved forward, striking the percussion cap at its front, which fired through a flash channel drilled through the plunger. (Illustrations by John Hooper)

The Confederates, according to LTC William LeRoy Brown, commander of the Confederate arsenal at Richmond, also had a type of percussion fuze for smoothbore artillery, but the details of this fuze are not known.[1]

With the advent of rifled artillery on the eve of the Civil War, the design of percussion fuzes was greatly simplified, and almost all were constructed on the same principle. The Hotchkiss fuze (figure 3), which used an inertial plunger capped by a percussion primer, is a good example. The plunger was placed in a channel parallel to the axis of the projectile, with the top of the channel closed by an anvil cap. When the shell was fired, the inertial slider remained at the bottom of the channel; but, on striking a target, the shell and channel stopped while the plunger continued to move forward by inertia, striking the anvil cap and firing the primer into the shell filling. This type fuze was made in several forms and initially had no safety devices, the plunger being free in the channel before firing. Later, safety devices were designed which decreased the number of accidents. In addition to the lead plug shown in figure 3, other techniques were used, such as a frangible screw (Schenkl fuze), a pin (Parrot fuze), or a friction plug (Absterdam fuze), all of which held the plunger in place until the projectile impacted. In later models of the Hotchkiss fuze, two wires were used which were forced outward by centrifugal force to prevent the plunger from creeping forward during flight. Such creeping was not dangerous, but because the plunger traveled a shorter distance when the shell impacted, it caused a higher dud rate. Slightly improved models of the Hotchkiss continued in use until the early 1890s.

American artillery developed slowly after the Civil War. Breechloaders were not adopted until 1885, and advances in ammunition and fuzes were equally slow. Throughout the 1870s and 1880s, the US Army had no standard shells or fuzes and continued to use ammunition left over from the war or used the products of private contractors. When standard fuzes were finally adopted in the early 1890s, the point detonating types were almost entirely dropped in favor of the base detonating models (figure 4).

World War I proved the advantages of high explosive as a shell filler, but there was a need for fuzes that would burst the projectile instantaneously before it penetrated the earth. Even though such a technique seems obvious today, before World War I, common artillery shells were desirable only for use against fortifications, structures, and materiel where some penetration of the target was needed to provide maximum effect.[2] Enemy troops were not engaged by common shell, but by shrapnel, similar to modern "beehive." With high explosive, it was now possible to cause a shell to fragment into thousands of splinters which were effective against personnel, provided the burst took place before the shell entered the earth, where the fragments would be absorbed by the ground. The "super-quick" fuzes required for such bursts had been in existence since the 1860s, but the need did not materialize until World War I.

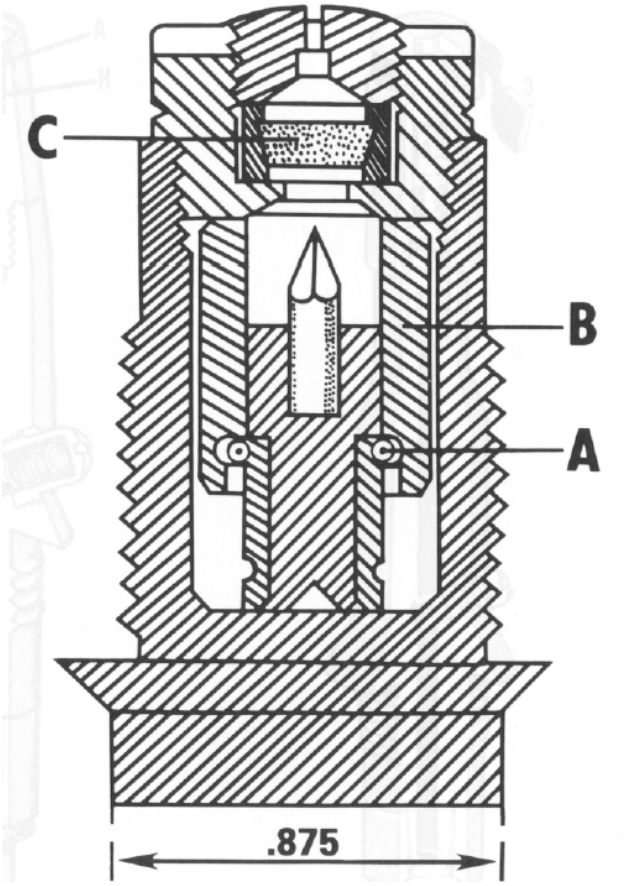


Figure 4. The Frankford Arsenal Fuze C, Model 1894, used in the 3.2- and 3.6-inch field guns, is typical of almost all US service percussion fuzes from the 1890s until World War I. It was a base fuze, but operated on the same principle as the Hotchkiss fuze (figure 3) except that arming was accomplished by a spring bronze resistance ring (A) being forced rearward by a setback weight (B) on firing, permitting the entire firing pin assembly and setback weight to move forward on impact, striking the primer (C).

[1]Journal of the United States Artillery, Jan-Feb 1898, p. 7.
[2]Provisional Drill and Service Regulations for Field Artillery, 1916-1917, GPO, p. 126.

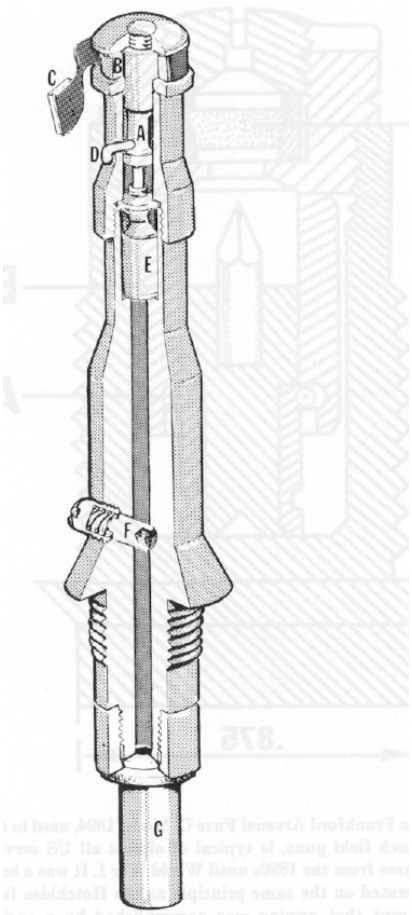


Figure 5a. The MkIII is a modified version of the French Model 1916 fuze. In the American version, when the gun was fired the firing pin (A) was prevented from moving rearward by two half-circles of solid metal (B), held in place by a safety spiral of spring bronze (C). Centrifugal force unwound the spiral, permitting the half-circles to fly off. On impact, the firing pin broke the shear wire (D) and fired the relay detonator (E) which in turn fired the main detonator (G). The difference between the French fuze and the MkIII was the interrupter (F) which blocked the flash channel until after initial acceleration ceased, at which time centrifugal force moved the interrupter out of the channel.

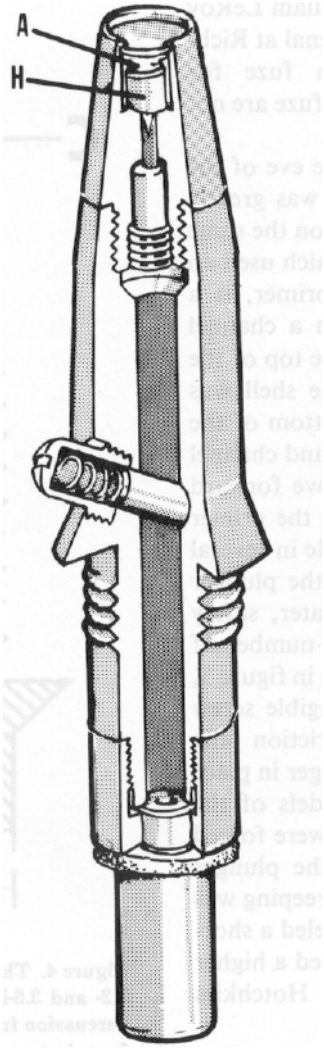


Figure 5b. In the M46, the cumbersome firing pin assembly of the MkIII was replaced by a simpler type. The pin (A) was now held in place by a metal support (H) which was crushed on impact. Otherwise, the fuze is very similar to the MkIII.

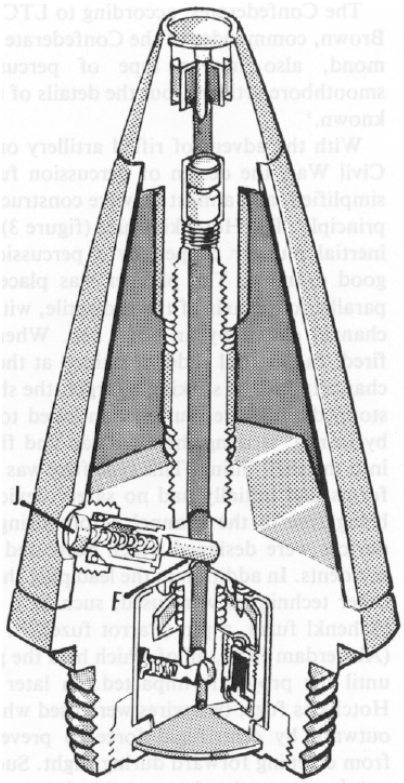


Figure 5c. With the M48, super-quick action is the same as the M46, but now the fuze has an optional delay mechanism which operates in the same fashion as that of the T3 (figure 7). In addition, the interrupter (F) has been modified to act as a selector as well. When set for super quick by the selector sleeve (J), the interrupter acts as on the MkIII and M46. When set for delay, however, it is prevented from moving out of the flash channel and only the delay plunger will act. The delay element also operates when the fuze is set for super quick, acting as a backup, giving the modern fuzes (M51, M572, and M577) a dud rate of less than 1 percent. When fired delay only, however, the dud rate may be up to 6.9 percent. The modern fuzes also have a separate delayed arming device, similar to that of the T3, as part of the booster (not shown above).

Figure 5. US super-quick fuzes from World War I to date show a definite, though perhaps not immediately obvious, family relationship. (Illustrations by John Hooper)

The United States, however, not only did not have super-quick fuzes, but had very little ammunition of any type when she entered the war. Guns, fuzes, and ammunition were in short supply, and the American artillery (which had been tolerably modern in 1914) was approaching obsolescence by 1917. Great advances had been made in gun and ammunition designs in Europe during the war. The US had to catch up by adopting already existing foreign weapons and ammunition and procuring a pair of Russian fuze designs then being manufactured under contract in America. In 1917, however, the US decided to standardize on French artillery (plus the British 8-inch howitzer) and three types of French impact fuzes. Two of these fuzes were of the old inertial type, but one, the MkIII (figure 5a) became America's first super-quick fuze.[3] These French and Russian fuzes, which served the nation through World War I, were not without problems, especially in regard to standardization (table 1).

At the close of World War I, the US Artillery had a confusing mixture of point detonating fuzes. Not only were separate fuzes required for separate functions, but the various types and nationalities of designs had different base threadings, which meant that fuzes could not be interchanged on a particular shell. To vary the action, a complete new round might be necessary. Even in cases where fuzes were interchangeable, the fuzes had different weights, sizes, and aerodynamic characteristics.

The US was not alone in this dilemma—it was common to all the other nations in the war. The Germans, however, had developed standard fuze threadings and standard shapes so that a smaller variety of shells was required and a single set of firing data would work for all fuzes. They had also begun combining two or more actions into the same fuze—for example, the HZ16 with both non-delay and delay modes (figure 6).

Soon after the war, the US began a similar program to develop a single combination fuze which would provide interchangeability, simplicity, safety, and improved aerodynamic characteristics. By the late 1920s, a modern super-quick and delay model, designated the T2 (M39), which appeared to satisfy all the requirements, had been produced. It was manufactured in some quantity; but, after only a few years, it was virtually eliminated, presumably because the fuze tended to function

Table 1. PD fuzes in service after WW I, about 1920.

Model	Source	Action	Calibers
MkI	Russian GT3	Non-delay	3-inch
MkII	Russian GT4	Non-delay or delay	8-inch and larger
MkIII	French M1916	Super-quick	light and medium
MkIV	French M1899-15	Non-delay, short or long delay	3.8-inch and larger
MkV	French M1899-08	Non-delay, short or long delay	75-mm gun
HZ16	German	Delay or non-delay	105-mm German howitzer
HZ14Fb	German	Non-delay only	105-mm German howitzer
EHZ16	German	Super-quick only	105-mm German howitzer

Note: The French MkIV and MkV required separate fuzes for non-delay, short delay, or long delay action.

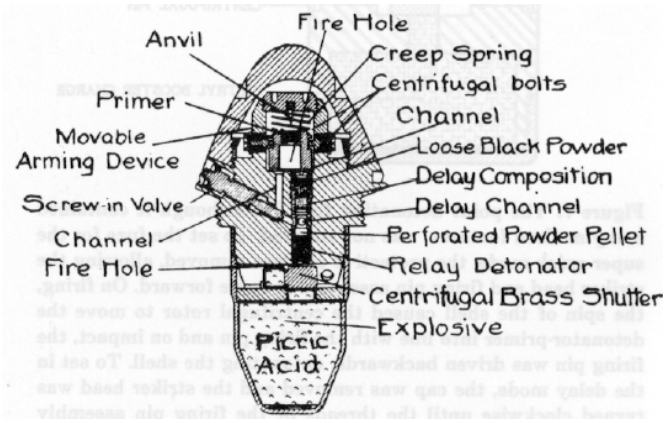


Figure 6. The German HZ16, though still an inertial fuze, shows many of the features that were to become standard in US fuzes by World War II. It has a dual function (non-delay or delay), a standard base thread for interchangeability, a standard aerodynamic shape, and a centrifugal bore safety shutter to separate the detonator from the booster (a technique also used by the British). The "screw-in valve," used as a function selector, was combined with a safety interrupter to act as both a selector and safety device in the M48 series fuzes.

[3]Handbook of Ordnance Data, GPO, 1919, p. 158-159.

as super-quick, even when set on delay. Experimentation resumed with a new model, the T3 (figure 7), with a strengthened setting mechanism.

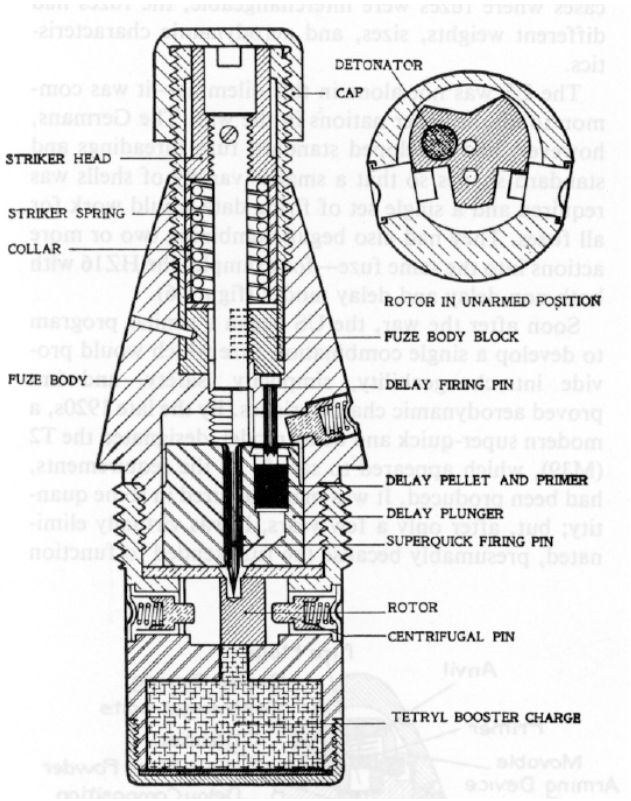


Figure 7. The point detonating fuze T3, although it contained many modern features, was not adopted. To set the fuze for the super-quick mode, the protective cap was removed, allowing the striker head and firing pin assembly to move forward. On firing, the spin of the shell caused the centrifugal rotor to move the detonator-primer into line with the firing pin and on impact, the firing pin was driven backwards, detonating the shell. To set in the delay mode, the cap was removed and the striker head was turned clockwise until the threads of the firing pin assembly engaged those of the fuze body block, preventing rearward movement of the pin on impact. When the shell struck the ground, the delay plunger moved forward, striking the delay pellet against the delay firing pin, detonating the shell after 0.05 second. The delay plunger and centrifugal rotor are similar to those later used in the M48.

Almost overnight a new candidate for a safe and reliable service fuze was developed. This model, the M46 (figure 5b), was developed by modifying the firing pin of the old MkIII. It was simpler in operation and manufacture than the T3, but there was still the problem of separating the detonator from the booster and the problem of interchangeability, since a separate delay fuze (M47) was required. It seemed that nearly 20 years of development had been for nothing and that American Artillery would enter the next war with only marginally better fuzes than those used in the previous war.

The M46/47 fuzes served only as interim models. Within a very short time, the M48 series (figure 5c), the basic design of which is still current, was designed and produced. This model, which contained all the criteria of interchangeability and simplicity, combined the best features of the M46 and T3 fuzes. The safety shutter and delay mechanism of the T3 and the improved firing pin of the M46 were used. A thin metal windshield gave it the proper aerodynamic shape. Since the adoption of the M48, no major changes have been made in field artillery point detonating fuzes, except that the bore-safety device and booster are staked to the body of the fuze rather than being issued separately as before.

During World War II, the M78 concrete piercing fuze was added. This consists of the inertial delay plunger from the M48 series fuze contained in a hardened steel body. Since the M78 requires a different shape to pierce masonry efficiently, it is also manufactured in a non-delay form for adjusting onto the target and to clear away rubble from the target.

What is the future of field artillery point detonating fuzes? In the immediate future, the current models, based on the M48, seem likely to be around for many years to come, but in the distant future the trend is toward multi-purpose electronic fuzes. The Infantry's new XM224 60-mm mortar already has such a multioption fuze, capable of being manually set for delay, super quick, and high or low variable time burst. A similar fuze, the XM433 has been tested for the 2.75-inch rocket and not only has variable options, but can be set electronically from the aircraft cockpit. It seems only a matter of time until the Field Artillery will have a similar all-purpose fuze set electronically by FADAC or TACFIRE.

CPT John R. deTreville is in the Individual Ready Reserve and is attending graduate school at the University of North Carolina. Illustrator John Hooper served as an Infantry officer in World War II and is now an engineering illustrator with Fisher Body.

Due for reassignment?

MILPERCEN officer career managers are working on overseas requisitions with a reporting date of December 1979 and January 1980. Officers stationed in CONUS who are completing normal tours and company grade officers who have 24 months on station are being reviewed for possible assignment to overseas commands. The CONUS requisitions, with reporting dates in September and October 1979, are being filled by officers returning from overseas areas and certain officers in CONUS who are eligible for CONUS assignment. Officers in these assignment categories should insure that their preference statement, DA Form 483, is current.

FAOAC 4-79

Officers on orders to Field Artillery Officer Advance Course class 4-79 should submit an updated preference statement (DA Form 483) to Field Artillery Branch. The preference statement is the only formal method to make Branch aware of your personal and professional desires and is an important management tool in the advanced assignment process. FAOAC class 4-79 should receive their follow-on assignments in April or May. (CPT(P) James E. Shane, AV 221-0116/0118/0187)

Officer "alert date" defined

Officers who do not want to accept assignment instructions, pending a voluntary retirement or unqualified resignation, must submit separation requests to their approving authority within 30 days of assignment notification.

Official assignment notification is defined as an interview, phone call, or correspondence from a MILPERCEN career manager to an officer with a "firm" explanation of where and when the officer will be assigned. An official notification date can also be the date an officer receives a copy of a request for orders from MILPERCEN.

Females in CMF 13

Women in the Artillery? Sure, sometime in the future. Well, the future is now. Career Management Field (CMF) 13, except for MOSs 13B, 13E, and 13F, have been open to women since December 1977. Women have been trained as FA surveyors (82C), meteorological crewmen (93F), Pershing crewmen (15E), Lance crewmen (15D), FA radar crewmen (17B), and FA target acquisition specialists (17C). During fiscal year 1978, Fort Sill trained and graduated 107 women in these MOSs. These soldiers are qualified and able to serve in all FA units except cannon battalions and batteries.

There are studies underway to determine whether there is an optimum number of females that can be assigned to a given type section or unit and to derive a standard physical classification for both men and women in each MOS. There are less than 300 women in CMF 13, with a relatively small increase projected during the current fiscal year.

The major problem that men in the Army must overcome is the male-oriented attitude. As more and more women are awarded FA MOSs, it becomes imperative that they be assigned in their MOSs and perform all MOS-related duties. Each of these MOSs are presently understrength, and each time a woman is malutilized, *because she is a woman*, the shortage is increased. Each time a woman is not required to perform, or worse, not allowed to perform, all the normal duties of her MOS, unit effectiveness and morale are decreased. The Chief of Staff of the Army has stated that if the unit is deployed these soldiers will deploy with their units and serve with their units in case of war. Therefore, if we do not properly train and utilize our woman soldiers, we are reducing the combat readiness of our units.

The leadership style of many of our commanders and noncommissioned officers may have to be modified, along with their attitude about women, but this is a small price to pay for the additional highly qualified and motivated soldiers we will gain. The Army of the future has its beginning today, and today's Army includes female soldiers. They are soldiers and must be given the same duties and opportunities as any other soldier in the Field Artillery.

Command tour time increased

Command tours for colonels and lieutenant colonels serving in Europe are being extended from 18 to 24 months. The 24-month command tours have been used on a test basis since October 1976.

Army acts to stem pilot shortage

Several actions are being taken to relieve an Active Army company grade aviator shortage and to "maintain an acceptable level of readiness," according to MILPERCEN. The shortage is caused by decreased training of new aviators, increased aviator requirements, and the fact that aviators also serve in branch assignments that decrease the number on full-time flight status.

"Near term" solutions to the shortage include:

- Limited assignments of majors to captain positions.
- Allowing more aviators to remain on flight status for longer periods before returning to ground duties.
- Aviators now assume a four-year service obligation after completing flight school, and keeping new aviators on flight status during their full obligation is a goal.
- Fully funded advanced civil schooling for company grade aviators must be related to specialty 15 and be based on validated needs.
- Certain officers who formerly held specialty 15 positions will be reassigned to the specialty at company grade levels. These assignments will not be mandatory and officers picked may request redesignation.

Commissioned officers will also be allowed to enter flight training immediately after completing basic branch training, deleting the requirements to serve 24 to 36 months in their basic branch first.

These actions will not penalize officers in specialty 15 because their assignments to not follow normal career patterns, according to MILPERCEN. If necessary, promotion and school boards will be given guidance to insure fairness to aviators. This will probably not be necessary, since post-Vietnam aviators have performed as well as, or better than, their contemporaries in DA board actions.

Post-Vietnam losses among aviators left the Army with less than 80 percent of its required company grade specialty 15 officers.

Ten Artillerymen selected for brigadier general

Department of the Army has released the 1979 list of 59 colonels selected for promotion to brigadier general. The list contains 10 Field Artillerymen, two of whom are at Fort Sill and one who was recently reassigned from Sill.

Congratulations go to these colonels:

Jack O. Bradshaw	Claude M. Kicklighter
Jerry M. Bunyard	John H. Mitchell
James E. Drummond	Gerald E. Monteith
Wendell H. Gilbert	Joe S. Owens
Robert D. Hammond	Joseph J. Skaff

New Army fraternization policy set

New guidelines for commanders and supervisors have been established by the Army regarding problems of fraternization between soldiers. The new guidance is necessary because of "an increasing number of . . . inappropriate relationships" between soldiers of different ranks, according to the Department of the Army.

The policy, to be included in AR 600-20, is "deliberately broad" and designed to permit local commanders to "exercise good judgment in implementing a sensitive and important Army policy," while also reemphasizing Army customs and traditions.

In part, the new policy states, "Relationships between service members of different rank which involve, or give the appearance of, partiality, preferential treatment, or the improper use of rank or position for personal gain, are prejudicial to good order, discipline, and high unit morale. Such relationships will be avoided. Commanders and supervisors will counsel those involved or take other action as appropriate."

Local commanders have latitude in applying the new guidance since the policy allows them to deal with situations having unique or extenuating circumstances.

Some S1 and S4 jobs frozen

Officers assigned to S1 and S4 jobs at battalion level (usually captains) will be stabilized in these positions for 12 months where possible, according to a recently approved Army policy.

Stabilization of these jobs will help battalion operations and improve readiness by promoting continuity in these critical positions. Prevailing company grade shortages in certain branches will prevent 12-month stabilization in some units.

NCO course board meets soon

Soldiers in grade E6 will be selected to attend Advanced Noncommissioned Officer Education System (ANCOES) courses during Fiscal Year 1980 by a board scheduled to meet early in April. Those in grade E6, with a date of rank after March 1974 and before April 1977, who have a basic active service date after October 1962 and who have not been previously selected for ANCOES, will be considered for the courses.

Eligible soldiers should review their official records before the board meets. Individual letters to the board president and letters of recommendation from officials in a soldier's chain of command will be accepted. Records review procedures and other information about the ANCOES board are available through local MILPOs.

ROTC scholarship deadline near

Active duty enlisted soldiers interested in the two-year Army ROTC scholarship program have until 1 May to submit their applications for the 1979-80 school year. Winners will be announced in June.

These scholarships provide soldiers the opportunity to obtain both a college degree and a commission through the ROTC program. The scholarships provide full tuition, books, and educational fees, plus a living allowance of up to $1,000 per year.

Those selected for the scholarships will also be paid while attending the advanced camp, normally held during the summer between the junior and senior years of college. To compete for the scholarships, soldiers must:

- Have served at least one year on active duty.
- Be under 25 years of age on 30 June of the year they're eligible for commissioning.
- Have received credit for at least two, but not more than two and one-half, years of college.
- Have been accepted by a college for next fall's enrollment.
- Have a GT score of 115 or higher.
- Be a United States citizen.

Winners may attend any four-year college or university hosting Army ROTC or a non-host college with a cross-enrollment agreement with a nearby host school.

Scholarship winners will receive an early discharge so they can arrive on campus in time to enroll for the 1979-80 fall term. They must also enlist in the US Army Reserve before enrolling in the Army ROTC advanced course. They are not required to attend Reserve meetings while enrolled.

After completing their Military Science and baccalaureate degree requirements, these soldiers will be commissioned second lieutenants in either the Regular Army or the Army Reserve and will serve four years active duty.

Details on the scholarship program are contained in AR 145-1. Applications must be requested by 15 April 1979; however, applicants have until 1 May to submit them. Individuals desiring applications and information may write: Army ROTC Scholarships, Fort Monroe, VA 23651.

Info needed

Information is needed by Field Artillery Branch on officers who have completed the Field Artillery or other branch advanced course *by correspondence*. Please submit the information to CPT(P) James E. Shane, DAPCOPE-F, USA MILPERCEN, 200 Stovall Street, Alexandria, VA 22332.

USMA Prep School applications

Qualified enlisted men and women interested in attending the United States Military Academy Preparatory School (USMAPS) should forward their applications to arrive at USMAPS not later than 1 May in order to be considered for the 1979/80 class which begins in August.

Attendance at this course assists service members in qualifying for admission to the US Military Academy. To be eligible to attend USMAPS, one must be—

- A citizen of the United States.
- At least 17 but not yet 21 years of age on 1 July of the year entering the Preparatory School.
- Unmarried and have no legal obligation to support a child or children.
- In good health and have no disqualifying physical defects.
- A high school graduate or the equivalent.
- Of high moral character and never have been convicted by civilian or military court of a felony or have a history of veneral infection, habitual intemperance, or drug or narcotic addiction.

Regular Army applicants should follow the guidelines established in AR 351-12 dated 1 July 78. Application procedures for Reserve and National Guard soldiers on active duty are the same as those for Regular Army soldiers.

Additional information may be obtained by calling the USMAPS Admission Office at AUTOVON 992-1807 or commercial (201) 532-1807, or write to Commandant, USMAPS, Fort Monmouth, NJ 07703.

Degree program moves overseas

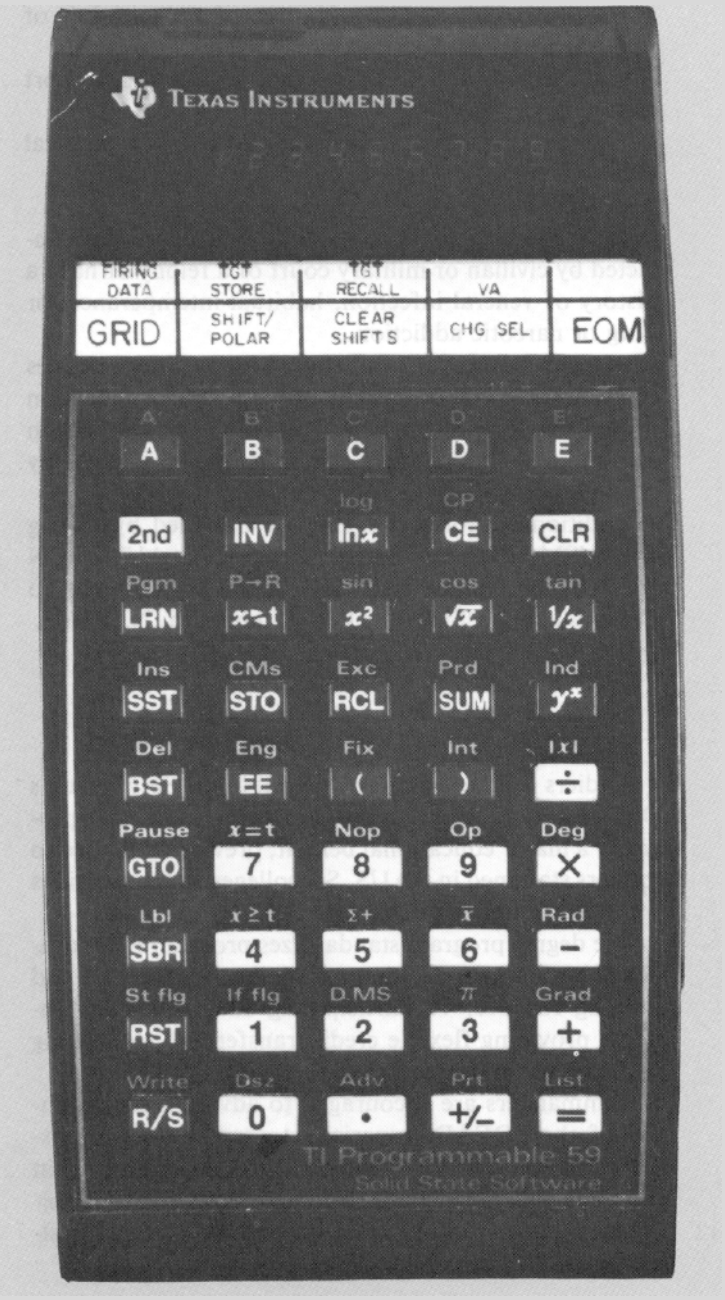
Soldiers overseas may now enroll in the Servicemen's Opportunity College Associate Degree (SOCAD) program, a major educational benefit, previously limited to soldiers stationed in the US. Six colleges and universities will participate in the overseas SOCAD program.

The degree program standardizes procedures for academic evaluation of military schooling, experience, and training for over 70 participating educational institutions, providing flexible credit transfer options leading to an associate degree.

Commanders are encouraged to advertise the potential of the SOCAD, especially to senior noncommissioned officers. SOCAD can assist enlisted personnel in meeting educational goals relating to professional development. Further information is available at local installation education services offices.

The hand-held calculator: A status report

by CPT John M. Chaney
Mr. Don Giuliano, and
Mr. Dean Johnson



Advances in hand-held calculator technology have had a major impact on the Field Artillery. Application of this technology toward solving the gunnery problem has been the subject of an extensive evaluation by the Field Artillery School for the past two years.

In the past, the gunnery solution has been limited to manual procedures and FADAC. A replacement will soon become a reality with the deployment of TACFIRE at battalion, division artillery, FA brigade, and corps, to be followed by the Battery Computer System (BCS) at firing battery level. During the transition period to TACFIRE and BCS, there may be some problems. FADAC has reached total "materiel-maturity," and our ability to support the FADAC system in the future will become more difficult. Should our ability to support FADAC fail before BCS is available, there will be a gap before a computer solution is available. If this gap occurs, we believe it would be unrealistic to rely on a totally manual system. With this in mind, USAFAS is evaluating the hand-held calculator (HHC) as a solution for the period between FADAC and BCS. The HHC offers several advantages over a pure manual system. For example, it—

- Eliminates the chart.
- Reduces time to prepare for action.
- Decreases computation time for initial firing data.
- Reduces time to compute met corrections.
- Provides a quick, mobile solution for offset missions.
- Computes survey solution to orient observers and locates "did hit" grid for high burst/mean point of impact (HB/MPI) registrations.

History

A detailed study of HHCs began at Fort Sill in July 1977. The Field Artillery Board, in conjunction with the Gunnery Department, conducted a concept evaluation test from August to October 1977. During this evaluation, the Board looked at two commercially available calculators, the Texas Instrument 59 and the Hewlett Packard 67. An independent evaluation was completed by the Gunnery Department and forwarded to TRADOC, and a procurement action was initiated on 10

January 1978. As a result of the branch-wide interest, an "HHC Guidance Package" was developed by USAFAS and made available to the field in March 1978. Interest continued to grow, and in August 1978, at the request of III Corps and TCATA (TRADOC Combined Arms Test Agency), a 5,000-step memory module (microchip) for the TI-59 was designed at Fort Sill. This module is now being tested, and results of the evaluation should be available in June 1979.

Capabilities

The HHC has been touted as a total replacement for FADAC. This statement is inaccurate with the present state of the art. FADAC, BCS, and TACFIRE contain sophisticated mathematical models which predict the trajectory of a round while taking nonstandard conditions into consideration and applying corrections for those conditions.

The gunnery solution computed by the HHC is *an approximation* and is not as technically correct or as accurate as the FADAC, TACFIRE, or BCS solution. However, the solution is more accurate than the manual method. The firing data output of the HHC uses solutions to quadratic equations which are derived from least squares curve fits to tabular firing table data.

Initial program development focused on the internal memory capabilities of the HHC and its adaptability to a field environment. Programs were designed to solve the basic gunnery problem without benefit of the extended memory afforded by the modular chip. The result was a basic cannon gunnery program which solved the high explosive, low angle problem for up to four charges. With the development of the 5,000-step module, more features were added to the basic gunnery program. These features included:

- Solution of the high angle problem.
- Solution of the 81-mm and 4.2-inch mortar problems.
- Location store/recall capability (maximum of seven).
- Clear Shift Key for subsequent corrections.
- Vertical Angle Key (computes vertical interval and updates observer altitude to obtain target altitude).
- Capability extended to seven charges.

In addition to the basic mortar gunnery program, the 5,000-step module includes programs for met, HB/MPI, Lance gunnery, and a munitions effectiveness program. A breakdown of programs and memory allocation for the initial module is shown in figure 1. Additional advantages achieved by using the module are as follows:

- The module significantly reduces the use of magnetic cards. Computation of firing data for high angle and mortars still requires the use of magnetic cards; however, this problem may be eliminated with the development of additional modules.
- The TI-59 has a volatile memory (i.e., when the calculator is turned off, the program and all associated data are lost). Without the module, reprogramming is required with magnetic cards each time the calculator loses power. With the module, the program is maintained on the module when power is lost and need only be recalled. Therefore, the time to set up the HHC with the module is reduced compared to using magnetic cards, and the process is simplified.
- Computation time is significantly reduced with the module.

Program number	Title	Number of steps
1	M102 Low Angle; HE Constants	538
2	M109A1 Low Angle; HE Constants	546
3	M110A1 Low Angle; HE Constants	546
4 and 5	Basic Cannon/Mortar Gunnery Program	1007
6	Diagnostic Test	53
7	HB/MPI	340
8	Concurrent/Subsequent Met Math	604
9	Lance Gunnery	671
10	JMEM/SS	574
	Total	4879

Figure 1. Programs available on test module.

Limitations

There are several HHC limitations which must be addressed:

- The major limitation, which separates the HHC from FADAC, is the HHC's inability to automatically compensate for nonstandard conditions. With FADAC, we are able to compensate for differences in muzzle velocity, weather, powder temperature, projectile weight, etc., by merely inputing the information. With the HHC, these differences must be determined manually and applied as a range K correction, time correction, or deflection correction.
- The constants, which are used with the quadratic equations, are for the optimum ranges for a specific charge. If a charge is used in which the computed range-to-target lies outside the curve fit interval for that charge, significant inaccuracies may occur.
- Currently, the only shell/fuze combinations the HHC will compute are high explosive/quick, time, or variable time. If an ICM round is being fired, high explosive/time data is determined and then modified manually by the correction factors from the appropriate TFT addendum.

• The HHC will compute and apply an angle of site or an average site only. It will not determine the complementary angle of site. Therefore, if comp site is significant (large vertical interval), it must be applied separately.

• The issue of a power source has not been resolved. The following options are available:

1) Inverter (steps up 24 volts DC to 115 volts AC).

2) 1.5-kw or 3-kw generator (110 AC output).

3) 12-volt adapter (converts 12 volts DC with commercial adapter).

Status of development

Recognizing the unlimited potential of this technology, USAFAS has been involved with an expedited procurement action over the past year to place this asset in the field. USAFAS has accepted the hardware limitations of using an off-the-shelf commercial item, outlined a simplified logistics support package, and volunteered to produce the necessary training material. Presently, the major milestones for this effort are as follows:

Evaluation of module at Fort Hood	Jan-Apr 79
Environmental test	Feb-Apr 79
Receipt of procurement funds	Apr 79
Contract award	Jul 79
Initial operational capability	Nov-Dec 79

To meet this schedule, we must overcome several obstacles. Field testing at Fort Hood should provide a majority of the answers to finalize this concept; however, this testing is looking only at the cannon and mortar gunnery application. It is envisioned that the fielded item will include capabilities for Lance gunnery and survey also. The Lance program has been evaluated, but the survey programs have not.

The cannon gunnery application will require additional testing to validate an organization/operational concept and to determine final software requirements. The plan is to provide a module per weapon system concept, with a basis of issue as outlined in figure 2.

What is currently available?

There are several packets available, but the available programs are limited. Since the effort has been to design software for the 5,000-step module, the programs designed for this module cannot be executed by the calculator using magnetic cards. Packets available are:

• Cannon Gunnery: "Hand-Held Calculator, Cannon Program Packet," GD-CH, May 78.

• Lance Gunnery: "Programmable Hand-Held Calculator Lance Missile Program Packet," WLCPHHC, Aug 78.

These packets may be obtained by writing Commandant, US Army Field Artillery School, ATTN: ATSF-CT-RC-FS, Fort Sill, OK 73503.

Cannon units	Number
Battery fire direction center (FDC)	2
Battalion FDC	3
Fourth order survey set	2
Headquarters battery (floats—two gunnery chips and one survey chip)	3
Lance units	
Battery FDC	2
Battalion FDC	3
Fourth order survey set	2
Headquarters battery (floats—two gunnery chips and one survey chip)	3
Printers per battalion (one per FDC and two floats)	6
Pershing	
Fourth order survey set	2
Headquarters battery (float)	1
Target acquisition battery	
Sound/flash platoon	2
Fourth order survey set	2
Battery headquarters (floats—one sound/flash chip and one survey chip)	2
Division artillery	
Fourth order survey set	2
Headquarters/headquarters battery (float)	1

Figure 2. Proposed basis of issue for calculators with modules (Active, National Guard, and Reserves).

Summary

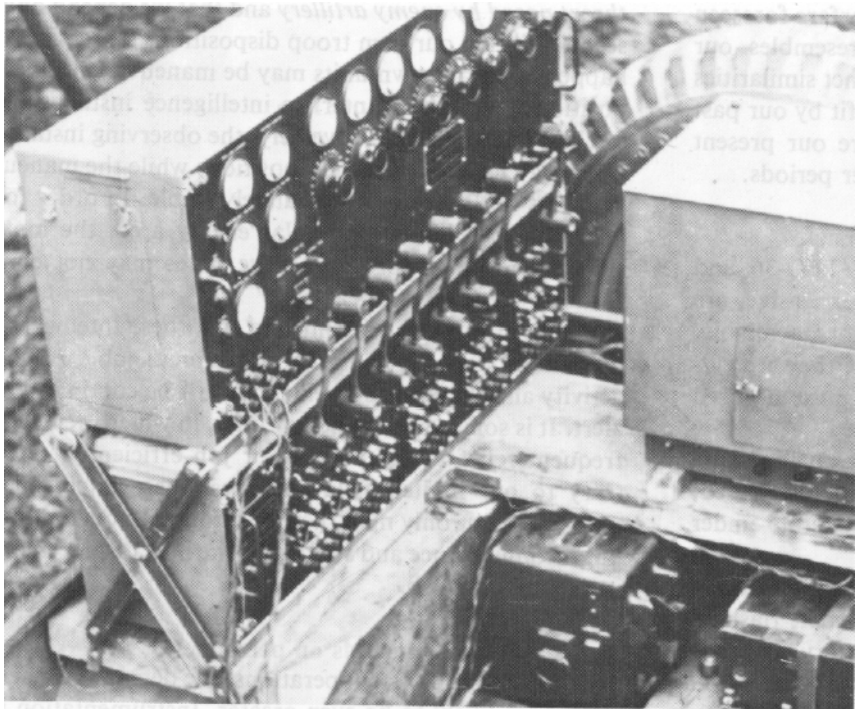
The intent of this article has been to clarify the misconceptions surrounding the capabilities of the hand-held calculator and to inform the field of the developmental steps being taken to get the HHC into the system. The response from the field has been an integral part of the effort and USAFAS thanks all who have contributed. We welcome all letters to help us deliver the best possible product in the shortest possible time.

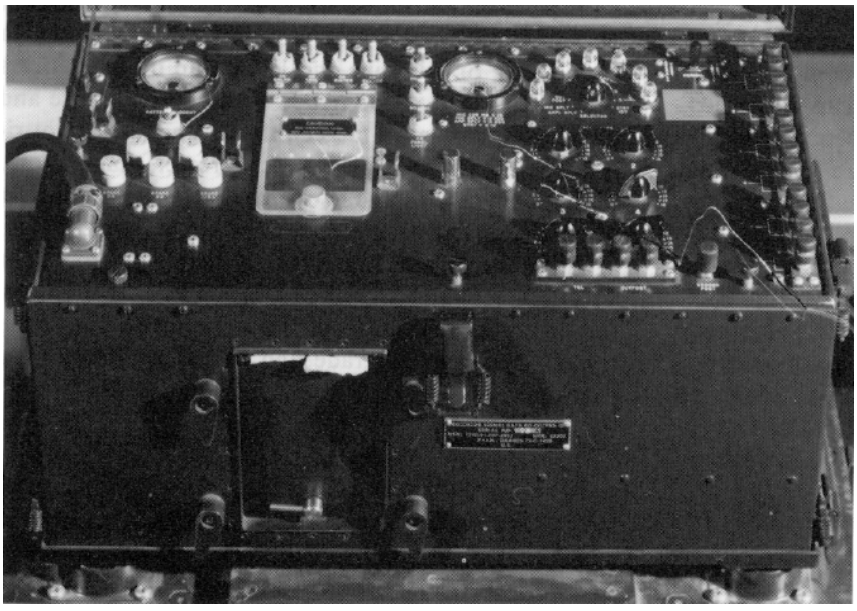
A final caution: Due to the state of the art and the fast pace of this technology, it must be understood that the calculators evaluated *do not necessarily represent* the final product which will be procured. Therefore, units should use care before taking independent action to procure a specific calculator model.

CPT John M. Chaney and DA civilians Don Giuliano and Dean Johnson are assigned to the Computer Section of the Gunnery Department, USAFAS.

Viable counterfire is the answer

by COL (Ret) Arthur R. Hercz





Sound ranging sets from World War II and today show the changes in equipment. The GRS-3 (top), shown in the back of a ¼-ton truck, has been replaced by the TNS-10 (bottom) which is being issued to sound ranging sections.

In the last few years the Field Artillery has become acutely aware that it will not hold undisputed sway over the battlefield. In fact, it has become painfully evident from the preponderance of Soviet artillery, with its counterfire reconnaissance capability, that we may have a hard time surviving unless effective countermeasures are taken. So the old time artillery duel is back in modern guise and with even greater importance than before. Several countermeasures are possible, either singly or in combination.

One such passive countermeasure is frequent movement of firing batteries. If the combat area is moving rapidly, this will take care of itself. Otherwise the idea will have limited application. About 1940, a similar policy was tried on some large-scale maneuvers. It worked fine for the first move or two. Thereafter all usable positions had been occupied and units were waiting for each other to move so the new battery could move in. The absurdity of the policy caused it to be dropped. This does not mean that alternate positions should not be prepared when time and terrain permit. But, even with the wide deployment now contemplated, it is doubtful that such a policy is generally feasible under Soviet air observation and interdiction. And, of course, batteries on the move cannot shoot.

Another possibility is to provide so many batteries that a reasonable percentage loss will not materially affect the maneuver plan. But in spite of our current increase in organic division artillery, this is not a likely solution for us.

Another, more reasonable alternative, is to actively seek out and destroy the enemy batteries. Various forms of aerial reconnaissance and attack are available for this. But *potentially* the most effective means is the use of ground counterfire locating units and counterbattery fire. The term "potential" is used advisedly, since under the present organization it is very doubtful that the counterfire intelligence units can fulfill their mission. With respect to these units, the type of warfare foreseen in our current planning most nearly resembles our World War II experience. There are distinct similarities and some differences. So in order to profit by our past experience it may be helpful to compare our present capability with that existing during earlier periods.

Ground counterfire intelligence systems

The new counterfire radar sets, AN/TPQ-36 and AN/TPQ-37, although complicated and expensive, are the most effective counterbattery locators available. However, since they use an active emitter, they are vulnerable to enemy countermeasures and must be used with caution and must move frequently.

Sound ranging is our most effective passive locating system. Though the new AN/TNS-10 is being fielded, training of crews is barely adequate to operate under most favorable conditions.

Flash ranging is the other traditional passive locating system. With weapons using flashless powder, flashing cannot be expected to pick up as many battery targets as the other systems. On the other hand, it may be useful against such targets as multiple rocket launchers. This would require field testing and possibly development of procedures using the new rangefinders. Present equipment is not well adapted to true flash ranging. Personnel allocation and training are completely inadequate. This is at least partially due to the common misconception that counterbattery flash ranging is comparable to spotting friendly shell bursts. The latter can be learned in a few hours, whereas to train a competent counter-battery flash ranging team would require months. At present we do not have a real counterfire flash ranging capability.

To support any of these ground-based systems, adequate survey must be available at all times. Fortunately, some excellent equipment is now available which permits the various survey units to cover the ground faster. But the survey demands have also increased due to the greater mobility of maneuver forces. Adequate survey equipment and personnel must be allocated for use by counterfire units.

Tactical conditions

The sector now contemplated for a division is approximately the same as that formerly covered by a corps. Similarly, a brigade now covers the old division frontage. On the enemy side, the artillery threat from the modern Soviet army is much greater than anything encountered since World War I. Even on the fronts where no breakthrough is planned, there will be many enemy batteries to be targeted.

It must be continually emphasized that our counterfire intelligence units must be employed *according to the threat posed by enemy artillery* and that we depend only secondarily on our own troop disposition. It frequently happens that our own units may be maneuvered to new positions, but the counterfire intelligence installations are best left in place. Conversely, the observing installations may have to shift their positions while the maneuver units in the sector are relatively stable. In order for us to observe into a particular enemy area, the most suitable positions for counterfire bases may not conform to brigade sectors at all.

Finally it must be remembered that these intelligence operations depend primarily on unpredictable enemy activity and therefore surveillance must be continuously alert. It is somewhat like sentry duty, in which men need frequent relief to carry out their job efficiently. Contrary to our limited field exercises, these intelligence units must not only man their positions 24 hours a day, but reconnaissance and survey for the next displacement is a continuing job.

Demands on personnel

Compared to former operations, the demands on personnel are likely to be even greater. Instrumentation is more complicated, requiring greater technical knowledge in some fields. Each of the three systems (radar, sound, and flash) requires a different type of terrain and these positions must be selected and coordinated. All of this requires considerable technical knowledge and a high degree of initiative and leadership by the officers and NCOs. Due to the tempo of modern warfare and the greater number of targets, the fatigue rate and attrition for all ranks will be much greater than before. Rather than take these factors into account, the number of personnel has been reduced to absurd limits.

Under the present organization there is no room for advancement in this field so there is little inducement for young officers to stay with counterfire units long enough to learn the trade and to contribute to their development.

Organization

Since the missions and extent of the problems of counterfire intelligence have not changed, it is worth going back a step to compare the resources now available to those of the old observation battalions or target acquisition battalions. Each of the three target acquisition

Excerpts from Colonel Ellerson's letter

* * * * * * *

By some strange quirk of the human mind, the idea has sprung up that sound and flash ranging are different if they are being done for a division than they are if being done for a corps. This has resulted in demands for us to organize and send into combat haphazard detachments that cannot function efficiently unless all goes as planned, cannot sustain losses in personnel, transport, or equipment, and cannot maintain the pace in continuous operation for any reasonably prolonged period. I think this all grows out of several basic misconceptions:

(a) That a counterbattery intelligence agency is a luxury instead of a necessity, and that sound and flash ranging are of dubious value. People hereabouts have been cured of that — with Jerry's [German] assistance.

* * * * * * *

(c) That all divisional sound and flash ranging should be done by comparative methods, thus eliminating the necessity of accurately surveyed positions on the common grid. Actually comparative work is impossible at the ranges involved and in at least 80 percent of the cases where good locations can be made if installations are properly prepared and tied to the guns.

(d) That divisional artillery is going to engage a rattle-bang--drop trail and shoot--brand of war and won't have time to wait for sound and flash installations to go in properly. Mine warfare and well considered interdiction by enemy artillery makes the tempo a little more majestic, with the result that we find we not only can keep sound and flash and survey abreast of the situation, but can make locations before divisions can get into position to do anything about it — provided we had been allowed the proper personnel and equipment to do the job.

* * * * * * *

(f) That divisional work will not be prolonged and hence relief for personnel is not necessary. This is probably a hangover from maneuvers in which the war was over when the installation was completed. Actually, the payoff is in the operation and maintenance of the installation. Since the operation of our installations is a function of enemy, rather than friendly, activity, there are no quiet periods in the operation of our installations—they must function on the alert and be completely manned 24 hours a day. How long do you figure a man can efficiently go on a 24-hour-a-day basis?***

We are convinced that the only feasible divisional detachment is a complete letter battery which we normally reinforce with one of the battalion survey sections.*** Corps counterbattery and divisional counterbattery, however, are not separate problems.*** Hence, we feel that the battalion should exercise all possible control of the batteries even during the divisional phase, a support mission rather than a detachment being desirable. Again, since the disposition of enemy artillery (which is the factor governing our disposition) does not necessarily conform to the zone of action of any particular friendly division, a support mission enables the battalion commander to continuously direct the bulk of his observing agency on the bulk of enemy artillery without a regrouping upon resumption of corps control. Obviously, however, the support mission is impossible in the case of a division operating alone.

***Decentralization of control of sound and flash personnel below division artillery, we feel is not only pointless, but fritters away specialized and irreplaceable personnel and equipment on tasks that forward observers and organic survey personnel of light battalions can do and which the good book contemplates they will do for themselves. It is easy enough to turn flash teams loose, but it's very difficult to get them back into the picture. No single field artillery battalion can take full advantage of the capabilities of a sound or a flash team.

* * * * * * *

Operations:***one of our biggest difficulties to begin with, arose from the fact that no one had thought out very well in advance, just how sound and flash reports were to be processed. ... whatever one [method] you adopt has to be worked out to the smallest detail with the people you're working with, or much of the work you do will not result in prompt, effective fire missions. If you don't watch out, the first thing you know, some lieutenant in the counterbattery section will be sitting around in the corps CP looking at a map and trying to evaluate therefrom, one of your sound locations. The only man who can usefully evaluate a sound location is a man with a sound camera.

batteries had a sound-ranging platoon of one officer and 24 enlisted men and a flash ranging platoon of one officer and 32 enlisted men. These plus the radar platoon were supported by a survey platoon and a communication platoon as well as a maintenance section. The counterfire intelligence field operations in each area were coordinated and directed by the battery commander with his operations section. This was the organization after numerous cuts in personnel and does not by any means represent any "padding."

Three such batteries were coordinated and supported by the battalion headquarters and headquarters battery, with another survey platoon, the survey information center, and the meteorological section. Since then, the combat support system (administration, supply, and maintenance) has been decreased, but the requirements and problems of the operating units have only intensified.

By contrast, the current counterfire unit is a "battery" in name only. The battery commander, with no operations section of his own, functions as a staff and liaison officer at the tactical operations center. The sound/flash platoon and radar sections are simply the old detachments which appealed to the paper planners of World War II. These free floating units never performed satisfactorily, and there is even less reason to believe they will do so now. It should be noted that as WWII progressed, artillery commanders not only gave up the idea of skeletonized sound ranging and flash ranging detachments, but employed even higher proportions of complete observation battalions. To hope that two detachments, each of one officer and 34 enlisted men plus one warrant officer and his radar crew—all without adequate supporting units—can produce the necessary results, certainly assumes genius and iron constitutions. The slogan "do more with less" translates into "get something for nothing." It is hard for this old timer to believe that the new generation of the Army is all that much tougher and more capable than the 1940 vintage.

Lumping sound ranging and flash ranging into a single unit could only have been conceived by someone unfamiliar with either type operation under combat conditions. Generally the terrain suitable for one type base is by no means compatible with the other, and, during active periods, only bedlam could result at a combined sound/flash central. Even the detachment advocates of WWII didn't propose that one.

To show that these are not just gripes by one "old crank" and that there are precedents for these ideas, refer to the excerpts from a letter written by LTC Geoffrey D. Ellerson in 1944. He was the commander of the 1st Field Artillery Observation Battalion throughout the combat in Tunisia, Sicily, and Italy. Keeping in mind the changes in organization (generally substituting division for corps, and brigade for division) his comments are just as valid now as then.

In short, it seems to me that the present elaborate superstructure, including the tactical operations center, is based on a foundation of sand. We are building up a false sense of security based on an assumed capability which does not really exist. The expected performance of the counterfire intelligence units cannot be achieved until these units are provided adequate personnel, equipment, and training equal to those of the old battalions.

Must we repeat history to learn its lesson? This time the cost of learning will be much higher!

COL (Ret) Arthur R. Hercz, a former director of the Counterfire (Target Acquisition) Department, now lives in Ann Arbor, MI.

Commanders Update

COL Virgil D. Detrich
82d Airborne Division Artillery

COL Joe J. Breedlove
101st Air Assault Division Artillery

LTC Victor M. Fernandez
1st Battalion, 2d Field Artillery

LTC Gary L. Brown
2d Battalion, 4th Field Artillery

LTC Carl R. Morin
2d Battalion, 12th Field Artillery

LTC Roger W. Franke
1st Battalion, 19th Field Artillery

MAJ(P) Gary J. Walk*
2d Battalion, 19th Field Artillery

LTC Otto D. Laursen
1st Battalion, 20th Field Artillery

LTC Carl S. Taylor*
1st Battalion, 21st Field Artillery

LTC Stephen H. Kelley
1st Battalion, 40th Field Artillery

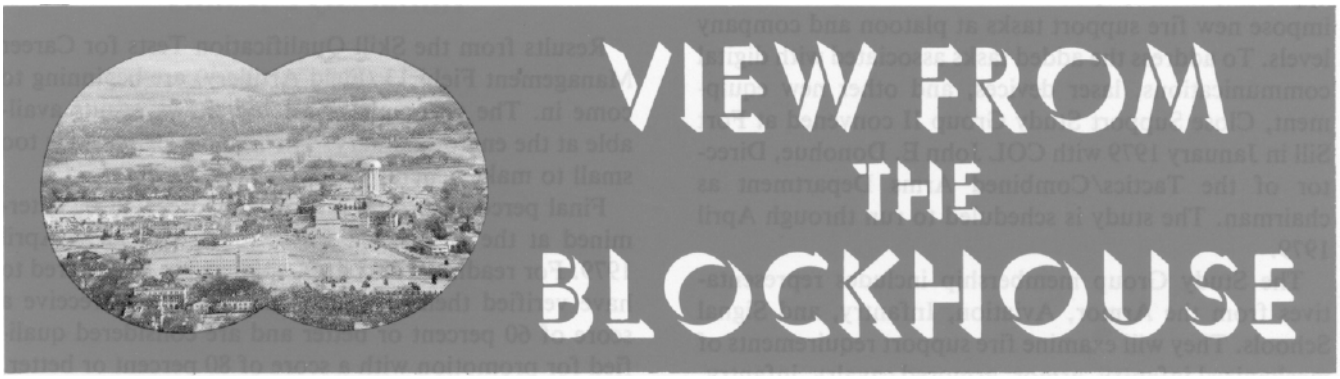
LTC Reinhold J. Kraft
1st Battalion, 82d Field Artillery

LTC Thomas D. Gaither
3d Battalion, 319th Field Artillery

LTC Douglas Morgan
1st Battalion, 320th Field Artillery

LTC Fred C. Dunaway*
3d Battalion, 3d Training Brigade
Fort Leonard Wood, MO

***corrections to previous listings**



Damage to 8-inch tubes

Recently, four M110A1 8-inch battalions in Europe experienced damage to the lands of the M201 cannon when firing the M106 projectile. All four units indicated that the weapons were shooting well and that they had no knowledge of any problem until the weapons were borescoped. The M110E2 Project Manager conducted an investigation and issued a worldwide message advising M110 units of the hazards and probable cause of the occurrence (see page 46, November-December 1978 *FA Journal).*

A Blue Ribbon Panel was formed to investigate the problem in detail. Preliminary findings suggest that the damage might have been caused by firing unseated rounds from a fall-back position. *The extreme result of this condition could be a close-in or inbore premature detonation.* The tentative probable cause for unseated projectiles has been identified as failure by the crew to perform certain critical checks and adjustments, an improperly timed loader and rammer, or a combination of these factors.

Based on available evidence and pending final resolution of the problem by the Blue Ribbon Panel, prescribed procedures detailed in the howitzer operator's manual (TM 9-2300-216-10) *must be* precisely adhered to. There are three critical checks and adjustments that must be made upon initial receipt of a new weapon, retubing, replacement of the breech ring, or replacement or modification of the loader and rammer. These checks and the reference in TM 9-2300-216-10 are:

• Projectile tray adjustment—Steps 1 through 5, paragraph 2-6, page 2-54.

• Determining correct cannon position for the loader and rammer—Steps 1 through 8, paragraph 2-6, page 2-55.

• Alignment of the cannon tube and loader and rammer—Steps 1 through 12, paragraph 2-6, pages 2-56 through 2-58.

Additionally, there are three critical checks that must be performed each time a weapon occupies a new position:

• Equilibrator adjustment check—Table 2-1, item numbers 29 through 30, page 2-19.

• Establishment of an oil reserve—Table 2-1, items 33 through 37, pages 2-20 and 2-21.

• Fluid level check—Table 2-1, item number 38, page 2-21.

These checks must be performed *in sequence* and any deficiency found in one must be corrected *before proceeding* to the next check and before timing the loader and rammer. Procedures for inspecting the loader and rammer to determine whether it is correctly timed are given in table 2-1, items 39 through 45, pages 2-22 and 2-23, of TM 9-2300-216-10. Procedures for timing a loader and rammer which is out of adjustment are listed in paragraph 2-11, steps 1 through 8, pages 2-104 and 2-105.

It is imperative that 8-inch howitzer sections know and follow these procedures. Additionally, it should be noted that the hydraulic loader and rammer should *never* be operated without a projectile. A dummy projectile (M14, DODAC 1320-D679) is available in limited quantities in the supply system. This projectile will enhance howitzer section training and preclude damage to the loader and rammer assembly.

Until the findings of the Blue Ribbon Panel are published, the procedures described above must be diligently performed. Laxness or inattention to detail could result in loss of life, injury to personnel, or damage to the howitzer. (CPT Johnson, Weapons Department)

Close Support Study Group reconvenes

The TRADOC Combined Arms Close Support Study Group, which met in 1975 at Fort Sill, resulted in the Fire Support Team (FIST) concept being approved in June 1977 and the establishment of an enlisted fire support specialty, MOS 13F. Since the FIST concept was

approved, new equipment has been developed that will impose new fire support tasks at platoon and company levels. To address the added tasks associated with digital communications, laser devices, and other new equipment, Close Support Study Group II convened at Fort Sill in January 1979 with COL John E. Donohue, Director of the Tactics/Combined Arms Department as chairman. The study is scheduled to run through April 1979.

The Study Group membership includes representatives from the Armor, Aviation, Infantry, and Signal Schools. They will examine fire support requirements of mechanized infantry, armor, armored cavalry, infantry, airborne, air assault, air cavalry, and attack helicopter organizations and will provide input to the Division '86 study effort. (Major Kurtz, TCAD)

Transition to BCS

The fielding of the Battery Computer System (BCS) was scheduled to have sufficient overlap with FADAC to insure a smooth transition without degrading the present FDC computational capability. Recent developments indicate that complete supportability of FADAC after the year 1980 is questionable. However, this problem is being thoroughly researched. If a satisfactory solution is not reached, there may be a substantial period of time between the phase-out of FADAC and the arrival of BCS. This potential void must be recognized as a problem which could have a major impact on the Artillery Community.

USAFAS will monitor the supportability of FADAC and the development of BCS and will continue investigation of an interim solution to preclude complete reliance on a manual solution. (Mr. Johnson, Gunnery)

Lance ARTEP

The first DA print of the Lance ARTEP 6-595 has been sent to the field by pinpoint distribution. Units should have received their copies in January. This new document contains nuclear training objectives based on FM 100-50 which are effective for training and evaluating by units.

Upon notification by DA, the ARTEP will be effective for implementing the Army's new concept of nuclear training and its associated reduced-in-scope inspection conducted by the IG. Comments concerning the ARTEP should be addressed to: Commandant, US Army Field Artillery School, ATTN: ATSF-TD-CT, Fort Sill, OK 73503. Additionally, the ARTEP Hotline is available 24 hours a day by calling AUTOVON 639-2064. (SFC DeWald, DTD)

Initial SQT results

Results from the Skill Qualification Tests for Career Management Field 13 (Field Artillery) are beginning to come in. The accompanying table shows results available at the end of January. The number of scores is too small to make general conclusions.

Final percentages and mean raw scores will be determined at the end of the SQT testing period in April 1979. For readiness purposes, soldiers are considered to have verified their current skill level if they receive a score of 60 percent or better and are considered qualified for promotion with a score of 80 percent or better.

For EPMS purposes, SQT scores will be converted to promotion points (DA Form 3355) for a maximum of 150 points of 1,000 points. All soldiers achieving the mean raw score (recomputed in April) will be eligible for promotion.

SQT	(track)	Number of scores	Qualified (%)	Verified (%)	Mean score
13B20	(1)	309	1	20	48.5
	(2)	289	12	45	60.7
	(3)	312	0	14	44.2
	(4)	1,489	4	36	55.9
	(5)	626	3	32	54.4
13B30	(1)	46	4	55	62.3
	(2)	66	32	58	74.0
	(3)	23	17	57	64.4
	(4)	219	19	51	66.1
	(5)	67	19	57	67.5
13B40	(1)	27	7	30	50.7
	(2)	137	30	35	66.6
	(3)	29	0	24	47.4
	(4)	224	18	35	61.4
	(5)	57	2	19	44.3
13E20		436	1	13	36.6
13E30		161	3	11	36.7
13E40		128	2	24	41.0
15D20		199	8	40	57.8
15D30		69	3	49	57.9
15D40		57	14	33	60.2
15E20		48	4	13	49.0
15E30		78	8	56	63.0
15E40		29	7	45	59.6
15J20		21	57	33	77.4
15J30		19	58	42	81.1
15J40		21	48	43	78.5
17B20	(1)	55	0	9	41.5
	(2)	5	0	0	41.2
17B30	(1)	7	0	14	40.6
	(2)	2	0	0	48.0
17B40		19	5	11	37.1
17C20		99	0	2	36.7
17C40		8	0	0	25.8
82C20	(1)	171	2	17	42.9
	(2)	79	0	19	43.6
82C30		110	0	2	32.5
82C40		79	3	23	45.2
93F20		45	27	51	68.7
93F30		28	11	50	60.0
93F40		14	29	57	71.5

TACFIRE MOS structure

After successful testing of TACFIRE by the 1st Cavalry Division, a decision was made by the Department of the Army and Secretary of Defense to equip the Active Army with TACFIRE. During the developmental process, personnel and training managers analyzed various alternatives on how to best identify, manage, recruit, and train the personnel required to operate and maintain the system.

It was determined that the most efficient way to manage personnel for the new system was to create a new MOS (13C) within career management field 13. This would preclude personnel problems associated with additional skill identifiers whenever MOS command ceilings are imposed on major commands. A separate MOS also provides the means to requisition the TACFIRE-trained personnel necessary to operate the system.

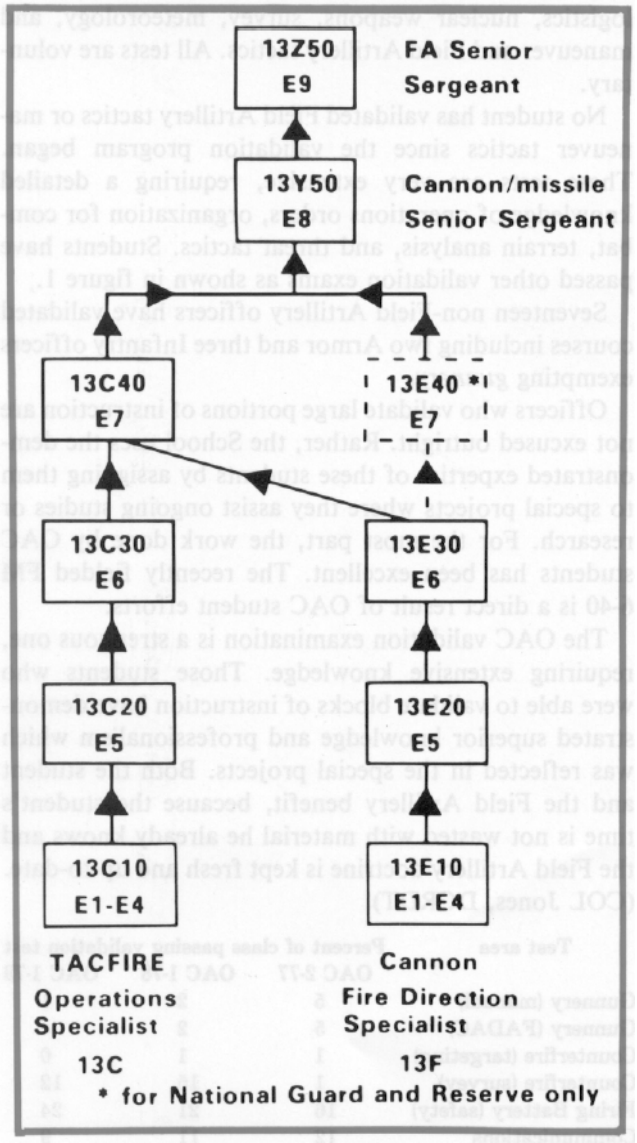


Figure 1. Career progression for MOSs 13C and 13F within career management field 13 (Field Artillery).

With the implementation of MOS 13C, a significant change in MOS 13E will take place. Figure 1 shows the career progression of MOSs 13C and 13E. Basically, MOS 13C will replace 13E positions at Field Artillery battalion and higher level fire direction centers and operations centers. MOS 13E will terminate at grade E6 in the Active Army. This means a 13E E6 promoted to E7 will be promoted into MOS 13C40. This does not mean that a 13C30 has a better chance for promotion than a 13E30. Both MOSs will have their own SQT and MOS cutoff scores, and both will have the same opportunity for promotion to E7. MOS 13E will continue through E7 for Reserves and National Guard which will not have TACFIRE.

To implement transition into MOS 13C, a DA circular will be distributed in late April or early May 1979 outlining the necessary changes to authorization documents. Change 12 to AR 611-201 will be the authority to reclassify some 13Es into 13C. The 13Es in skill levels 1 through 3 will be reclassified to MOS 13C on 1 September 1979 or when their unit receives TACFIRE, whichever is later.

All 13Es at skill level 4 (E7) in the Active Army will be reclassified to MOS 13C effective 1 September, since MOS 13E will terminate at E6. To identify those 13C40s with TACFIRE training, a Special Qualification Identifier "T" will be awarded in September 1979 for three years and may be extended if necessary until TACFIRE is fully deployed.

Resident training will be provided at Fort Sill for CONUS-based units and at Vilseck, Germany, for European-based units. After successful completion of training, 13Es assigned to 13C positions will be reclassified to 13C.

Advanced individual training for 13Cs will begin at Fort Sill in April 1980. Basic fundamentals will be taught, and unit commanders will have an exportable self-training package to train an individual as a 13C. This gives the commander the flexibility to train his 13Es into 13C duty positions and to develop additional proficiencies for existing 13Cs. (Major Meek, TACFIRE TSM)

Commanders' Conference follow-up

The 1978 Senior Field Artillery Commanders' Conference ended with a few issues not totally resolved. The following information provides a response to those subjects.

Target Acquisition Battery TOE—The Combat Developments Directorate is working on a revised TOE along the lines of the US Army, Europe MTOE which adds an automotive maintenance section to the TAB. Also recently completed is a new TOE for a combined Aviation/Target Acquisition Battery for the Air Assault

Division. This organization, TOE 6-787H, has been approved by DA and has been forwarded to The Adjutant General for publication. Addition of a maintenance capability to this TOE is also to be proposed, pending receipt of supporting documentation from Fort Campbell.

Wargames—"First Battle" has recently undergone a major revision and is scheduled for production in early 1979 with distribution to local Training and Audiovisual Support Centers in March.

—"Broadsword" is a division level battle simulation, similar to the CAMMS simulation, but is improved in the play of indirect fire effect, target acquisition, air support, and logistics. USAFAS has been developing a fire support module for this simulation, and field testing is scheduled for the second quarter of FY 80. Broadsword offers the following improvements over existing simulations: Conventional and nuclear effects have been revised to include several shell/fuze options, close air support and air defense are a viable part of the computer model, and the detailed logistics program includes both resupply and maintenance considerations.

Training Ammunition—USAFAS developed a report that was sent to TRADOC in November 1978, outlining the Field Artillery's "unconstrained" training ammunition requirements for a 155-mm battalion. This report was based on information provided by senior Field Artillery commanders throughout the Army. A second report addressing the "minimum essential" training ammunition requirements based on commanders' input was sent to TRADOC in February 1979. These inputs, along with those from the other TRADOC schools, will be used to develop a training circular (TC 25-3) on training ammunition management. (LTC Seitz, DCRDT)

OFT not selected

The Observed Fire Trainer (OFT) is an economical training device used to train observers in the adjustment of indirect fire without using live ammunition. The computer-controlled trainer uses a visual projection and sound system to create a realistic terrain scene. The student observer's call for fire is entered into the computer, and then the artillery and mortar bursts are superimposed on the terrain scene at the called-for location.

Operational Test II was conducted during the summer of 1978 at Fort Sill and, although there was good student and instructor acceptance, the OFT exhibited poor reliability and maintainability. As a result, USAFAS did not recommend production of the US-manufactured version of the OFT.

Representatives from USAFAS went to England to observe two British-developed indirect fire trainers—the "Master Gunner" built by Marconi Space and Defence Systems and a trainer built by Invertron Simulated Systems. USAFAS is planning to lease both devices and bring them to Fort Sill for a formal evaluation.

The trainer selected will be issued to major CONUS posts and major units in Europe and Korea. (CPT Rozzoni, DTD)

Validation tests pay off

To eliminate unnecessary and redundant training, USAFAS allows Field Artillery Officer Advanced Course students to "test out" of instruction. Before attending classes in many blocks of instruction, the student is given a comprehensive examination on the material to be covered. If the student demonstrates proficiency, he is excused from that instruction.

Validation examinations are given in most areas of instruction, including communications and electronics, manual and FADAC gunnery, firing battery/safety, logistics, nuclear weapons, survey, meteorology, and maneuver and Field Artillery tactics. All tests are voluntary.

No student has validated Field Artillery tactics or maneuver tactics since the validation program began. These tests are very extensive, requiring a detailed knowledge of operations orders, organization for combat, terrain analysis, and threat tactics. Students have passed other validation exams as shown in figure 1.

Seventeen non-Field Artillery officers have validated courses including two Armor and three Infantry officers exempting *gunnery*.

Officers who validate large portions of instruction are not excused outright. Rather, the School uses the demonstrated expertise of these students by assigning them to special projects where they assist ongoing studies or research. For the most part, the work done by OAC students has been excellent. The recently fielded FM 6-40 is a direct result of OAC student efforts.

The OAC validation examination is a strenuous one, requiring extensive knowledge. Those students who were able to validate blocks of instruction have demonstrated superior knowledge and professionalism which was reflected in the special projects. Both the student and the Field Artillery benefit, because the student's time is not wasted with material he already knows and the Field Artillery doctrine is kept fresh and up-to-date. (COL Jones, DCRDT)

Test area	Percent of class passing validation test		
	OAC 2-77	OAC 1-78	OAC 1-79
Gunnery (manual)	5	2	1
Gunnery (FADAC)	5	2	4
Counterfire (targeting)	1	1	0
Counterfire (survey)	1	15	12
Firing Battery (safety)	16	21	24
Communications	12	11	9
Nuclear weapons	0	2	1

Figure 1.

COUNTERFIRE SYSTEMS REVIEW

Reducing radar vulnerability

Methods and procedures must be devised which will reduce the vulnerability of FA radars to detection by enemy direction finding equipment.

Current doctrine states that FA radars be turned on (transmit) only when enemy mortars or artillery are active. Radar-observed registration in a hostile environment is an exception, but measures can be taken to reduce vulnerability.

Transmission time can be greatly reduced by using "splash" to cue the radar. For radar observation, "splash" must be transmitted 10 seconds prior to impact to provide sufficient time to bring the radar to a transmit condition. As soon as each round is observed, the transmitter is turned off.

Decreased radar transmission time means less time for the enemy to employ his electronic detection devices against us and assures a greater chance for survival on the modern battlefield. (See FM 6-161, 27 July 1978, for a complete discussion.)

More power for hand-held calculators

Does the lack of power in your survey section's handheld calculator (Texas Instruments series) cause problems? Do the batteries die right in the middle of a field problem, dropping all of your survey computations? Take heart—there is a solution on the way.

A power adapter, developed by the Survey Division of the Counterfire Department, is in production at the Fort Sill Training and Audiovisual Support Center, and shipment to the field began in January. The power adapter is a small device which replaces the battery in your Texas Instruments hand-held calculator (models SR-56, SR-57, TI-58, and TI-59).

The existing calculator battery (TI battery pack BP-1A) provides 4.5 volts for operation. With the power adapter inserted in place of the battery and hooked to a T16 or T2 theodolite night light power supply, you still have 4.5 volts for the calculator, but with a much greater power reserve. To make connections, simply remove the battery pack and insert the power adapter in its place.

The adapter is designed to fit snug, so you may need to take a thin key to depress the tongue latch. Use a gentle tug to insure that it is latched properly. (You will notice that the adapter has a sloped base which angles the calculator toward you for easy operation.) Next take the night light power supply for your T16 or T2 theodolite (NSN 6675-00-997-4340) and, using the connector cable, plug one end into the inboard receptacle of the power supply and the other end into the power adapter. This provides enough power for more than 36 hours of computations in warm weather and more than 24 hours in cold weather, which is a major improvement over the one to two hours available using the manufacturer's battery pack.

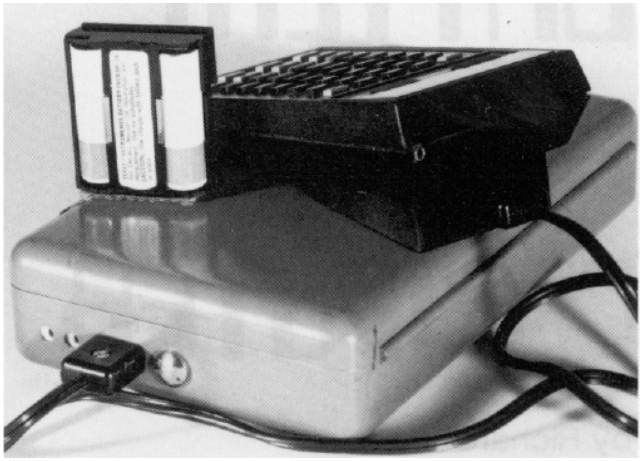
If nothing happens when you turn on the calculator, check these items:

- Insure that there are six *good* BA-30s in the power supply.
- Insure that the calculator is plugged into the *inboard* receptacle of the power supply.
- Check for reverse polarity by turning the plug around at the adapter end.
- If all else fails, check for a bad connector wire. Repair or replace it.

Hang on to your old battery. It can be recharged in garrison and used for training.

The production schedule calls for European-based units to receive their adapters by March 1979. Pacific and CONUS units should receive theirs by mid-summer 1979. Basis of issue will be one per survey calculator.

Texas Instruments calculator with USAFAS-designed power adapter, manufacturer's battery pack, and theodolite power supply. Note that holes nearest the chrome knob on the theodolite power supply are the ones to use. (Photo by Herb Thompson)



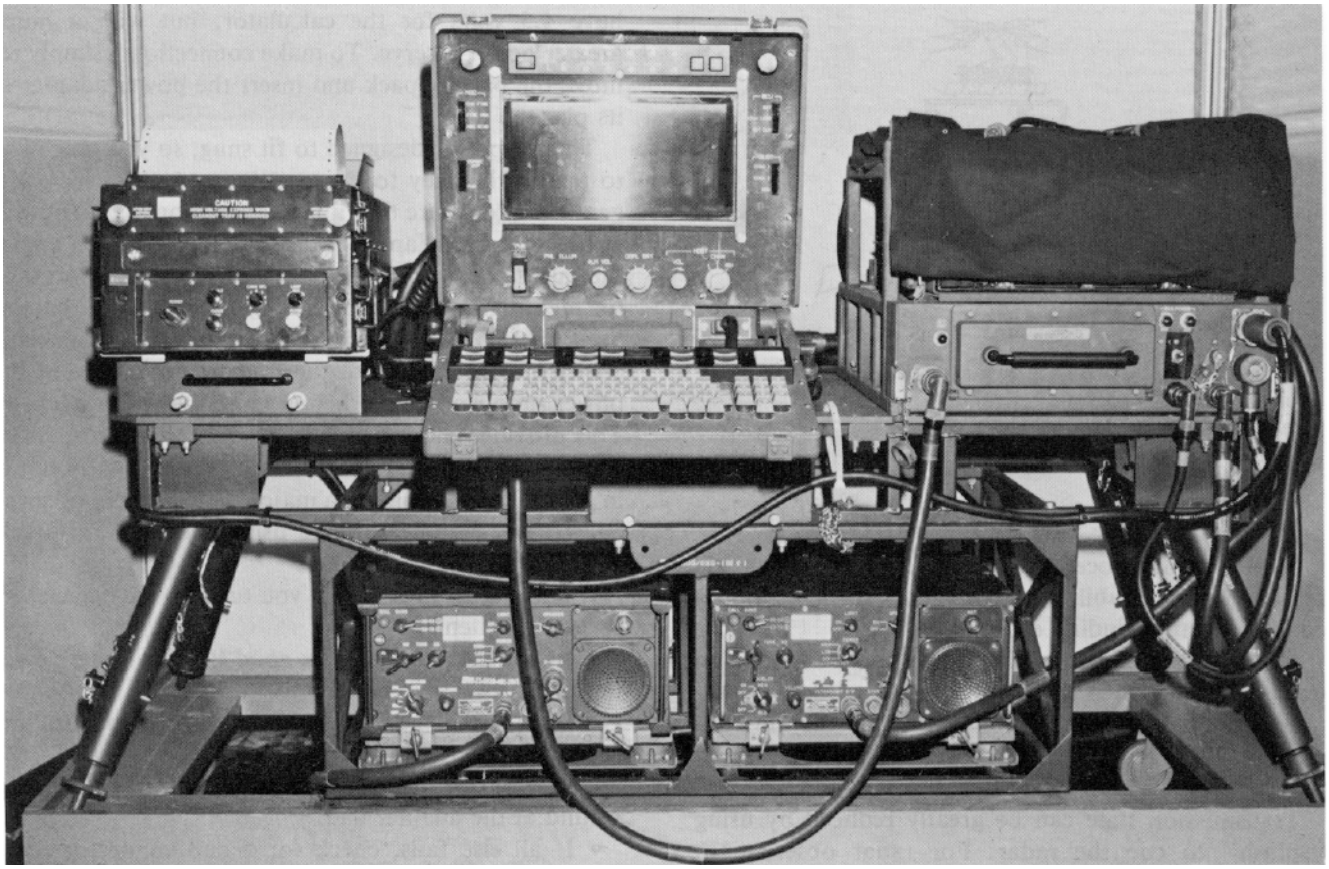


Figure 1. The fire direction subsystem contains the battery computer unit, the Power Distribution Unit, and two radios (RT-524). The configuration is "out of vehicle" and referred to as the field mount. (Photo by Jose E. Ruiz)

THE BATTERY SYSTEM COMPUTER

by Richard F. Brown

With the coming of the silicon chip and monumental advances in large scale integration of computer logic circuits, the modern computer age has come to the Field Artillery. One of the most recent developments is the Battery Computer System (BCS). The BCS comes to the Field Artillery as a remote terminal of TACFIRE, giving the battery fire direction center a two-way digital communications capability. It also comes as an independent gun direction computer replacing FADAC, for which repair parts are difficult to find.

To understand how the BCS works, one must keep in mind that it is a *system;* that is, it takes the manual fire direction process, automates it, and integrates communications, tying radios directly into the computer. Communications are both voice and high-speed digital, with the added feature of being 100 percent secure with battalion and potential for adding communications security with observers. Digital communications are extremely fast, keeping radio transmissions short and thereby reducing the potential for location by enemy radio direction finders.

Hardware

The BCS development effort did not seek to produce any new technology; it used current computer hardware throughout. During the engineering development phase, advances in the state-of-the-art were incorporated. The system may be broken down by two functional areas: the battery FDC and the howitzer section.

The battery FDC components (figure 1) include the following:

• The ***Battery Computer Unit*** (BCU) contains the central processor, communications interfaces, memory, etc. It is also the FDC's man-machine interface providing display, keyboard, indicators, etc., all contained in one case.

• The ***Power Distribution Unit*** (PDU) is a power routing device that takes vehicle power or 28-volt DC generator power and sends it to all system components. The BCU memory, which is volatile, can be held up to two hours by means of lithium batteries located within the PDU.

• The BCS uses ***standard military radios*** and ***field wire*** for communications. The radios are cabled directly to the BCU for digital communications on both the battalion command net and the battery fire direction net. BCS communication with the guns is currently by field wire, using existing battery circuits; however, the AN/PRC-68 intrabattery radio will be incorporated into the system as it becomes available.

Figure 2. The Gun Display Unit includes the Section Chief Assembly, two identical Gun Assemblies, and a carrying case.

Figure 3. The cycle buttons on the Section Chief Assembly allow the section chief to display fire commands. Pushing any button on the front panel causes that element of the fire command to be displayed immediately. A connector allows a headset to be attached for voice communications.

• ***Communication security (COMSEC) devices*** provide on-line secure digital communications with the battalion TACFIRE.

Note: The inclusion of an on-line, hard-copy printer is presently under study. Operational Test II, scheduled for early 1979, will include a close look at the need for a printer. The BCS engineering model can operate with or without an on-line printer.

The equipment (figure 2) used at the howitzer section is collectively called the Gun Display Unit (GDU). It includes the following:

• The ***Section Chief Assembly*** (figure 3), which looks much like a hand-held calculator, gives a digital display of fire commands and has a head set connector for voice communications as well. Communications between the FDC and the guns can be voice or digital, as required.

• Two ***Gun Assemblies*** at each howitzer display deflection or quadrant elevation, depending on how they are wired. The gun assemblies are mounted directly on the piece.

• The ***GDU carrying case*** holds all components for storage, provides power from lithium batteries or an external 28-volt DC power source, and is the central wiring point for the Section Chief Assembly and the Gun Assemblies.

The GDU is flexible and adaptable to both towed and self-propelled artillery. Since the latter uses its own internal communications and has its own power supply, the GDU may be modified to provide better service to the crew. It should be noted that no operational tests have been conducted. The results of Operational Test II, to be conducted early in 1979, may force changes in hardware and software design and operational employment.

Software

The software, or computer programming which the BCS uses, is being developed by the software developer for the Royal Artillery's computer system. BCS software provides an operating system containing instructions which run the computer in an orderly and logical sequence. Next, there are applications programs having specific functions; for example, computing corrections for nonstandard meteorological conditions. There is also a maintenance and diagnostic function providing a self-test of the system.

Operation

The best way to understand BCS operation is to view the initial sequence of steps in a fire mission done autonomously. Autonomous fire missions are not the usual case, but serve to demonstrate the BCS's capabilities. In this example the observer is equipped with a digital message device (DMD) and is in a static location. He will adjust fire on an area target.

The BCU display contains all the essential elements of data and information to follow the fire mission from the initial digital fire request through "end of mission."

On the display (figure 4), there are three areas. The bottom section displays the observer's fire request. The format is the same as that used by TACFIRE, providing commonality in training for BCU operators and TACFIRE operators. The use of common formats is carried throughout the applications programs. Although BCS does make some changes, the relation is very close.

Having reviewed the fire request, the FDO must issue a fire order. At this point, it is very important to distinguish fire control processing differences between TACFIRE and BCS. TACFIRE analyzes targets for hardness and determines which combination of firing batteries can best defeat the target based on many considerations. The BCS does *not* analyze targets; it is a ballistic gun direction computer. Even though the BCS is very sophisticated, it is not designed to accomplish TACFIRE's mission—only to supplement it.

Having received the FDO's fire order, the BCS operator edits the fire request and enters the necessary data. The BCS computes the ballistics and presents several packets of data to the operator. Computation time is based on the time of flight and the number of weapons:

(Number of weapons) (0.04) (TOF) + 2 seconds = computation time.

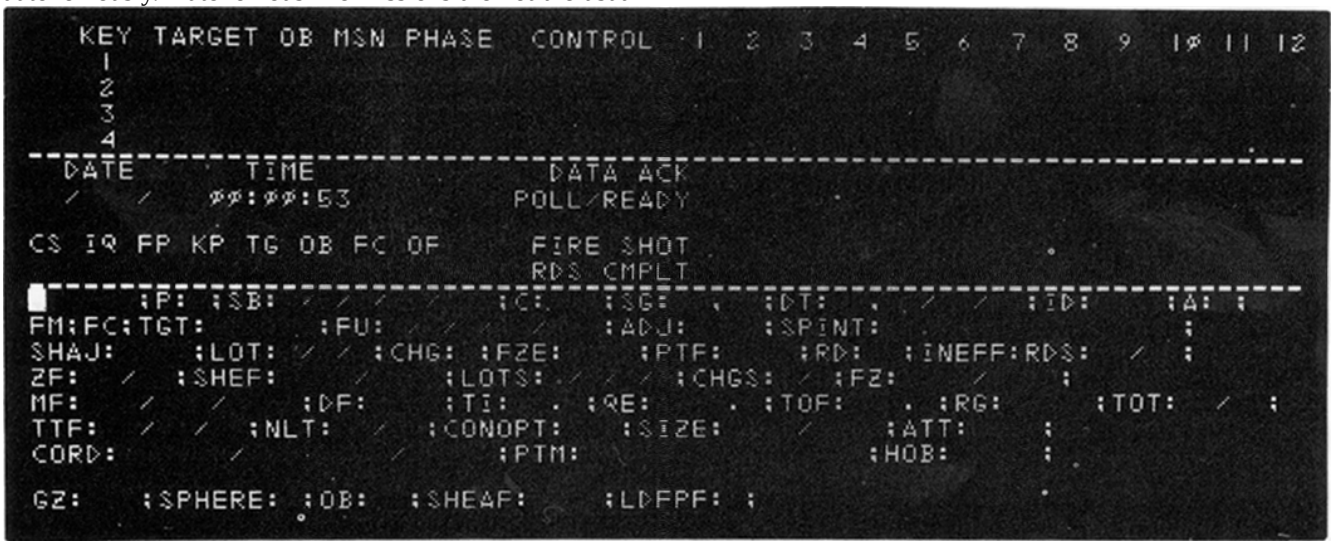


Figure 4. The BCU display is divided into three areas: The top area keeps track of up to four fire missions. The middle section reflects memory file capacities, current date and time, and the status of sections during a single given fire mission. The bottom part shows a typical TACFIRE message format.

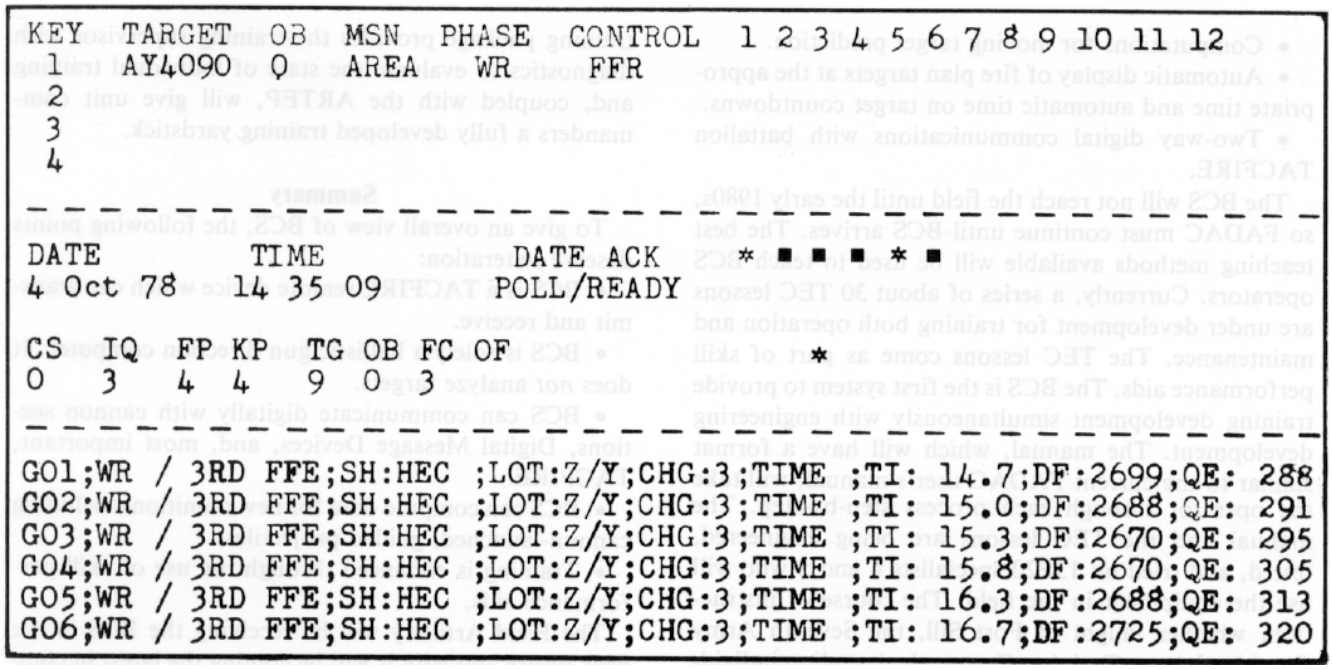


Figure 5. BCS mission and section assignment displays: The top section shows the FDO and the operator which mission is in progress and which sections are assigned. The left side of the middle section keeps track of available memory by file name and continuously displays the date and time. The right side of the middle display depicts the status of each section. The "asterisks" indicate queries from FDC, and the "squares" are responses from the firing section. The bottom section is a sample set of firing data for an entire six-gun battery. Note individual time, deflection, and quadrant for each piece.

For fire missions having a time of flight of 20 to 30 seconds, the fire commands appear in about 7 to 9 seconds. The deflection and quadrant elevation for each section are different since the computer determines an aimpoint for each piece.

The observer should make every possible attempt to describe the size of the target since this will provide a better basis for decisions on type munition and volume of fire by the FDO in an autonomous mission or by TACFIRE.

While the computations take place, the uppermost part of the display is automatically filled out (figure 5).

The BCS automatically assigns the target number and, based on the observer's fire request, lists the "OB" (observer number), "MSN" (type mission), and the method of fire and control to be exercised. The "PHASE" is linked to method of control. The operator determines assignment of cannon sections to the mission when the initial fire request is edited.

The BCS can accommodate four fire missions concurrently, one of which (key number 4) is reserved for the final protective fire.

The mid-level display is divided into left and right sides.

Since BCS memory space can become a critical factor during peak operating conditions, the operator is shown the status of each file in the memory. This includes the number of messages waiting to be processed. A digital clock, directly linked to the computer, displays date and time.

On the right side of the display, the status of each section can be checked to determine if they have received the fire commands and if they are ready.

Transmission time to the guns is rapid. The section chiefs respond to commands by pushing the acknowledge (ACK) key on the Section Chief Assembly. While acknowledgements are being received, the operator reviews the message to observer which the BCS automatically displays after "fire orders." Noting the time of flight, the operator pushes the transmit (XMIT) key, sending the digital message to the observer. BCS then automatically displays a "SHOT" message and then a "SPLASH" message.

The entire mission proceeds digitally. Voice communications are immediately available on the same nets if digital communications should fail.

The BCS provides these added capabilities:

• Computation for FASCAM, dual-purpose ICM, and nuclear munitions.

• Computation for cannon-launched, guided projectile Copperhead, including digital interface with the laser locator-designator.

• Computations for moving target prediction.

• Automatic display of fire plan targets at the appropriate time and automatic time on target countdowns.

• Two-way digital communications with battalion TACFIRE.

The BCS will not reach the field until the early 1980s, so FADAC must continue until BCS arrives. The best teaching methods available will be used to teach BCS operators. Currently, a series of about 30 TEC lessons are under development for training both operation and maintenance. The TEC lessons come as part of skill performance aids. The BCS is the first system to provide training development simultaneously with engineering development. The manual, which will have a format similar to the current FADAC user's manual, will take the operator through each process step-by-step. The manual and the TEC lessons are being engineered, tested, and tried on 13E20 specialists 4 and 5 who will use the equipment in the field. The course of instruction, whether taught at Fort Sill, the Seventh Army Combined Arms Training Center, the battalion individual learning center, or some other location, will require a structured OJT followup.

Since the BCS is a system involving observers with Digital Message Devices, section chiefs with Gun Display Units, TACFIRE, etc., it is essential that team training be exercised. This is done best in the unit and must develop team proficiency in maintaining digital communications as well as processing fire missions. The training package provides the training supervisor with diagnostics to evaluate the state of individual training and, coupled with the ARTEP, will give unit commanders a fully developed training yardstick.

Summary

To give an overall view of BCS, the following points deserve reiteration:

• BCS is a TACFIRE remote device which can transmit and receive.

• BCS is solely a ballistic gun direction computer. It does *not* analyze targets.

• BCS can communicate digitally with cannon sections, Digital Message Devices, and, most important, TACFIRE.

• BCS can compute data for new munitions including cannon-launched, guided projectiles.

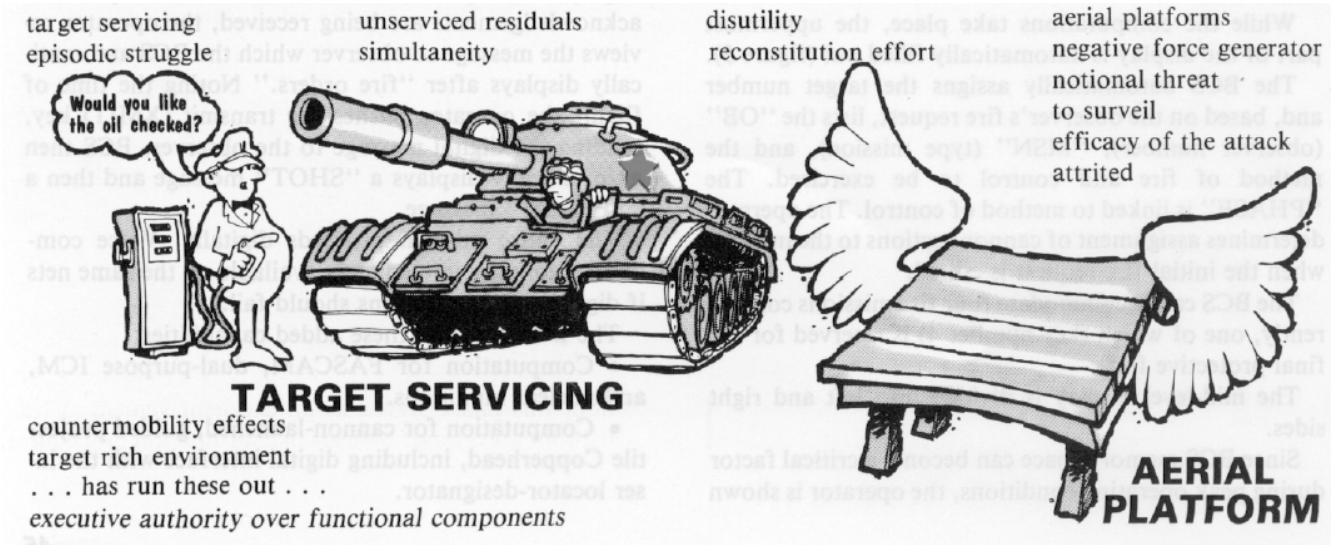
• Training is enhanced through the use of skill performance aids.

The Field Artillery will be receiving the BCS in the near future and with it will be coming the latest in computer design and integration of communication which the automatic data processing industry has to offer. We need to be ready!

Richard (Dick) F. Brown is a technical writer on the TACFIRE Team in the Directorate of Combat Developments, USAFAS. He is also a Field Artillery captain in the Oklahoma National Guard.

Briefing Jargon?

Attending briefings is essential to keep track of developments in our technologically advanced Army. Sometimes the briefings are boring and dull and the "briefees" resort to doodling or other activities to appear attentive. At one recent briefing at an unnamed post, the following terms were used, recorded, and taken to a dictionary for help.



Deployment Training

by LTC Bruce H. Ellis and MAJ Ray E. Porter III

Two divisional Field Artillery battalions have discovered a way to conduct realistic deployment training to off-post sites at *no* extra training cost. The operation is a mini-REFORGER type exercise, designed to expose troops and leaders to typical deployment requirements—that first step in all contingency plans.

The 1st Battalion, 27th Field Artillery, from Fort Carson, CO, and the 3d Battalion, 6th Field Artillery, from Fort Riley, KS, conducted a firing battery deployment exchange exercise in October 1978. The firing battery teams included FIST, survey, and Redeye personnel in addition to the gun sections and FDC personnel.

Each of the divisional 8-inch battalions deployed one firing battery per week during the three-week exercise. The purpose of the operation was to exercise air deployment plans, practice drawing firing battery equipment from a prepositioned stock, and externally evaluate ARTEP 6-165 firing battery tasks, while keeping the training cost of the exercise to a bare minimum. All planning, execution, and evaluation were handled solely within the two battalions. All aspects of the exercise were essentially duplicated at both installations.

Planning

The idea for the exercise was conceived by the two battalion commanders during early summer 1978. Both battalions had projected battery-level training during September and October and were looking for a way to incorporate other training into the external evaluation of firing battery tasks in ARTEP 6-165. Numerous objectives (figure 1) were developed. In July and September, the 3-6th Commander and his staff visited Fort Carson for planning conferences. In August, we visited Fort Riley. During these conferences, the details of personnel and logistics support and the ARTEP tasks to be evaluated were resolved. Those areas to be evaluated (figure 2) and the designation of unit responsibilities (figure 3) were determined and incorporated in a memorandum of mutual agreement. Every member of the battalion staff was involved during this phase, planning activities in his particular area of responsibility. In addition, this phase served as an excellent vehicle to train battalion-level staff officers in coordination procedures, forecasting requirements, and interfacing with a counterpart at a distant location.

- **Exercise air deployment plans.**
- **Simulate prepositioned materiel receipt.**
- **Conduct external evaluation under ARTEP 6-165 on unfamiliar terrain by unbiased evaluators.**
- **Accomplish the above objectives at near-zero extra cost.**

Figure 1. Objectives.

- **Deployment preparation.**
- **Tactical operations.**
- **Delivery of fires (157 rounds per battery).**
- **Fire direction.**
- **Fire support team (FIST).**
- **Survey.**
- **Communications.**
- **NBC.**
- **Redeye.**
- **Mess.**
- **Maintenance.**

Figure 2. Areas to be evaluated.

Action	Responsibility of:
Planning	Both units
Control	Host unit
Evaluation	Host unit
Range safety	Host unit
Meteorology/radar support	Host unit
Communications:	
SOP	Both units
Issue CEOIs	Host unit
Departure/arrival	Host unit

Figure 3. Designation of responsibilities.

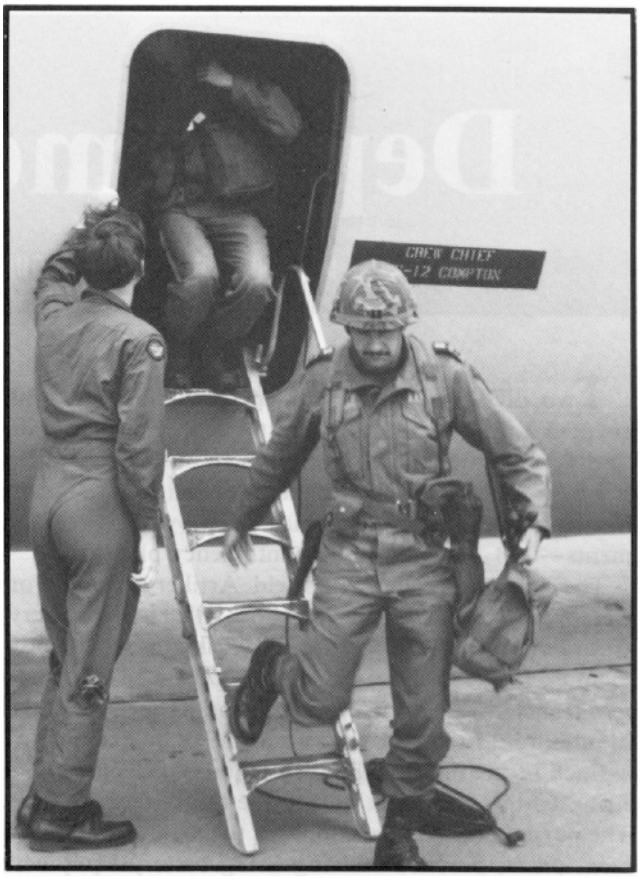
Deployment

On three successive Sundays, a battery was alerted for deployment by battalion and was required to muster personnel with their equipment, conduct a briefing on deployment procedures, and palletize duffle bags and other accompanying equipment in preparation for departure. Early Monday morning the battery processed through a Departure Airfield Control Group (DACG) which checked all preparation for overseas movement (POM) required items. Inoculations were given and ID cards and ID tags were inspected, but it was the battery commander's preinspection which insured that POM standards were met. The deploying artillerymen were bused from Fort Carson to nearby Peterson Air Force Base, CO, and from Fort Riley to Shilling Air Force Base, KS—a distance of approximately 60 miles. The 62d Military Wing, McChord Air Force Base, WA, supported the exercise with one C-141 aircraft. The 68th Transportation Battalion at Fort Carson and the 541st Maintenance Battalion at Fort Riley provided DACGs and Arrival Airfield Control Groups (AACGs) at their respective home stations. The DACGs and AACGs were arranged for by the host battalion. The airflow schedule was coordinated with the US Air Force to fit the Air Force's desires and to take advantage of the posts' different time zones. Air travel time between the posts was approximately one hour.

Reception

When the visiting battery arrived, the AACG transported the personnel and equipment to the host battalion area. The arriving unit was fed the noon meal while the battery commander was escorted around the area and briefed on the day's schedule. The first day's schedule included bivouac setup, equipment issue, and a tactical briefing. The host battalion's motor pool was used to issue the needed equipment in about four hours. By previous agreement, TOE equipment not needed for the operation was deleted from the issue list. Battery mess and maintenance section equipment was not signed over, so the hand receipt holder went along as an escort. This was to save time during the issue phase and to facilitate ration issue and maintenance support. After receiving its equipment, the battery moved into a bivouac area near the host battalion's motor pool. The austere bivouac area contained a small general-purpose tent for the officers, two medium general-purpose tents for the EM, a shower point, and commercial portable latrines.

Late Monday afternoon, the visiting battery commander and key personnel were briefed by the host battalion and were given an evaluation packet. The briefing included safety and range regulations; types of battalion support available to the battery; a complete tactical situation; introduction of a "support slice" provided by the host battalion, including communications, safety officers, and medics; introduction of evaluators/controllers; and issuance of an operation order. The battery spent Monday night in the bivouac area, concentrating on activities directed by the battery commander in preparation for a Tuesday morning movement to the initial firing position. Reconnaissance, registrations, and other activities conducted before 1200 hours Tuesday were at the option of the visiting commander.



Firing battery commander from the 4th Division Artillery deplanes at Shilling AFB, KS, to lead his unit through a week of training with the 1st Infantry Division Artillery. Traveling batteries carried only personal gear; the host battalion provided essential TOE equipment.

Evaluation

The evaluation, based on the ARTEP, began at noon on Tuesday. The evaluation included 14 delivery of fire tasks; day and night deliberate moves; hasty moves; defense against ground, CBR, and air attacks; and other tactical operations tasks. Performing these tasks on unfamiliar terrain was a challenging experience. The evaluation

Firing section from the 1st Battalion, 27th Field Artillery, occupies its initial position at Fort Riley. The 8-inch howitzer and ammo carrier were borrowed from a mirror image section which was simultaneously using equipment of the section in this picture.

lasted 24 to 36 hours, as slight modifications were made to the tactical scenario for each iteration of the exercise. The tactical scenario, evaluation of the ARTEP tasks, and logistics support for the field exercise were the responsibility of the host battalion. The host unit also provided range control and radar reports and acted as the battalion headquarters for the evaluated battery. Logistical support included battalion recovery, PLL, and float items of equipment, which were available on a direct-exchange basis so that the evaluated unit would not be penalized for equipment failures.

Recovery/equipment turn-in

Late on Wednesday afternoon after completion of the ARTEP tasks, the firing battery returned to the bivouac area. Equipment clean-up operations began early Thursday morning. Turn-in inspections, conducted by the host battalion, focused on equipment accountability and completion of all operator maintenance requirements before turn-in. Any organizational or support maintenance requirements on equipment items were handled by the host battalion after the turn-in was completed.

Redeployment

The redeployment was a reverse of the deployment operations. The batteries returned home Friday morning and began cleaning and inspecting sensitive items, personnel equipment, and accompanying unit equipment.

Conclusion

Including predeployment training and preparation, the operation lasted five weeks, during which time the battalions were totally dedicated to the exercise. All of the original objectives, plus many more, were accomplished. It was five weeks very well spent. From the young soldier, many of whom had never been a part of a unit movement or had even flown, to the FIST chief, the exercise provided an exceptional learning environment.

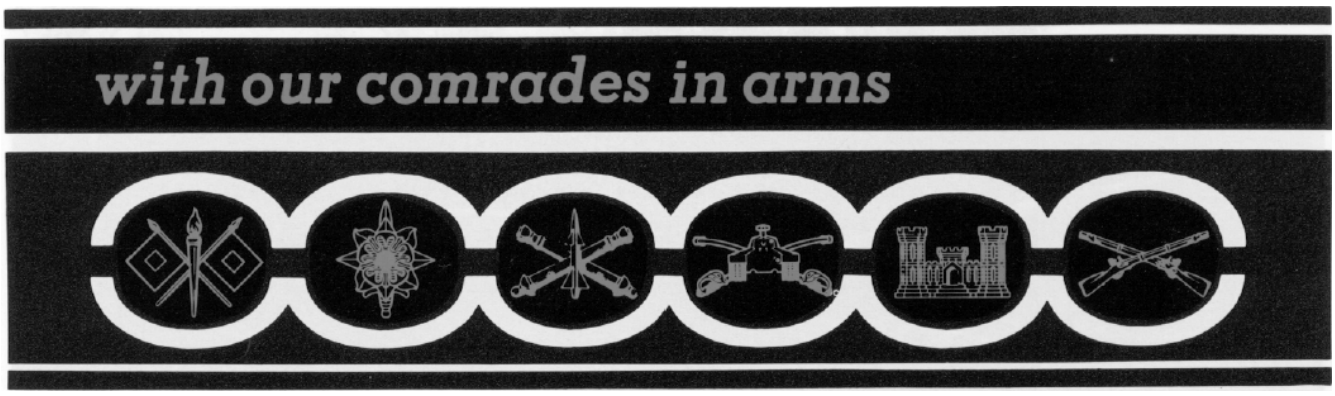
The intangible benefits, including the expertise gained, the teamwork developed, and a vastly improved appreciation for the battalion's missions and capabilities, will certainly have a lasting impact.

The authors have experienced a European REFORGER and believe that this type exercise contains many of the same learning opportunities. In short, it is a relatively easy exercise, is no more expensive than an on-post FTX, and provides realistic deployment experience, while adding interest and excitement to training.

For more information or a copy of the after-action report, write:

Commander
1st Bn, 27th FA
ATTN: S3
Fort Carson, CO 80913

LTC Bruce H. Ellis is Commander and MAJ Ray E. Porter III is Executive Officer of the 1st Battalion, 27th Field Artillery.



IFV rolls out

The Army has rolled out the first two prototypes of its XM2 Infantry Fighting Vehicle (IFV). The XM2 is the first US combat vehicle to offer the infantry squad the option of a mounted attack.

A development program for the XM2 and the XM3 Cavalry Fighting Vehicle (CFV) began in November 1976 and was expanded in June 1977 to include the Field Artillery's General Support Rocket System carrier. Production delivery is expected to begin in May 1981 after an $80 million engineering development program.

Principal features of the XM2 are:

• A two-man turret with a 25-mm automatic cannon as the primary weapon, firing both armor-piercing and high explosive ammunition. The XM2 carries two TOW launchers as well as a 7.62-mm machinegun. All weapons except the TOW can be fired while the XM2 is moving.

• Six protected firing ports to permit squad members to fire 5.56-mm automatic firing port weapons while moving.

• An integrated day/night sight using the latest thermal imaging technology.

• A 500-horsepower turbocharged diesel engine and an improved transmission and suspension system for increased mobility and a top speed of 42 miles per hour.

The XM2 will provide a more heavily armored vehicle with high mobility and survivability that can move troops rapidly to accompany the XM1 tank.

Hellfire passes test

The Army Missile Research and Development Command has launched a laser-guided Hellfire missile from a low-flying helicopter, successfully opening the engineering development flight test program with the new armor killer. The missile "homed" on and hit a stationary target illuminated by the Ground Laser Locator Designator. Tests will continue for the next couple of years.

Hellfire is being developed as an evolutionary modular system that will accommodate a family of terminal homing seekers on a common airframe to engage tanks and hard point targets. The initial configuration uses semiactive laser guidance.

Hellfire is to be the primary armament on the new AH-64 advanced attack helicopter and will be fielded in the early 1980s.

First Improved Hawk battalion activated

The 2d Battalion, 51st Air Defense Artillery, has been activated as the first Improved Hawk battalion to be deployed with an Army division. The Battalion has been assigned to the 1st Infantry Division at Fort Riley, KS.

Improved Hawk has the necessary mobility to keep pace with the mechanized elements of the Division and complements the coverage of the forward area Chapparral/Vulcan and Redeye weapons with its greater range and all-weather capability.

More A-10s to forward bases

The German air bases at Leipheim and Ahlhorn have been designated the second and third forward operating locations in Germany for US Air Force A-10 aircraft. The first location was Sembach Air Base. A fourth base will be selected soon.

By 1980 a wing of A-10 aircraft, based at RAF Bentwaters-Woodbridge, England, will operate routinely from forward locations on the continent to place the A-10s closer to NATO forward defense positions.

Women in military to double by 1984

The Pentagon expects the number of women in the armed forces to double to 12 percent by 1984, and it says women already are moving into male-dominated jobs such as missile units and airborne duty.

A recent Defense Department report indicates that women are playing an increasingly important role in the effort to fill slots in the all-volunteer Army.

According to the report, women are now getting better military jobs, but many still wind up with traditional work as secretaries, clerks, and medical assistants.

The report said the number of women in the military has increased threefold since the draft ended, rising from less than two percent in fiscal year 1973 to nearly six percent in 1977.

The number of women is expected to double to nearly 12 percent of all military personnel by fiscal year 1984 and to reach almost 20 percent in the Air Force.

Army buys 36 radars

The Army has purchased 36 mortar-locating AN/TPQ-36 radars from Hughes Aircraft Company. The production contract for 50.5 million dollars was awarded recently by the Army Electronics Research and Development Command.

Of the 36 radars called for in this contract, 24 are for the Army and 12 are for the Marine Corps. Delivery will begin in October 1980.

Bye bye "Cs"

The traditional "C" ration will be replaced with new ready-to-eat meals in flexible packages in mid-1980, according to *Army Logistician* magazine.

Developed by the US Army Natick Research and Development Command, the ready-to-eat ration is said to be easier to prepare, tastier, and more nutritious than the individual combat meal. The new ration will be easier to carry, be 50 percent lighter than canned foods, and fit comfortably into a combat uniform pocket. The ration packet can be opened easily by tearing off the sealed edge of the pouch. The contents of some ration items may be heated by dropping the sealed pouch in hot water or they may be eaten unheated.

Twelve different meals will be available, with each meal containing an individually packaged meat portion; crackers and a peanut butter, jelly, or cheese spread; a high-calorie dessert; and instant coffee powder. Three of the menus contain beans, two contain a freeze-dried potato patty, seven contain cocoa beverage powder, and five contain one of three freeze-dried fruits.

Recommended reading

The November 1978 issue of *Aviation Digest* contains an interview with GEN Don Starry, Commander of the Army Training and Doctrine Command. Many aspects of doctrine and development of the Army air arm of fire support are covered in the interview.

An article entitled "Mortars — Bane to Boon," written by a Field Artilleryman, appears in the November-December issue of *Infantry*. It describes a program used by the 82d Div Arty to upgrade all aspects of the division's mortar operations. In the same issue's "Training Notes" feature, there are two short discussions of using "roving mortars" similar to the Field Artillery's "roving gun" concept.

The November 1978 issue of *Defense and Foreign Affairs Digest* has an article by that magazine's European bureau chief which takes a close look at all aspects of Soviet Artillery. Among the conclusions reached as ways NATO can defeat the Soviet artillery threat is by devoting all efforts to standardizing 155-mm howitzer ammunition throughout the Alliance.

For those who were interested/surprised/dismayed/pleased/mad about the *FA Journal* coverage of women in the November-December 1978 issue, the October-December 1978 issue of *Military Intelligence* magazine has much more of the same. Almost the entire issue is devoted to the subject of female officers and soldiers in the MI branch. The Intelligence School Commandant notes in his column, ". . . roughly one third of new Military Intelligence [personnel] acquisitions are women."

Defense and Foreign Affairs Digest for December contains a good update of Soviet chemical warfare capabilities and doctrine. Two points—chemical release authority is delegated to division commanders, and our nuclear capable artillery systems are high priority targets for chemical attack.

Issue number 9/1978 of the *International Defense Review* has an article entitled "Tactical Problems Facing the Soviet Army" which should be read. In the article, current roles, missions, capabilities, and shortcomings of Soviet artillery are discussed in some detail. One key point made is that the Soviets themselves believe they will not be able to achieve the 50 percent destruction of NATO artillery essential to conducting offensive operations.

Moving? Subscribers should send their new address four weeks in advance to: Field Artillery Association
c/o Fort Sill Museum
Fort Sill, OK 73503

FIST fire planning

or

"on time, on target"

by CPT J. C. Stewart, RCA

A company team has encountered the enemy in a particularly stubborn delaying position during an advance to contact and is forced to stop. Immediate suppressive fires enable the team to withdraw behind cover. The team commander sees that a hasty attack is required before the advance can continue and that a bypass is out of the question.

Although no time is stipulated in any field manual, 30 minutes is considered to be the minimum time for the team commander to carry out a quick reconnaissance, pass fragmentary orders, move troops to the line of departure and overwatch position, and then begin the attack.

A vital part of any plan of attack is the fire support plan, or fire plan, which specifies how the maneuver commander wants to use all of the fire support resources available to him. Necessarily, this plan must be coordinated. Therefore, it is a wise team commander who formulates his plans in full consultation with his fire support coordinator (FSCOORD), or fire support team (FIST) chief. FM 6-20 notes that, in a movement to contact situation, the FIST chief is primarily concerned with ". . . providing immediate suppressive fire to his team" and that he must be concerned ". . . with planning to support the team's action after making contact."

The FIST chief, then, must be able to react quickly and plan fires. This obviously involves some planning of fire support for the team's maneuver options upon contact. Because of the unpredictability of combat, the FIST chief must also be prepared to plan fires upon contact—in the heat of battle where time is critical. LTC Carl Taylor, in his article "Effective Fire Support" (May-June 1978 *FA Journal)*, wisely stated that FSCOORDs "must be trained to ply their trade in a rather disorderly maneuver environment where immediate reaction may mean the difference between success and failure."

Several *FA Journal* articles have indicated weaknesses in FIST fire support officer (FSO) training, and several have discussed the key principles that a good FSCOORD should follow. Few, however, have addressed how realistic FIST training can be accomplished *now* so that our FIST chiefs will be technically proficient *before* the next combined arms ARTEP, REALTRAIN exercise, or real war.

What do I mean by "technically proficient"? I mean that our FIST chiefs must be able to *shoot* as opposed to simply adjust fire. I mean that they must be able to do more than place Xs on maps and make target lists. They must be able to *guarantee* fires on certain targets (i.e., be "on target"). And I mean that they must be able to provide, not only responsive fires on targets of opportunity and suppression targets, but also timely fires (i.e.,

fires that are "on time") on those targets that support the team commander's scheme of maneuver. No black-box wizardry in the guise of TACFIRE or laser rangefinders will impress a maneuver commander if the resulting fires are off target, too early, or too late to support his scheme of maneuver. As FM 6-20 so emphatically states: "In combat, seconds are precious. Unresponsive fires cannot be tolerated."

Any fire plan developed at the company team level is ultimately the team commander's plan converted to reality by the FIST chief. Accordingly, the FIST chief should, as a minimum, when faced with a hasty attack situation be trained to:

- Understand the scheme of maneuver.
- Know where, when, and in what quantity fires are required.
- Coordinate with the FSO and fire direction officer (FDO).
- Warn the artillery and mortar FDCs to prepare firing data and ammunition.
- Adjust several targets in 30 minutes.
- Predict targets.
- Formulate and transmit a request for a series of targets to the FSO, mortars and artillery.
- Be prepared with fires prior to the beginning of the attack.
- Be ready to modify the fires during the assault, should things go wrong.

The Field Artillery School has spent much time on the generalities of fire planning but not enough on the specifics. Anticipating in a realistic, worst case situation that four targets are needed to support a team hasty attack, the question is:

Are your FIST chiefs trained to prepare, adjust, and predict a simple, four-serial fire plan when soaking wet, with a soggy map, behind fogged binoculars, and beside an impatient, hard-nosed armored team commander who wants to attack in 30 minutes?

Frankly, I don't believe that they are, and I question whether FIST chiefs are being properly prepared for the pressures of fire planning in the even more disorderly environment after contact has been made on the battlefield. Therefore, I propose a live fire exercise that will force the complete gunnery team—but the FIST chief, in particular—to be more responsive. This simple FIST fire planning exercise requires the FIST chief to give advice about, and perhaps coordinate, mortar, artillery, tank fires, TACAIR, and helicopter gunships for a company team action after contact with the enemy. The exercise will accomplish the following:

- Prepare the FIST chief to "think maneuver."
- Make him *communicate* (not just use radios) with, and be responsive to, maneuver.
- Stress an "on target, on time" philosophy.
- Force the FIST chief to apply a sense of urgency, be flexible, and respond to the unusual.
- Offer an interesting, challenging, and enjoyable alternative to stereotyped training.
- Reinforce the fundamentals of fire planning.
- Provide a simple, yet realistic, method for spanning the gaps between maneuver, artillery tactics, and pure gunnery.
- Test total system response and prepare the gunnery team for a combined arms ARTEP.

The term "FIST fire planning" was selected to differentiate it from the more formal fire planning accomplished in the relative comfort and quiet of FDCs or command posts; however, the principles are the same. After a briefing that may be extremely vague and rapid, the FIST chief must understand what the team commander wants; he must be prepared to formulate a plan applying doctrine; and he must be prepared to coordinate and transmit the team commander's intentions rapidly in a simple, logical, and complete format so that everyone—especially the FSO and supporting artillery and mortar FDCs—is aware of what the commander wants and where and when he wants it. A FIST fire plan is worthless unless it is properly executed, so FIST chiefs must be taught in minute detail how to coordinate and plan fire support on the spot. Drills must be established so that there is no question on what the FIST chief must do. The question is, "How does he do it?"

How the exercise works

A FIST fire planning exercise is now in use by the Gunnery Department for the Field Artillery Officer Advanced Course students. No extra equipment other than a locally produced FIST fire planning form is required. The form in figure 1 is a guide only, but will help streamline radio transmissions and organize thoughts. The FSO and FDO should use the form to follow the FIST chief's request.

The FIST fire planning exercise is initiated and controlled by the FIST instructor. In field units this could be the FIST chief's battery commander or the FSO. The FIST instructor assumes the role of maneuver team commander and plans an appropriate scheme of maneuver for a hasty attack. The instructor must have imagination and a knowledge of basic maneuver terminology. Input from actual maneuver branch officers should be encouraged from time to time, because schemes of maneuver from artillery "maneuver commanders" are often more difficult and complex than an actual scheme of maneuver would be.

The FIST fire plan

The FIST fire plan normally consists of two to four targets coordinated by the FIST chief supporting a company team maneuver advancing to contact.

1. Keep the plan very simple.

2. Get the following from the team commander:
   - Targets and their priority.
   - Timings.
   - H-hour.
   - Tactical restrictions to adjustment.

3. Use officer-to-officer conversations with the FDC to pass:
   - Target numbers and locations.
   - Fire units and ammunition.
   - H-hour.
   - Timings and other instructions on planned targets.
   - Method of engagement and distribution of fire as necessary.

4. Continue adjustment while the fire plan is transmitted. No particular format is required. (The artillery FIST fire planning form in figure 1 can be used for training.)

5. Adjust targets in reverse order of planned engagement.

6. Be on time! You may be required to sacrifice accuracy if short of time.

7. Adjust targets by using simultaneous missions or shifts from adjusted targets when possible.

8. Determine predicted grids while adjustment is in progress. These predicted grids may have to be sent to the FDC should time run out for low priority targets. A target providing security against a counterattack during the consolidation phase may qualify as a target to be predicted. It could be included on the fire plan as an "on call" target, rather than a scheduled target. The FIST chief could adjust this target upon reaching the objective.

9. Synchronize your watch with the team commander's and the FDC's.

10. Know at all times exactly what fire support resources are available.

11. Know, practice, and anticipate modifications to FIST fire plans. Should something go wrong during the attack, what do you and the FDC do? Some techniques are:

"Modify fire plan . . .

a. Dwell on target 7860, continuous fire, restart at + 10," or

b. Cancel target 7845," or

c. Add (subtract) ___ minutes to (from) all timings," or

d. Amend to read target 7860 plus 8 to plus 10 Smoke."

13. Don't make promises to the team commander that you cannot keep! Know artillery limitations!

14. Use your mortar and tank white phosphorous (WP) when possible. An 81-mm WP round is very effective, and tanks carry five to six WP rounds. Tank WP is useful for marking targets for airstrikes.

15. Remember the principles of any form of fire planning.

- Simplicity.
- Cooperation (with maneuver).
- Concentration of fires (not piecemeal fires).
- Flexibility. (Be ready for modifications and have something up your sleeve before things go wrong—as they probably will!)

The maneuver commander first orients the FIST chief (student) as to the ground over which the hasty attack will take place and then rapidly explains the scheme of maneuver. Infantry or armored methods of target identification should be used; common artillery terms should be avoided. Diagrams may be used, but the maneuver commander has very little time to brief the FIST chief and consequently must be concise and direct.

Team commander: "Thanks, FIST chief. That immediate suppression on target 2802 was excellent. We lost one APC, but we would have lost more without your help. We have a sticky problem. There is a platoon dug in on the hill west of the crossroads . . . Target AB 2801. It appears to have some ATGMs. We have to secure the hill before we can move on. The hill is my objective. It's now 0900 and we will secure the hill by 0945 with a hasty attack. Here is my plan: Time of attack 0930; I have three targets for you. . . ."

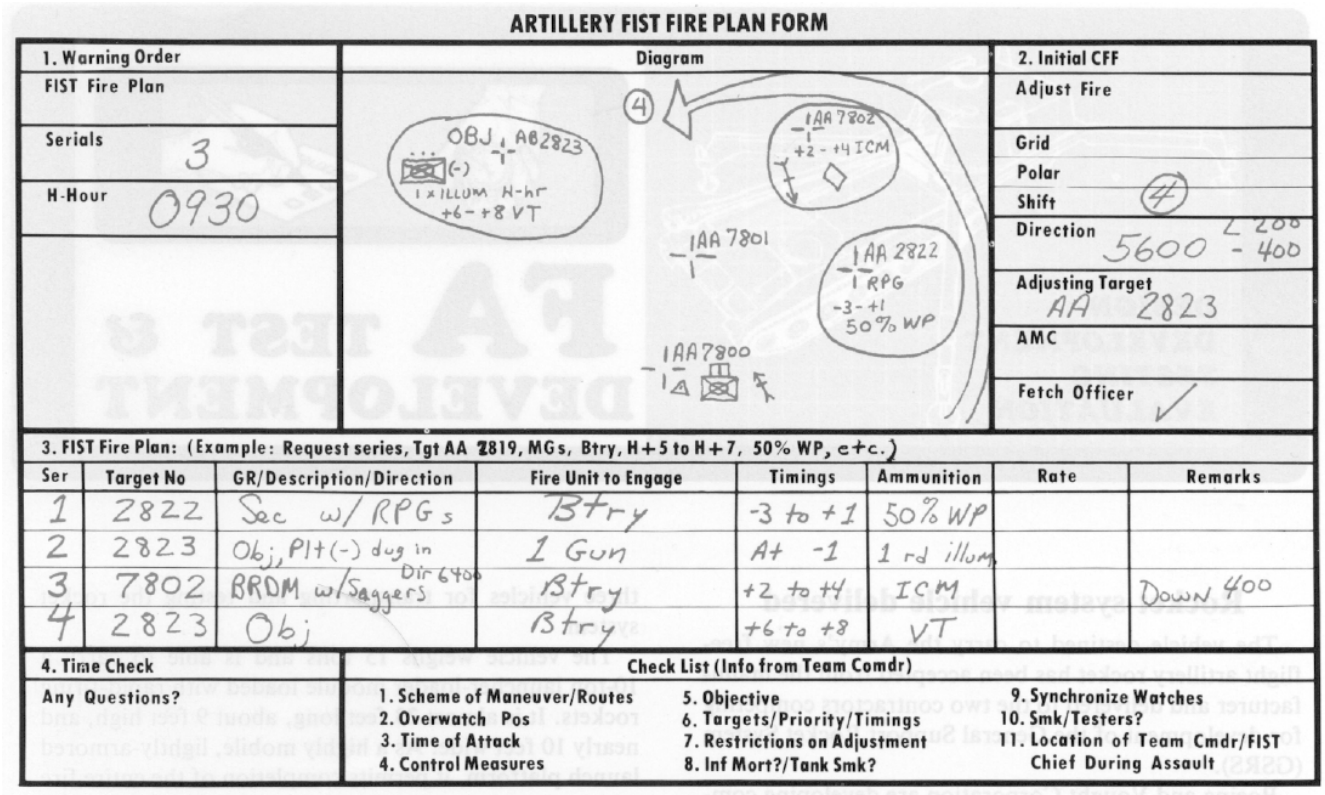
FIST chief: "Excuse me, sir, I'll call the objective target 2823. I'll get my RTO adjusting on it now."

FIST chief (to RTO or convenient FO): "Adjust the battery onto the objective. Use target number 2823. Send a warning order to the FSO and FDC. 'FIST fire plan, three serials, H-hour 0930'."

Team commander: "Here is my plan. The overwatch position is here. We'll start from here and maneuver to the right flank. I want an airstrike at H-hour on the objective. Make sure you mark the objective—I don't trust those fly boys—use an illum round on the ground; it lasts longer than WP, doesn't obscure the target, and will help orient my track commanders. I want all you have on the objective at 0936 hours, for two minutes, I want your fires *on target*, Lieutenant!"

The team commander continues to indicate to the FIST chief the remaining targets in his plan. They agree on target numbers, the timing of the series, and any particular shell/fuze combinations desired. To assist the FIST chief in coordinating with the team commander, a checklist and room for a diagram are provided on the FIST fire planning form.

Do not confuse priority of target with artillery priority target (immediate suppression). The team commander indicates which targets are most critical to his



ARTILLERY FIST FIRE PLAN FORM

1. Warning Order
FIST Fire Plan
Serials 3
H-Hour 0930

Diagram

2. Initial CFF
Adjust Fire
Grid
Polar
Shift 4
Direction 5600 L 200 - 400
Adjusting Target AA 2823
AMC
Fetch Officer ✓

3. FIST Fire Plan: (Example: Request series, Tgt AA 2819, MGs, Btry, H+5 to H+7, 50% WP, c+c.)

Ser	Target No	GR/Description/Direction	Fire Unit to Engage	Timings	Ammunition	Rate	Remarks
1	2822	Sec w/ RPGs	Btry	-3 to +1	50% WP		
2	2823	Obj, Plt(-) dug in	1 Gun	At -1	1 rd illum		
3	7802	BRDM w/Saggers Dir 6400	Btry	+2 to +4	ICM		Down 400
4	2823	Obj	Btry	+6 to +8	VT		

4. Time Check
Any Questions?

Check List (Info from Team Comdr)

1. Scheme of Maneuver/Routes
2. Overwatch Pos
3. Time of Attack
4. Control Measures
5. Objective
6. Targets/Priority/Timings
7. Restrictions on Adjustment
8. Inf Mort?/Tank Smk?
9. Synchronize Watches
10. Smk/Testers?
11. Location of Team Cmdr/FIST Chief During Assault

Figure 1. Sample artillery FIST fire planning form.

scheme of maneuver. All targets are to be engaged in series but, because of priority, the FIST chief may be required to spend more time and use greater care in adjusting targets of priority. The time must also be coordinated; the team attacks on the team commander's time—not the time displayed on the FDC clock! The FIST chief must determine whether he will accompany the assault. Perhaps he should consider leaving an FO to "anchor" the OP while he accompanies the team commander.

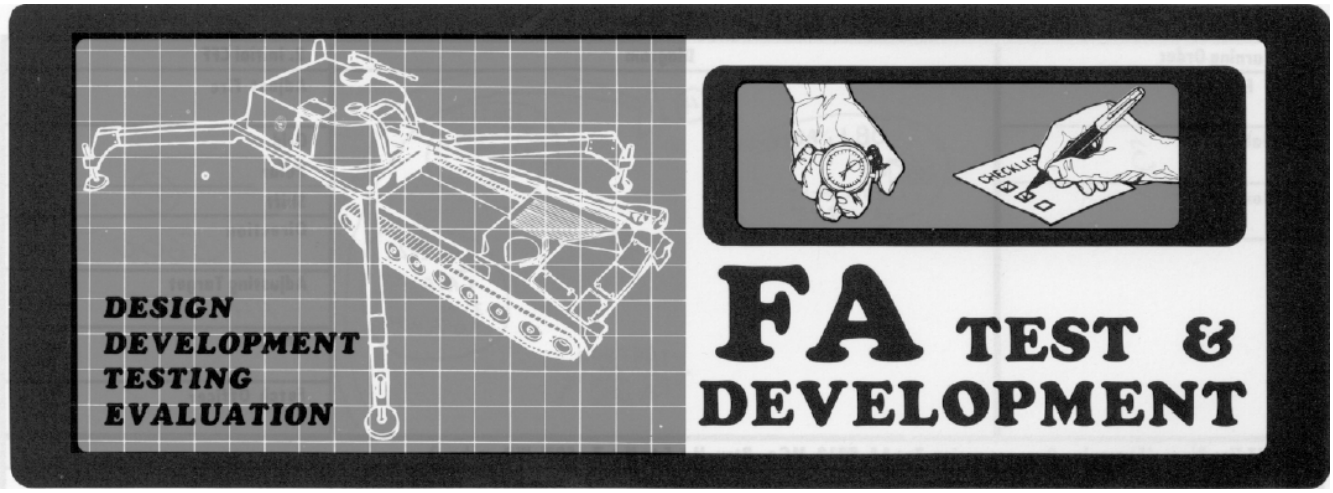
The briefing is over. The FIST chief decides on an adjustment plan; i.e., who adjusts each target with which guns. He may have time to task his FOs, but in most cases he will be required to adjust targets himself. He should transmit data from any line on the form as soon as possible to the FDO.

The call should be made by the FIST chief himself directly to the FDO (hence, the Canadian term "fetch officer" or "get the FDO") to minimize confusion and save time. This "fetch officer" procedure contradicts US Army communications procedures, but it has been the experience of British, Canadian, and Australian artillery fire planners at the company team level that the procedure of talking directly to the officer in the FDC is the most expedient, and often the only method of communicating concepts.

The FSO should monitor this FIST fire plan and may be able to provide additional advice or fire support. The 30-minute time criterion limits FSO participation. It is the FIST chief's show, as well as the team commander's, at least until the "platoon" turns out to be a heavy company and the maneuver battalion commander takes over to launch a battalion hasty attack. The FSO should be coordinating this possibility with the battalion commander.

The adjustment is complete, ammunition has been prepared, and the FDC reports to the FIST chief, "Ready on FIST fire plan." The FIST chief now can report to the team commander with confidence, "Sir, your fires will be 'on target, on time'. . . . We're ready."

Captain J. C. Stewart is a Canadian artilleryman assigned to the Gunnery Department, USAFAS.

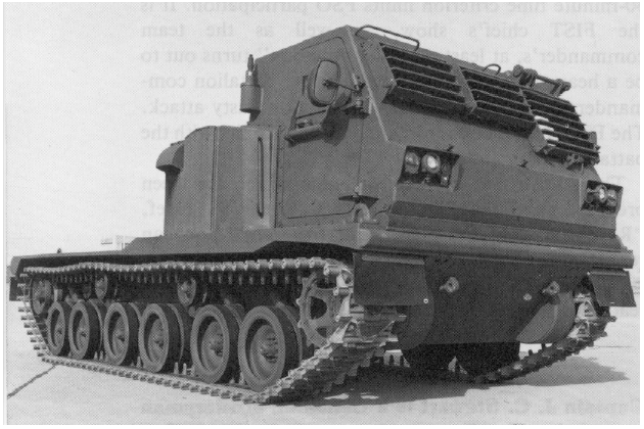


Rocket system vehicle delivered

The vehicle destined to carry the Army's new free-flight artillery rocket has been accepted from the manufacturer and delivered to the two contractors competing for development of the General Support Rocket System (GSRS).

Boeing and Vought Corporation are developing competing GSRS designs with the Army providing the vehicles on which the systems will be mounted. The tracked carrier, a modified Infantry Fighting Vehicle, is manufactured by the FMC Corporation of California.

Precise timing is essential in the accelerated GSRS development program and the Army delivered the carrier vehicles on schedule. Each company will receive three vehicles for transporting and testing the rocket system.



The General Support Rocket System carrier.

The vehicle weighs 15 tons and is able to carry a 10-ton launcher-loader module loaded with rapid-firing rockets. It is almost 23 feet long, about 9 feet high, and nearly 10 feet wide. As a highly mobile, lightly-armored launch platform, it permits completion of the entire fire mission from the cab interior.

Following a test and evaluation program, the Army will select a single contractor in the spring of 1980 to continue system development and begin production.

M735 fuze to enter production

The Army's Harry Diamond Laboratories has completed development of the M735 proximity fuze designed for the new 8-inch artillery nuclear projectile.

Characteristics of this system include in-flight safety, high invulnerability to any known electronic countermeasure, an accurate height-of-burst function, and a fail-safe capability.

The M735 fuze incorporates the latest technology to assure:

• Ground safety since the fuze is designed with a removable nose section containing the power supply and the electronic programmable timer.

• In-flight safety since two of the three independent electrical timers must function in coincidence (a two-out-of-three logic) before electrical arming can occur.

• High reliability since the fuze has a dual-channel, ground-proximity sensor system.

Production of this addition to the Army's arsenal will start this year at Motorola's Government Electronics Division.

M198 accident

Failure to follow prescribed misfire procedures resulted in a recent accident involving the M198 155-mm towed howitzer.

During firing using the M549A1 rocket-assisted projectile with the M203 propelling charge, a misfire occurred in a hot tube. The thermal warning device was in the yellow, indicating a temperature of about 325 degrees.

The primer had not fired (attributed to a broken firing pin). The breech was never opened and the propelling charge never removed. The on-site personnel called an explosive ordnance disposal unit to remove the projectile from the howitzer. Instead of opening the breech, removing the propelling charge, and attempting to remove the projectile, a decision was made to shoot it down range—several hours after the misfire has occurred. That decision resulted in a low order explosion inside the tube that ripped the breechblock off and threw it about 100 meters to the rear of the howitzer. Fortunately, there were only two minor injuries.

Apparently the TNT inside the projectile had liquefied and leaked from the projectile around the fuze well. Some of the components of the propelling charge had also melted or changed composition. Possibly the projectile had also been seized by the cooling, contracting tube.

Misfire procedures call for removal of the projectile after a misfire—if it cannot be fired within five minutes of being chambered. No attempt should be made to fire a chambered projectile in a hot tube if it cannot be fired within the prescribed five-minute period.

Procedures governing actions to be taken in the event of a misfire are being revised to insure that all procedures are clearly understood.

Copperhead venom strikes deadly blow during SECDEF shoot

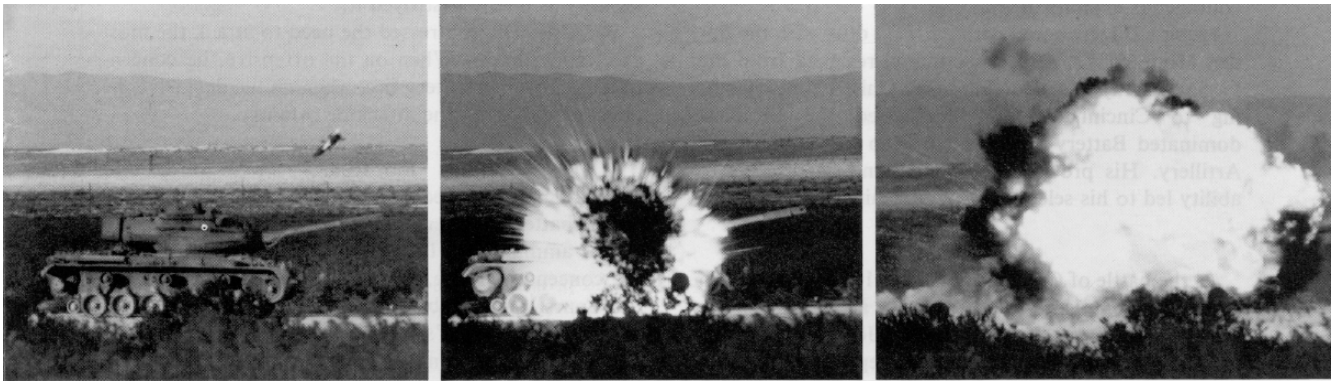
The Field Artillery's laser guided projectile, the 155-mm Copperhead, lived up to its namesake's deadly reputation by blasting apart two tanks during a demonstration of precision guided munitions at White Sands Missile Range. Attending the demonstration were Secretary of Defense Harold Brown and a large contingent of news media representatives.

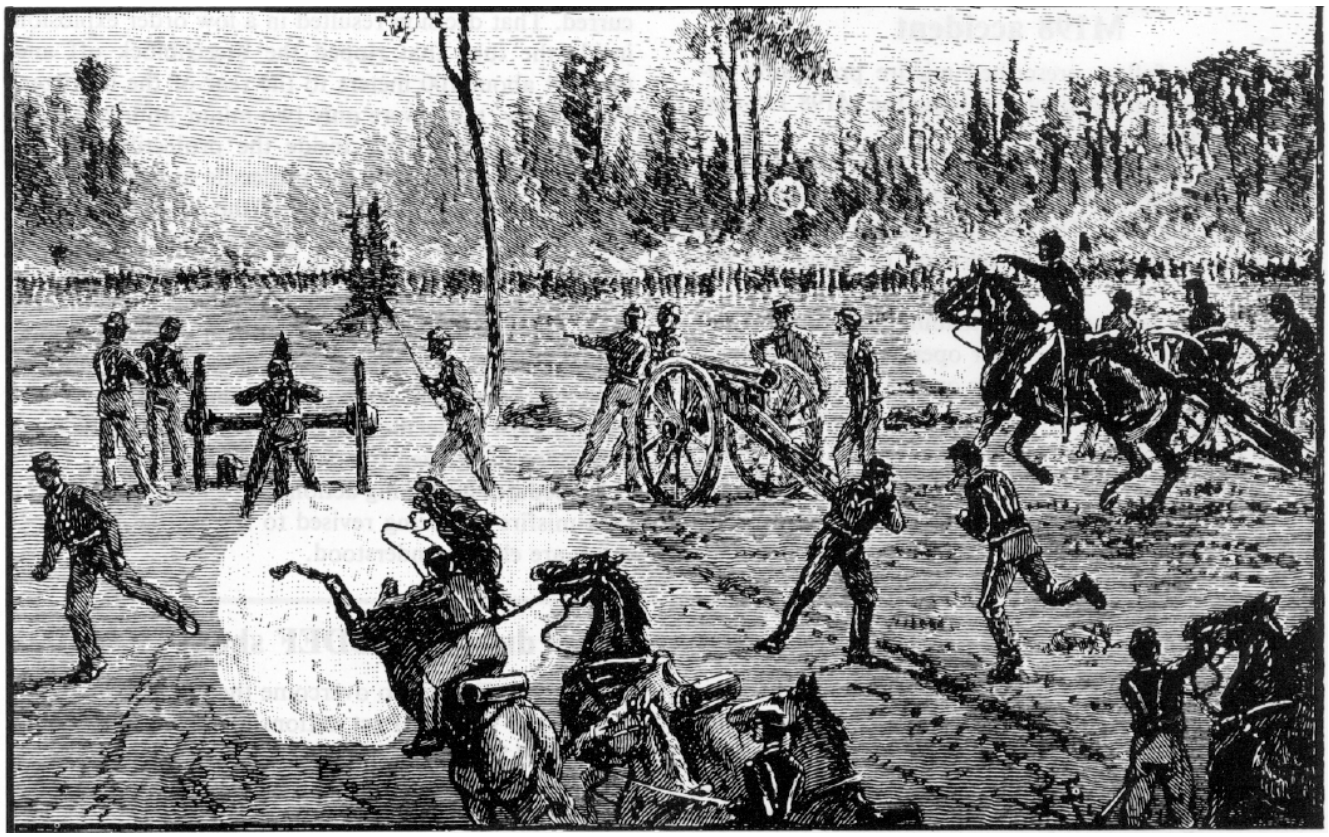
Both rounds contained high explosive instead of the telemetry package normally used in test firings. One round was guided to a remotely-controlled tank moving about 20 kilometers per hour, the first high explosive Copperhead round fired at a moving target.

The Copperhead firing was part of an Army/Air Force demonstration of several types of precision guided munitions being developed to shift the balance of power in Europe to overcome the numerical advantage of the Warsaw Pact nations. These munitions are considered "force multipliers" to enhance the firepower and effectiveness of conventional weapons.

Since August 1978 the Copperhead test program has had a remarkable string of 17 out of 20 completely successful firings, 11 of which were against moving targets.

The next major milestone for Copperhead is the operational test at Fort Carson in April and May 1979 when troops of the 1st Battalion, 19th Field Artillery, will fire more than 70 Copperhead rounds against remotely-controlled moving tanks. The final 10 rounds will contain live warheads which should destroy the clanking, lumbering iron monsters, turning them into silent smoking hulks of useless armor. The production decision will be made by the Secretary of Defense in August 1979.





The 1st Ohio Battery performed brilliantly throughout the war.

Dilger—Artilleryman of note

by COL (Ret) Robert M. Stegmaier

The name "Dilger" may not be familiar to most present-day soldiers; but, for soldiers of the Civil War, the name represented some of the most brilliant and courageous exploits of that era.

Hubert Dilger, bored with garrison duty with the Baden Mounted Artillery in Germany, resigned from the German Army to seek action in the United States. Coming to Cincinnati, OH, he joined the German-dominated Battery I of the 1st Ohio Volunteer Light Artillery. His previous experience and his leadership ability led to his selection as its captain.

Cross Keys

At the battle of Cross Keys, 8 June 1862, the 1st Ohio received its baptism of fire. In heavy action, it steadily held its position in the line. General John C. Fremont, in command during that encounter, reported: "A Louisiana regiment of Taylor's brigade, undertaking to charge upon Dilger's battery, was received with a fire of canister and grape, delivered with such precision and rapidity as nearly destroyed it."

In battle, Dilger stressed the need to attack the most profitable targets. When on the offensive, he concentrated on counterbattery fire; when on the defensive, he directed all fire on the attacking infantry.

Bull Run

At the battle of Second Bull Run, after three of the Union batteries either had been destroyed or had run out of ammunition, Dilger's battery arrived to receive the concentrated fire from 10 Confederate guns. For two hours, the lone battery slugged it out against formidable odds. Dilger's guns scored a hit on an ammunition dump, silencing most of the opposing guns. On the

lowing day, General Franz Sigel, facing a major Confederate attack, ordered a retrograde movement. Dilger volunteered his battery to cover the retreat.

Henry I. Kurtz, in an article suggesting that Dilger's battery was the best artillery unit in the Federal Army, described the action as follows: "With the Union columns streaming to the rear, Dilger raked the advancing Confederates with shell and case shot. One of his guns was knocked out; a second had a weakened gun carriage and couldn't be fired. Still he kept on, switching to double charges of canister as the enemy lines grew closer. When the Rebels were almost on top of him, the unperturbed German calmly pulled back 100 yards and resumed firing. This was too much for the Confederates; they withdrew out of range. His mission completed, Dilger limbered up and defiantly trotted off the field as if on parade."

Chancellorsville

Dilger's most outstanding success was in the battle of Chancellorsville. While on reconnaissance, he observed Stonewall Jackson's advance guard threatening the Union right flank. Narrowly escaping capture, he reported the fact to corps headquarters but was rebuffed because the observed maneuver was considered impossible. Dilger's division commander, Carl Schurz, believed the report and stationed Dilger's battery to face the threat until sufficient infantry could be emplaced.

Down the highway moved Jackson's men—25,000 strong.

Two batteries joined Dilger's battery to try to stop the onrush. One battery was overrun, and the other battery had used all its ammunition, leaving only Dilger's battery. He had six guns ready. One gun was immobile because its horses had been killed. He ordered the other five guns to pull back, but he stayed with the crew firing the forward gun until the enemy was almost upon them. As he mounted, his horse was shot from under him, but one of his men rode back to save him.

Supported by the Ohio Battery's five remaining guns, Union infantry formed a hasty line of defense, but they could not hold long. Dilger now adopted a leapfrogging tactic and sent four guns 100 yards to the rear. With one exposed gun forward, he met every Confederate advance. When the enemy filtered through the woods, he withdrew the forward gun to join the others and resumed firing. The Confederate's headlong attack was slowed, and infantry reinforcements finally arrived in sufficient strength to stem Jackson's attack. Artillery had played a major role in preventing the turning of the Union flank. Confederate COL Jennings C. Wise described Dilger's actions as "an example of almost superhuman courage and energy."

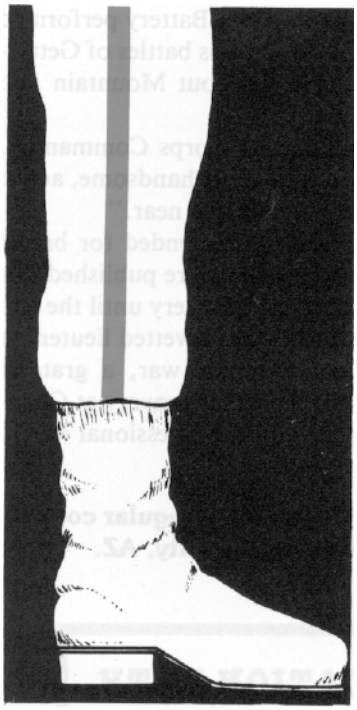
Throughout the war, the 1st Ohio Battery performed brilliantly, participating in the famous battles of Gettysburg, Missionary Ridge, and Lookout Mountain and the march through Georgia.

General O. O. Howard, the XI Corps Commander, described Dilger as ". . . one of those handsome, active young men that everybody liked to be near."

Although Dilger was twice recommended for brevet promotion, no implementing orders were published. He continued to serve as Captain of I Battery until the end of the war. In 1865, he finally was brevetted lieutenant colonel. In 1893, 28 years after the war, a grateful United States officially recognized his bravery at Chancellorsville by presenting him the Congressional Medal of Honor.

COL (Ret) Robert M. Stegmaier, a regular contributor to the *Journal*, lives in Sun City, AZ.

Redleg Review



THE US WAR MACHINE, Crown Publishers Inc., New York, 1978, 272 pages, $17.95.

The US War Machine is a master work encompassing the entire United States military might in one volume.

This book is a compilation of the organization, materiel, and people that make up the American war machine. The contributors, noted authorities in their fields, cover all four services, Active and Reserve. General (Ret) Richard G. Stilwell provides his typically "from the shoulder" evaluation of America's war potential in the book's foreword.

The text not only provides the facts and figures, but also provides an analysis and comparison with possible adversaries so often missing from such military encyclopedia. More than 600 maps, technical drawings, and photographs (most in color) accompany the 150,000 words of text and data. The inclusion of *all* the US military might into one volume impresses upon the reader how truly powerful the US is. With its sheer mass of information, one would expect the data to be dated, but the latest information on the M198 howitzer and the General Support Rocket System are included.

The US War Machine is a significant addition to the range of publications dealing with international military affairs.—Ed.

AIRBORNE AT WAR, by Napier Crookenden, Charles Scribner's Sons, New York, 1978, 144 pages, $14.95.

Airborne operations in Normandy and Arnhem have been well covered in books and films, so the author has taken five lesser known operations for *Airborne at War.* He looks at these World War II airborne operations, not to examine outdated techniques, but to see what sort of spirit the airborne assault developed in its soldiers and to compare the operations of the three nations who used airborne forces most often and effectively—Germany, Great Britain, and the United States.

The capture of the fort at Eben Emael by German parachute engineers in gliders startled the world in May 1940 and set the pattern for many subsequent glider assaults by both sides. The German Sturm regiment's attack on Maleme airfield on Crete was a triumph for German airborne troops, but it marked the death of their hopes for continued assault from the air. On 20 July 1941 following the Maleme assault, General Student (father of German airborne forces) reported to Adolf Hitler and was shocked to hear him say the days of parachute troops were over. Hitler had been appalled by the losses in Crete, where the Germans had lost more men on the first day than in the whole war to that date. The Germans were never again to use airborne assault as a method of strategic or tactical attack. In the same month generals in the US and Great Britain began to form the massive airborne forces which were to fight in North Africa, Sicily, Normandy and Holland and over the Rhine.

As the war was ending in Europe, on the other side of the world, the United States' recapture of Corregidor demonstrated how the bold and unorthodox use of airborne troops solved a difficult problem and actually saved many lives.

Finally, the author describes the use of the XVIII Airborne Corps in Operation Varsity, the largest aerial armada ever seen, as two complete airborne divisions were landed within 2½ hours using one lift.

The author continually alludes to the training, discipline, initiative, poise, and confidence of the airborne trooper. He talks specifically of the confidence that each man has in the other. Just as an airplane or a fighting ship reflects the spirit of those who man them, so does the individual trooper reflect the spirit of the airborne. This book is refreshing at a time when berets and distinctive uniform items are in question and at a time when many of the intangibles that go into the making of a good unit have been jettisoned in favor of expediency. We seem to have rejected the idea of elite units or distinctive units in our army. The early parachute units were elite organizations, difficult to join, and easy to leave. Today, countless young people would join units they consider elite, but want no part of the "run of the mill" general purpose Army. The homogenization process which will produce a million soldiers, each looking superficially like the other, is at cross purposes with the sense of identity a volunteer trooper should feel for his chosen profession.

The numerous excellent photographs in the book keep it alive and meaningful. The *Airborne at War* text is interesting and worthwhile and can be read in one sitting.

LTC Richard K. Holaday, IN, is a master parachutist and Chief of the Combined Arms Division, Tactics and Combined Arms Department, USAFAS.

TANKS AND FIGHTING VEHICLES, by Christopher F. Foss, Salamander Books, London, 1977, 248 pages, & 5.95.

Officially titled *The Illustrated Encyclopedia of the World's Tanks and Fighting Vehicles; A technical directory of major combat vehicles from World War I to the present day,* this book is a

study of the group of vehicles usually referred to generically as "tracked vehicles." The official title is almost a complete review in itself.

The attraction tanks hold among average people is due to the massive power sensed by the mere presence of these loud behemoths of destruction. This is carried through in this book by the heavy reliance on excellent pictures and drawings (many in full color) of the land combat vehicles produced since the middle of World War I. The text is limited in quantity and size (the six-point type is very difficult to read). Standard specifications are listed, accompanied by approximately 300 words on the design of the weapon. No attempt is made to analyze the weapons' impact on doctrine or tactics. There are a very few wheeled armored vehicles catalogued. The vast majority are track layers serving all purposes (personnel carriers, scouts, command vehicles, assault guns, antitank, air defense, field artillery, and light, medium and heavy tanks) and carrying all sorts of armament.

Vehicles are grouped by nation of manufacture. Two unfortunate omissions from the book are the new Soviet 122-mm and 152-mm self-propelled howitzers. *Tanks* is a handsome book, but it attempts to cover too large a range of equipment in one volume.—Ed.

FIELD ARTILLERY BATTALIONS OF THE U.S. ARMY (Volume II), by James Sawicki, Centaur Publications, Dumfries, VA, 1978, 1,281 pages, $24.95 (two-volume set, $34.95).

What is the highest regimental number ever assigned to a Field Artillery unit?

Do you know the difference between the Dexter chief and the Fess point in heraldric shield design?

Do you know which caliber(s) each FA regiment has had since 1921?

How many FA battalions (Active and Reserve) were in the Army in any year from 1940 to 1958?

To answer any of these questions (or about any other question related to our proud branch history), all you need is Mr. Sawicki's book. Volume I was reviewed in the November-December 1977 *FA Journal*, and Volume II completes this monumental and valuable research and compilation effort.

You're lucky if you've waited till now to buy the first volume, as the publisher (Box 188, Dumfries, VA 22026) is offering the two-volume set at $34.95, a 30 percent savings over the one-book-at-a-time price.

Volume II is constructed similar to Volume I in its listing of battalion/regimental crests, honors, and lineages. The second volume begins with the 400th Armored Field Artillery Battalion and carries through to the 1136th Field Artillery Battalion—the answer to question one at the beginning of this review. In addition, several valuable appendixes (with some excellent vintage photographs) are in this volume which were not in Volume I.

If you don't buy it, you certainly ought to visit your post library and spend an hour or two with it.—Ed.

SOLDIERS AND SOCIETY: THE EFFECTS OF MILITARY SERVICE AND WAR ON AMERICAN LIFE, by Peter Karsten, Greenwood Press, Westport, CN, 1978, 339 pages, $22.50.

Much has been written lately concerning the influence of the military-industrial complex on American society. The effects that war may have had on the individual American have not been so closely examined, and that is the purpose toward which Peter Karsten directed his efforts in *Soldiers and Society.* He attempts to synthesize existing studies, most of which are too narrow or too outdated, and to assay the historical record.

In view of recent revisionist tendencies in historical writing, the reader may well approach *Soldiers and Society* with some trepidation. Surprisingly, Karsten does not adhere to fad or trend and attempts to remain objective throughout the book.

The introductory essay is clear, logical, and eminently readable. Less clear is the arrangement and selection of the source material which makes up 90 percent of the book; and, unless one has bibliographical tendencies, it is difficult to validate the sources. Finally, Karsten asserts rightly that, while the sources are not definitive, they are at least illustrative. All who are interested in the interaction between the society and the American military will enjoy reading *Soldiers and Society.*

LTC David L. Miller Jr. is the Chief of the Command and Staff Branch, Tactics and Combined Arms Department, USA-FAS.

DEADLY MAGIC, by Edward Van Der Roehr, Charles Scribner's Sons, New York, 1978, 225 pages, $9.95.

Shortly before World War II, American intelligence had broken Japanese diplomatic and military codes. This was not discovered by the Japanese, and their top secret messages were read throughout the war. The intelligence operation, in which communications were intercepted and translated, was given the code name "Magic." In his book *Deadly Magic*, Mr. Van Der Roehr tells of his service with the "Magic" intelligence group and how the information they acquired was used in the war against Japan. He leaves no doubt that this secret operation was an indispensable part of US victory in the Pacific.

Mr. Van Der Roehr is careful to explain that the function of intelligence is to provide information, not to decide its use. Consequently, he tells of intelligence triumphs—the Battle of Midway and the assassination of Admiral Yamamoto—as well as the frustrations; e.g., when an American admiral disregarded intelligence, attacked a decoy, and allowed a Japanese fleet to escape.

The book is fascinating to read and gives well deserved credit to US codebreakers for their part in winning the war. A history of WW II would not be complete without this story.

COL Warren E. Norman is the senior USAF Representative at Fort Sill.

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Charles Scribner's Sons
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