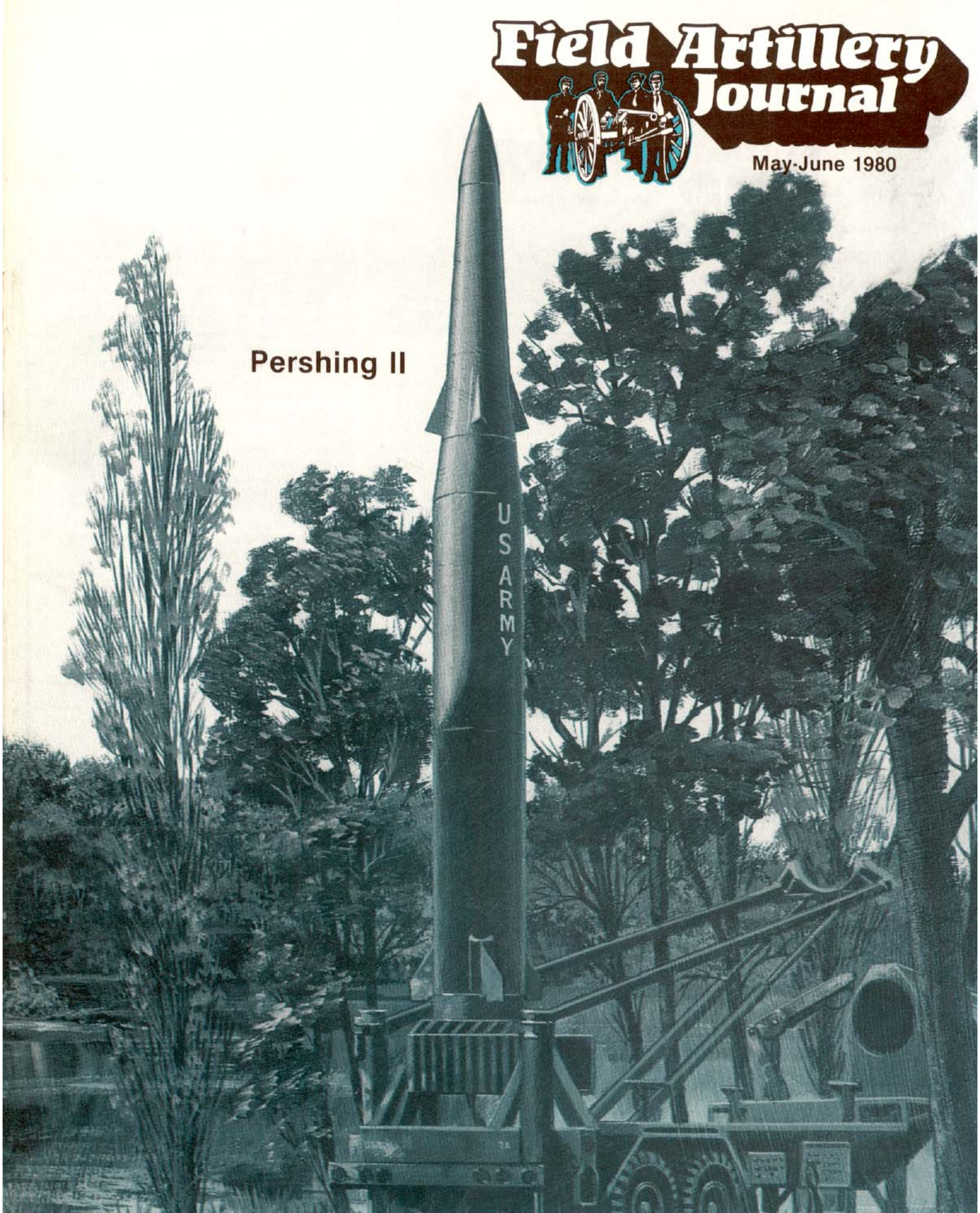
Field Artillery Journal

May-June 1980

Pershing II



Field Artillery Journal

the journal of fire support

Volume 48 **May-June 1980** **Number 3**

ARTICLES

FEATURES

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PURPOSE (as 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."*

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On the Move

by MG Jack N. Merritt

Included among the charges placed on the Commandant, US Army Field Artillery School, is an expected obligation to uphold the "unofficial" title of Chief Spokesman for the Field Artillery. In this capacity, I have, in past issues of the *Journal* and other media, voiced our requirements for improved hardware, training, and personnel management.

Aside from fulfilling those needs which are vital to the continued success of our branch, I think that, as a "community among communities," it is equally essential to our well-being that artillerymen worldwide maintain and strengthen close personal and professional ties. Accordingly, I have asked several individuals to undertake a revitalization of the Field Artillery Association (FAA), the objectives of which were established some 70 years ago.

Background

On 7 June 1910, the Field Artillery Association was created with the following objectives:

"The objects of the Association shall be the promotion of the efficiency of the Field Artillery by maintaining its best traditions; the publishing of 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."

Headquartered in Washington, DC, the Association prospered throughout the next 40 years and, during that time, attained a high of 19,000 in active membership. In 1950, however, the Field Artillery and Infantry Associations joined together to form the Association of the United States Army (AUSA). This new organization's purpose was to support the interests of *all* combat forces of the Army rather than promotion of two or three separate branches.

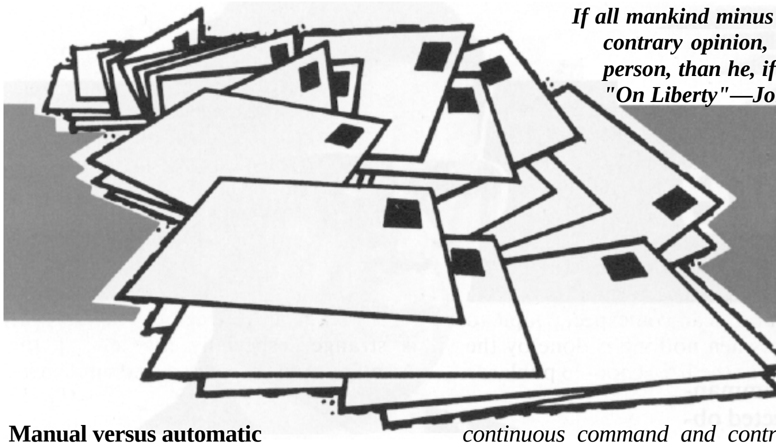
Although AUSA has proven far more effective in accomplishing this objective than perhaps initially envisioned, our particular need continued to exist, as it did in 1910, for an organization to promote and support the Field Artillery. As a result, on 17 November 1974, the Field Artillery Historical Association was established at Fort Sill, which in 1977 became the Field Artillery Association as we know it today.

New directions

During the past three years the FAA has experienced a substantial growth in membership, increasing from 500 members in 1977 to approximately 2,300 currently on our rolls—and this is commendable. With these recent gains then, we *now* have an opportunity and foundation to once again achieve professional stature and national prominence previously held by the Association. I believe the time is right to aggressively set to work to reach this objective. With implementation of a few new directions and dynamic ideas, I'm convinced we can succeed.

As a first step in this revitalization effort, an initial Executive Council has been apointed which includes both active and retired members. This Council will focus their many years of varied experiences and invaluable knowledge on viable programs which an executive director at Fort Sill will then put into effect. Additionally, a constitution and bylaws are being developed to establish the FAA as a separate organization rather than an activity of the Field Artillery Museum Association as it is now. As a third step, plans are now being made to hold a general membership meeting at Fort Sill this fall when an Executive Council will be *elected* and programs adopted for the coming year.

In the meantime, I urge all artillerymen to close ranks and support the FAA so that we together can see the success of this important effort to fruition. By so doing, the Association will better be able to serve the Field Artillery as it meets current and future challenges of this new decade.



If all mankind minus one, were of one opinion, and only one person were of the contrary opinion, mankind would be no more justified in silencing that one person, than he, if he had the power, would be justified in silencing mankind. "On Liberty"—John Stuart Mill

Incoming

letters to the editor

Manual versus automatic

I've been wanting to write to the *Journal* for years to set you straight on one subject. I was chief computer for a 155-mm SP howitzer unit (1-10th FA, 3d Inf Div) in Germany for 29 months during which time my battalion never had two FADACs working at one time (usually there were none). In fact in 1976 the 3d Infantry Division had 13 FADACs down for one reason or another.

Everytime I read an article in the *FA Journal* boasting about FADAC, TACFIRE, the Battery Computer System, or the hand-held calculator I laugh! I doubt very much that this equipment has been tested for being GI-proof. A word to the wise: Fort Sill—don't forget those manual procedures because that's the one thing that never breaks down!

Michael M. Manus
Indiana, PA

Thank you for your candid remarks. It is difficult to dispute the fact that manual procedures must be remembered. Unless one knows basic artillery, it is difficult to obtain and recognize the results desired from a computer.

It must be understood however that manual methods of fire support planning and coordination and technical and tactical fire control will be inadequate on the battlefield of the future. TACFIRE and BCS provide the means to transmit, receive targeting information, allocate firepower, compute ballistic firing data, and send fire orders in a matter of seconds. Continuous support of the combined arms operations demands a high degree of reliability from the fire support command and control system. These systems enhance this reliability because they are easily maintained at organizational level. In fact the operator is the organizational maintenance man. This simple maintenance concept, coupled with the ability of one computer to perform its own functions as well as those of another system during mutual support operations, insures continuous command and control for the fire support system and operational continuity. These systems can operate even if some of their peripheral components are down for maintenance. The advantages gained with TACFIRE and BCS are required to provide the command and control system that will meet the challenge of modern combat.—Ed.

Fire direction center and FADAC

As I leave the Gunnery Department, USAFAS, I feel I must share these thoughts with Redlegs worldwide.

Field Artillerymen must be prepared to provide accurate and timely indirect fire when and wherever the maneuver commander desires. Currently, the primary means of computing technical firing data is the Field Artillery Digital Automatic Computer (FADAC).

Many artillerymen will say that this system is outdated, the technology is obsolete, and FADAC is worn out. I will agree that our current technology is capable of producing something better than FADAC, but that something better is not here as of this writing.

Waiting in the wings are TACFIRE and the Battery Computer System (BCS). Both should be great assets to the FA, but what do we do until such time as fielding occurs? The solution is simple, but not everybody wants to hear it. Until TACFIRE and BCS are fielded, "Everything possible must be done to keep FADAC alive and well." Unfortunately, during the past several years, there has been a growing tendency to gradually let FADAC suffocate from lack of support. Statements such as "TACFIRE is coming soon and FADAC will no longer be needed," or "We don't need FADAC because it is dying," have placed the FA in a precarious position in the FDC.

Contrary to popular opinion, spare parts for FADAC are available with few exceptions, the majority of those being memory discs which are a rebuild item. A major problem with FADAC maintenance is the paucity of qualified FADAC repairmen in the system. This is true at the unit level (MOS 31V10F7), primarily because of malassignment, and at the DS/GS level (MOS 34G) because not enough personnel are being trained to meet the demand. Expertise in MOS 34G is also being lost due to the limited grade structure.

It is obvious that much of the criticism that has been attributed to FADAC has been general in nature and lacking in substance. It is imperative that FADAC be utilized and maintained to insure that the FA performs at peak efficiency.

The future of FADAC depends on the correction of some common misperceptions and sensitizing everyone to the following problems/solutions.

- Insure that "positive command emphasis" is exercised.
- Be a believer in FADAC and its capabilities.
- Establish contact with the field maintenance technician servicing your area.
- Do not be satisfied with mediocre support. Too many people have prematurely sounded the death knell for FADAC—make the system produce.
- Place FADAC on the list of reportable items for the Unit Readiness Report (at each installation having FADAC).
- Make certain that all 31V10F7 personnel assigned are in fact working in their MOS.

Currently the Programmable Hand-Held Calculator (PHHC) TI-59 is being issued to the field. The PHHC is a great tool to assist in the FDC; however, because of its limited capabilities it was never intended to replace FADAC.

If there are questions about FADAC, call the Gunnery Department, AV 639-3901/6108.

James W. Wurman
COL, FA
Commander
212th FA Group
Fort Sill, OK

What is Field Artillery?

I read with great interest "On the Move" in the March-April 1980 issue of *Field Artillery Journal*. Major General Merritt makes a valid point in stressing accession problems; however, I think that the greatest blame can be placed on the Field Artillery School itself.

Exposure of cadets to the Field Artillery in most ROTC programs is at best a hurried affair that fails to eliminate confusion they might have about the FA branch. A one-day orientation is conducted where cadets have the chance to fire a 105-mm howitzer and then practice a call for fire. They are rushed through the FDC and taken on a brief tour of 155-mm and 8-inch howitzer systems. The whole ordeal is so rushed that the Artillery takes on a less-than-appealing appearance.

Several branches publish branch-related brochures that inform cadets what duties they might expect as a lieutenant in that branch. I saw no such publication from the Field Artillery, and the University that I attended (Xavier University, Cincinnati, Ohio) at one time produced nothing but Field Artillery lieutenants! When I wrote to the FA School asking if such a magazine existed, I received a reply that they would try to send me a copy of the *Journal*. While the *Journal* is a fine publication, I feel that it cannot serve as a branch-orientation magazine. As a result, when Artillery branched cadets are sent a copy of the *Journal,* more confusion results in their minds.

When I received word that I was branched Field Artillery, I had mixed emotions. It was my fourth choice out of five, and there was no information as to what I would be doing as an FA lieutenant. The terms, "FIST," "FDO," "AXO", and "FDC" were like a foreign language to me and I didn't know whether to respect or fear them.

I have been an FA lieutenant for almost a year now, and even though I received little or no branch orientation, even though it wasn't my first branch choice, and even though FA Branch at DA did relatively nothing to answer my questions concerning the Artillery, I firmly believe that I wouldn't be happy in any other branch. Whenever cadets ask me questions about the Army, I never hesitate to tell them that the Field Artillery is the place to be.

While word-of-mouth advertising is always the best kind, the Artillery cannot expect lieutenants to flock to them in droves if they don't advertise themselves. The FA School needs to start an effective branch-orientation program to help cadets make up their minds. Included in this program should be what assignments to expect, what installations they will go to, and what challenges lay ahead of them at FAOBC.

The Field Artilery can be one of the most rewarding assignments in the US Army, but how can you expect people to know that when nothing is done by the FA Branch or the FA School to publicize it?

Jerry E. Sullivan
2LT, FA
A Btry, 2-18th FA
Fort Sill, OK

There is now and has been in the past an active Field Artillery information/orientation program. Xavier University ROTC detachment is on the current USAFAS mailing list and has been forwarded material on Field Artillery, USAFAS, Field Artillery Officer Basic Course, and Fort Sill on a regular basis as well as letters informing them of what is available at USAFAS to publicize Field Artillery. USAFAS ROTC Advisor and POC is Mr. Art Farrington, (405) 351-2520 or AUTOVON 639-2520/4587. Address: Commandant, US Army Field Artillery School, ATTN: ATSF-CT-RC (Mr. Farrington), Fort Sill, OK 73593.—Ed.

Maneuver and fire support

The two most conspicuous elements of combat power used by a combined arms team are *maneuver* and *fire support.*

• Maneuver elements may include armor, infantry, mechanized infantry, airlifted, and attack helicopter units together with their organic personnel and equipment.

• Fire support weapons for the team may include mortars, field artillery, close air support (CAS) and, when available, naval gunfire (NGF). For some operations, a division commander may *supplement* his conventional fire support means with other weapon systems to include attack helicopters and/or air defense weapons firing indirect fires against surface targets. In short, the force commander uses what's available to get the job done.

In developing Army literature today, some authors tend to consider *fire support* as synonymous with only *field artillery* fires. Mortar fires are sometimes treated as non-fire support means while CAS is discussed under the "air land battle" rather than under fire support. Attack helicopter fires are seen as "maneuver" and exclusive of fire support.

This fragmentation of fire support into several areas is contrary to good team practices. All successful football teams may drill their backs, ends, and linemen separately and then bring them together as a team before a game. The same need exists for fire support.

The tendency to fragment fire support is strange, especially in view of the Army's recent acceptance and implementation of the fire support team (FIST) concept wherein mortar and field artillery observers are combined under the new enlisted MOS 13F. FISTs with companies (troops) are supervised by fire support officers (FSOs) operating at maneuver battalions and brigades. Lieutenants, serving as FIST chiefs, are trained to direct close air support aircraft if an Air Force forward air controller (FAC) is not available. The tendency to treat CAS separate from fire support is faulty when one considers how often air vehicles will have need for an outside fire support means to suppress enemy air defenses (SEAD) while they operate in the face of hostile air defenses.

A common misconception of fire support which often fosters fragmentation of fire support efforts is that it reacts to someone other than the supported maneuver commander. This is not true. While field artillerymen do serve as fire support coordinators (FSCOORDs) at all maneuver levels, company and higher, they do so under the guidance and priorities established by the supported commander. For example, an FA battalion in direct support (DS) of a brigade provides full-time FSCOORDs throughout the brigade. They insure that the total fire support effort is responsive, effective, safe, and within the priorities set by the maneuver force commander. If fire support is denied, changed, or substituted for, it's usually because a maneuver commander so desired—not because a FSCOORD overruled. Fire support should function for the supported commander.

If Army fire support is to be truly responsive and effective, it should not be fragmented with each fragment managed independently. It must be collectivized into a single team effort and under one manager. A supported maneuver commander (or his operations officer) must speak to *all* his fire support means through one individual—his fire support coordinator.

Charles W. Montgomery
LTC (Ret)
Lawton, OK

Battalion FDO

In CPT Gary B. Griffin's article, "Wanted: Battalion FDO!," (January-February 1980 *Journal*), he expressed his opinion that a study should be initiated to identify current officer TOE duty positions that could be deleted in favor of a formal TOE slot for a battalion FDO. Further he argued that the position of battalion ammunition officer was one that could be eliminated.

Recently, I spent nearly eight months as the 1st Battalion, 20th Field Artillery, Ammunition Officer. By TOE, the service battery is only authorized a battery commander and an ammunition officer with the battery commander doubling as the battalion S4. In essence, the majority of my work and time was devoted to duties required of a battery executive officer. Being the only lieutenant in the battery, I also had to do extra duties normally accomplished by several officers in a firing battery.

I admit that, when the battalion went downrange, there was little for the battalion ammunition officer to do since most of his work is done before and after the exercise. (I spent most of my time downrange working with the Nuclear Special Weapons Team.)

Should Captain Griffin's suggestion be put into practice, service batteries would be in trouble. There is no way that a service battery can function properly with only one officer. I am not disputing the need for a battalion FDO slot in the TOE, but eliminating the battalion ammunition officer position in favor of a battalion FDO would only alleviate one problem and create a new one!

Martin L. Vozzo
2LT, FA
C/1-20th FA
Fort Carson, CO

Qualified NCOs can direct fire

We read CPT Gary B. Griffin's article "Wanted: Battalion FDO!" (January-February 1980 *Journal*), with a great deal of anticipation, until we got to the second paragraph. First of all, Captain Giffin makes no reference at all to those E6s and E7s such as we who were not reclassified and *do* have more self-confidence than the many lieutenants and captains that *we* trained in Vietnam, Europe, and CONUS in the past 15 years.

A great deal of technical skill will, in many cases, result in self-confidence, and skill is just what we have in abundance plus experience under fire and a multitude of untapped leadership potential. Captain

Griffin also makes a great deal of the FDO accomplishments during OTEA TACFIRE II. Certainly there were enlisted men involved when the FDCs were "saturated" with missions. The description makes it seem as though successful completion of the mission would have been impossible had the FDO become disabled.

Many were the missions fired, in combat, successfully, under an NCO's guidance when the FDO had little or no knowledge of the computation, was asleep, or was not there at all. We had self-confidence then, we have it now, and unless we're run off by an unprogressive system we will have it in the future.

We suggest jointly that the position of the battalion FDO or fire direction *NCO* be filled by an E8 with the necessary skills or that a 13E type warrant position be created. Those E6s and E7s who qualify could fill these slots and then the position could be filled by an officer and appease Captain Griffin.

If it appears that we are bitter and damn proud NCOs, it's because we are.

Ronald C. Fainter, SFC
Patrick M. Kiernan, SFC
Charles M. Sutterfield, SFC
Readiness Group
Fort Riley, KS

Calibers

Again, I must compliment you on changing the "caliber" of the *Journal*. (Perhaps I'm stretching the use of that old artillery term "caliber.") You are changing the emphasis, giving more space to where we're headed—in doctrine and now in calibers.

The weapon we've chosen for our divisional artillery basically comes to mind. The January-February 1980 *Journal* provides an illustrated description of the Soviet choice—their 122-mm self-propelled howitzer, and on page 40 there is an illustration of the US choice—the 155-mm self-propelled M109A2 howitzer.

It behooves every Redleg to carefully evaluate these artillery weapons. Soviet doctrine anticipates highly mobile forces on a battlefield of great depth. They have therefore designed a weapon (the 122-mm SP howitzer) to support these forces with unusual performance characteristics:

1) It is amphibious (4.5 km per hour).
2) CBR protection is provided.
3) It has a high rate of fire (5 rpm sustained).
4) It is capable of both direct and indirect fire.
5) It can effect high-angle fire (elevation 70°).
6) It has a revolving turret mount (360°).
7) It is relatively lightweight (16 tons) and can be easily air-transported.
8) It has high mobility and long range without refueling.

These are vital performance specifications for close effective support of maneuver forces. We have opted for a 155-mm howitzer weighing 55,000 pounds as the divisional weapon in support of our maneuver forces. One of the principal arguments for this weapon as the basic divisional piece is that this size and weight is necessary to accommodate nuclear ammunition as well as "smart" rounds. To obtain this requirement, we have a weapon deficient in the first seven listed capabilities of the Russian howitzer, and yet these seven capabilities describe Field Artillery as we have always defined it.

Present plans apparently contemplate creation of a rapid deployment force—an added reason for us to consider whether a single caliber div arty can meet our future needs.

R. P. Shugg
BG (Ret), USA
Oakland, CA

Assistance needed

I am currently conducting research on the Elsenborn, Belgium, sector of the Battle of the Bulge and am seeking any information available on this battle from the *Field Artillery Journal* readership.

Since, the Field Artillery played a unique and critical role in the early days after the German attack in this sector, I would sincerely appreciate any first-hand information/remembrances from field artillerymen who might have participated in that important action.

Joseph C. Doherty
P.O. Box 14259
Benjamin Franklin Station
Washington, DC 20044

Credit

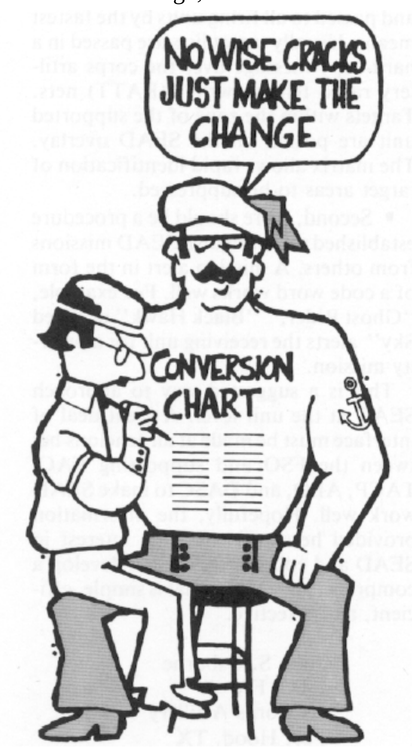
The article "New Concepts for Organizing and Managing Fire Support, 1986-2000" by COL (Ret) Robert S. Riley (January-February 1980 issue) contained some material extracted from a report written by Mr. James Campbell, General Research Corporation. Although Colonel Riley's original material contained appropriate footnotes to reflect proper credit, space constraints resulted in their deletion from the article.

Conversion correction

You almost had me thinking the Army was shaping up. I read the *Field Artillery Journal* (March-April 1980) and enjoyed it. It wasn't until the back cover that my earlier analysis of the Army was confirmed. Your equation for converting degrees fahrenheit to degrees celsius is incorrect. It should read "subtract 32, then multiply by 5/9."

Basically you have a pretty good rag. I especially enjoyed the article on Artillery Fired Atomic Projectiles by COL William E. Serchak. Keep up the good work.

William S. Perkins
Lt (jg) US Navy
San Diego, CA



Open letter to Dave

This is an open letter to LTC Dave Mooney concerning his article "Branch is NEVER Immaterial!" in our January-February 1980 issue.

You may notice, Dave, that I referred to OUR January-February 1980 issue. I look upon the *Journal* as your magazine and mine in the same manner that you do with respect to our branch. If we are to remain professional in arms, we must retain the pride and esprit de corps that are traditional in the Field Artillery. In fact, it is that pride and esprit de corps that helps in great part for us to attain and maintain that professionalism.

You and I, together with other Field Artillerymen who are no longer in the "Halls of Snow," heard all too often that same general officer remind us that "the future is now." He was as right in the early and middle 1970s as the saying is today. Every day is now, and that's when the future is. To remain a professional Field Artilleryman is to remain a professional soldier, and that's the charter of each of us whether in the Active or Reserve Components. If the balloon does go up, we will be judged in the fight by how well we do, not how we got there. I just hope the entire Field Artillery Community everywhere rises to your challenge.

Robert T. Fischer
COL, FA
US Property and Fiscal Office
Stout Field
Indianapolis, IN

MILPERCEN Team

I am pleased to see your update on the Field Artillery MILPERCEN Team which appeared in the November-December 1979 *FA Journal*. The photos, duty position titles, and AUTOVON phone numbers are information often sought by many in the field. Herewith, two suggested improvements or additions to this feature:

• First, why not publish the same information for our NCOs in FA career management fields (13, 15, 17, 82, etc.). As we move into a formalized NCO education and development system which parallels that for officers, the need for our NCOs to communicate with DA becomes greater.

• Second, I suggest inclusion of office symbols in all addresses listed. This information would be useful in speeding mail to and from MILPERCEN.

Thanks for periodically updating us on the MILPERCEN FA Team.

Leroy J. Buechele Jr.
CPT, FA
VII Corps Artillery
APO New York

*While doing the "spade work" for the FA officer MILPERCEN Team update, parallel coordination was accomplished with our "enlisted side of the house" with hope that the two layouts could be run in the same issue. To date the **Journal** has not received the required data and photographs.*

Office symbols were not published because of an impending reorganization at MILPERCEN.—Ed.

Simplicity is a virtue

I would like to wish you good luck and personal satisfaction in your assignment as editor of the *Journal*.

I was a product of OCS at Fort Sill in 1942 and wound up as battery exec of a 155-mm M1 howitzer firing battery in the European Theater of Operations in 1944-45. I'm a dedicated Redleg by choice, having enlisted in an FA outfit of the 30th Division in 1940.

I was recently flabbergasted by a TV program, wherein the new US Army tank XM1 was shown. I could not believe they cost $1.5 million each, with a turbine motor that I think is undependable; yet Chrysler got the contract over GM, whose tank was preferred by Army procurement for less money. This is putting too many eggs in one basket that can be effectively disabled by small, antitank weapons costing $20,000. Of course everything on the tank was electronic and computer controlled. This brings to mind a concern of mine about the Field Artillery. The ongoing trend is more and more electronic, complex methods in our branch. This is good up to a certain point and depends on artillerymen with the mental capacity to fully comprehend and use it properly and adjust and fix it under less than optimum conditions. I have my doubts that the all-volunteer system will provide a steady supply of men capable of utilizing such sophisticated materiel. I hope I'm wrong, but I believe simplicity is a virtue, which doesn't invite doubt, confusion, or indecisiveness under stress, nor does it cause unpredictable breakdowns by mechanical failure.

James B. Cummings
Memphis, TN

Reunions

The reunion of the WW II 773d Field Artillery Association will be 8-10 July 1980 at the Hilton Inn (North) in Columbus, OH. Contact Secretary Ed Brook, RD 1, Canisteo, NY 14823 (Phone: 607-698-4628).

The 58th Armored Field Artillery Battalion ("The Battered Bastards Of The First Team") will hold its 35th annual reunion 1 and 2 November 1980 at the Colonial Court Hotel, Greenville, SC. For information contact Charlie B. Hutchison, 137 Kathryan Court, Greenville, SC 29605 or phone 803-295-0109.

Kudos for Colonel Stegmaier

Just a short note to tell you how much I enjoyed "Bragg—Valiant Artilleryman" in the November-December 1979 *Journal.* This is another fine effort in a long series of interesting and informative articles contributed by Colonel Stegmaier on people and actions that helped give the Field Artillery the cherished history and great traditions it enjoys today.

Kudos are certainly in order for Colonel Stegmaier and his works which have made a meaningful contribution to the professional character of the *Field Artillery Journal.*

F. T. Unger
LTG (Ret), USA
Charlottesville, VA

Colonel Stegmaier has indeed been a long and invaluable contributor to and supporter of the ***Journal.*** *I'm certain he sincerely appreciates your comments as does our staff.—Ed.*

A look at SEAD

Suppression of enemy air defense (SEAD) in support of offensive air operations has become a validated part of our joint doctrine for waging the land battle. The Air-Land Forces Application Agency report of 1977 outlined the joint concepts and procedures. As stated in this document, "SEAD encompasses any action which destroys, degrades, or obscures enemy surface air defenses for a period of time to enhance the effectiveness of friendly air operations." In practical terms, field artillery, air defense weapons in a surface-to-surface role, and electronic systems are employed to suppress enemy air defenses in support of airstrikes. The concept sounds great, but so far little has surfaced about implementing a sound SEAD program. The purpose of this letter is to outline a system that has been tried, tested, and proved by III Corps, Fort Hood, TX.

As a general rule SEAD should be planned, coordinated, and executed at the lowest possible level. At the same time, channels for SEAD actions run from the lowest fire support echelon to corps *and* from corps to the lowest, most appropriate echelon. Basically, the channel used will depend on whether the aircraft are being employed as close air support (CAS) or as battlefield interdiction.

The following example shows the use of lower-to-higher channels for a SEAD action: A fire support team (FIST) has acquired a column of enemy tanks and in conjunction with the forward air controller (FAC) requests an immediate airstrike against the target. The request for air support is sent to the Direct Air Support Center (DASC) at corps fire support element (FSE) over the air request net. A quick assessment of the air defense threat indicates that SEAD is required in support of the air mission. The request for SEAD is passed through the fire support officer (FSO) at battalion and brigade to the direct suport (DS) battalion as an on-call mission. The DS battalion may either shoot the mission; pass it to a reinforcing unit; or send it to div arty as an on-call request for additional fires. Div arty also has some options. The mission may be passed to a divisional GS unit, an attached, reinforcing, or general support reinforcing (GSR) corps artillery unit, or the request can be sent to the corps FAS as a priority mission to be fired by a corps GS unit. While the air request is being processed, the unit selected to execute the mission will be planning fires, updating target information, and refining firing data. When the air request is approved, an aircraft time-on-station is announced and a time-on-target (TOT) is assigned. The SEAD is executed at the specified time and the air mission is flown.

A second example illustrates the higher-to lower flow for SEAD: The FA intelligence officer, FSE team chief, G3 Air, and DASC targeting officer plan and coordinate CAS missions at the corps FSE. These missions are targeted against second echelon formations with the intent to stop, impede, or disrupt their forward movement. These missions are executed by Air Force tactical units from sorties allocated to the corps. During mission planning sessions, the requirments for SEAD are considered, and specific airstrikes needing SEAD are identified. The operations element of the corps Field Artillery Section (FAS) passes the SEAD mission to a corps GS or GSR unit for execution. Necessary fire support coordination is effected with the div arty in zone and restrictive fire measures are updated. For fires beyond the fire support coordination line (FSCL), coordination is made with the DASC. As in the first example, aircraft on-station times are announced and TOT is assigned to the firing unit. When corps artillery units have been attached to the divisions or assigned a reinforcing mission, SEAD requirements are passed to the div arty for execution.

Standing operating procedures should be outlined in each unit so that SEAD can be implemented effectively. Like any other aspect of fire support, SEAD SOPs must be relatively simple to allow rapid execution. Normal fire support coordination parallels, for the most part, SEAD. However, there are some details and mechanics of implementation that should be covered.

- First, each firing unit constructs a SEAD overlay covering the zone of the supported unit. A matrix is placed on the overlay using letters to designate north-south grid lines and numbers to designate the east-west lines. The start point for the matrix is announced in the operations plan or fire support plan as appropriate. Enemy air defense targets are acquired from all available intelligence sources and passed to all firing units by the fastest means. Usually target lists are passed in a hard-copy message over the corps artillery radio teletypewriter (RATT) nets. Targets within the zone of the supported unit are posted on the SEAD overlay. The matrix allows rapid identification of target areas to be suppressed.
- Second, there should be a procedure established to distinguish SEAD missions from others. A mission alert in the form of a code word works well. For example, "Ghost Rider," "Black Hawk" or "Red Sky" alerts the receiving unit for a priority mission.

This is a suggested way to approach SEAD at the unit level. A great deal of interface must be made at all echelons between the FSO and supporting FAC, TACP, ALO, and DASC to make SEAD work well. Hopefully, the information provided here will stimulate interest in SEAD and collectively we can develop a comprehensive system that is simple, efficient, and effective.

John S. Osborne
LTC, FA
III Corps Artillery
Fort Hood, TX

As you point out, little in the past has been put into writing concerning SEAD doctrine. Your proposal or "how to" approach to implement a SEAD program, is however generally in line with the new preliminary draft of NATO Standardization Agreement 2930 (Suppression of Enemy Air Defense) which is currently under review. In May, this year, the tenth meeting of the Artillery Procedures Working Party will be held at NATO Headquarters in Brussels, during which time SEAD and, in particular, NATO approval of STANAG 2930 will be addressed.—Ed.

FIELD ARTILLERY ASSOCIATION

FORT SILL,
OKLAHOMA 73503

Dear Fellow Field Artillerymen:

It was 70 years ago this June that a group of Field Artillery officers from the Regular Army and Organized Militia gathered at Fort Riley, KS, to officially establish the United States Field Artillery Association. During that assembly a constitution was adopted and signed by the Association's 86 charter members whose primary interest was promoting the Field Artillery.

This year, just as in 1910, we find ourselves with much the same sense of direction as we organize our efforts to reestablish the Association as a separate organization and leader in this kind of activity. To get things started, an Executive Council has been formed which, in addition to developing programs in the best interests of the Field Artillery, is preparing a new constitution for approval by the Association's general membership.

The Council can do these things within the framework of its charter. However, to make sure the Association is the kind of dynamic organization we rightfully expect, it is vitally important that all artillerymen lend their full support to this revitalization effort.

Much like the "original" 86 members who first established the Association you now have an opportunity to actively participate in redirecting "OUR" Association. Now more than ever, only by being a member of the FAA can you effectively contribute to this end.

Walter T. Kerwin Jr.

WALTER T. KERWIN JR.
General, USA (Retired)
President

Field Artillery Survivability

This article is a result of joint efforts by the British, Canadian, French, and German Allied Liaison Officers assigned to the US Army Field Artillery School (USAFAS) and representatives of the USAFAS Tactics/Combined Arms Department, US Army, and US Marine Corps. The purpose of the article is to present for evaluation and comment by the Field Artillery Community current and proposed tactics and techniques which contribute to the survivability of artillery forces in their most lethal environment.—Ed.

It is common knowledge that the Warsaw Pact (WP) ground forces are numerically superior to those of NATO, but it is not common knowledge that the advantage of NATO technological superiority is rapidly decreasing. The response to an extensive firepower disadvantage by the NATO ground gaining arms has been the evolution of tactical doctrine which increases combat power through maneuver. The active defense, for example, has been formulated to reduce attacking enemy tank and mechanized forces to a combat ratio favorable to the NATO defender. Hopefully this can be achieved by mobility of force, which enhances survivability and cost-effective applied firepower in predetermined engagement areas. No similar evolution of tactics however has been expressed for the survivability of NATO *artillery forces*, which are outnumbered by Warsaw Pact artillery in excess of four to one. Survivability doctrine for NATO artillery has heretofore received a "shotgun" treatment. It has been vaguely addressed in field manuals and training circulars (often in terms of fundamentals of defense) or treated in professional publications as recommended techniques to meet specific threats. The subject is militarily and morally too vital to be treated in an off-handed manner, because it not only concerns the cannoneer and his weapon but also encompasses the infantryman and tanker who, without artillery support, are too vulnerable on the battlefield.

For the artillery to survive two tasks must be accomplished.

- First, effective counterfire must be applied to Warsaw Pact artillery units. The introduction of Firefinder radars and multiple rocket systems will substantially increase the chance for NATO success in the "artillery duel."
- A second task, which is long overdue a comprehensive examination, is preservation of the force; that is, those measures which prevent detection, engagement, and destruction by the enemy.

It is not intended that every tactical situation, every type or size of artillery force, or every kind of terrain and environment be addressed. Rather the scope of this article focuses on conditions that drive NATO material development and doctrine; that is, the worst-case situation of conflict in Europe against Warsaw Pact forces, an environment that presents tactical situations in which tank and mechanized forces will dominate the battlefield. Comments concerning infantry maneuver forces and their artillery support are noted where appropriate.

The threat

NATO artillery units are employed in an indirect fire role and are positioned some distance behind the forward line of the supported maneuver force. Further they are located to prevent attack by enemy ground forces and seek to avoid detection by movement and/or concealment. For these reasons, artillery units are least vulnerable to ground attack and most vulnerable to attack by enemy counterfires, not only because Warsaw Pact artillery can easily range and quickly engage NATO artillery units, but because counterfire is one of the key missions assigned to enemy artillery. A NATO artillery unit's vulnerability to enemy air attack lies between the threat posed by enemy counterfire and ground attack.

The Warsaw Pact doctrinally seeks and engages the NATO nuclear capable units before all others and will expend large quantities of ammunition on a single artillery battery. During the initial stages of a conflict, when stockpiled ammunition is available, they will expend in excess of 600 cannon-delivered artillery rounds in a five-minute attack or approximately five tons of ordnance delivered in 30 seconds by multiple rocket launcher systems. A NATO battery that suffers such an attack could lose all its howitzers and sustain *over* 30 percent casualties (figure 1).

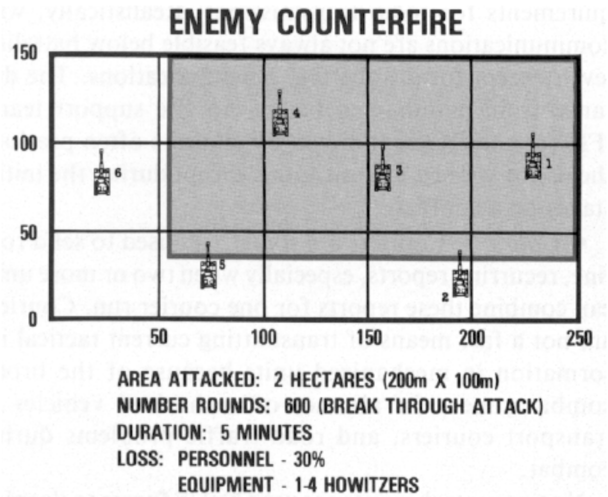


Figure 1. Simulated Warsaw Pact doctrinal counterfire attack under breakthrough attack conditions.

Artillery units are most vulnerable to air attack while moving, not only because they are more easily detected from the air, but because lack of prepared air defense positions and absence of normal vehicle dispersion and cover maximize the effects of the attack. It is unlikely that Warsaw Pact forces will utilize many aircraft in "search and destroy" type missions, as this is expensive in terms of aircraft losses. Air attack of NATO artillery is more likely to occur if the enemy has air superiority, since the number of armed reconnaissance missions will surely increase. While attack of NATO artillery units by counterfire may occur more frequently than by air attack, the devastating effects of a single attack by the most heavily armed helicopters in the world or by bomb-laden high performance aircraft must not be overlooked.

Even though NATO artillery forces are positioned behind the forward line of own troops (FLOT), they are not immune to ground attack. Warsaw Pact tank and mechanized forces could reach rear areas as a result of breakthroughs, reconnaissance, or flanking movements. Additionally, guerrilla, airborne, and partisan groups may attempt to interdict supply lines and to neutralize nuclear capable artillery units. Artillery units attacked by tank forces have small chance of survival considering the comparison of weapon systems, ammunition, and mobility. Against mechanized forces, the odds for survivability are only slightly improved since Soviet BMPs (Infantry Fighting Vehicles) are far superior to cannons in direct fire engagements. Airborne and guerrilla attacks can be repelled by the direct fire of organic artillery weapon systems but, in any case, NATO artillery units that must fight against ground attack are effectively suppressed.

The means by which Warsaw Pact forces can detect NATO artillery units is as important to the unit as the attack itself, for the first matter of surviving is to escape detection. The Warsaw Pact's three primary means of detecting NATO artillery units are (figure 2):

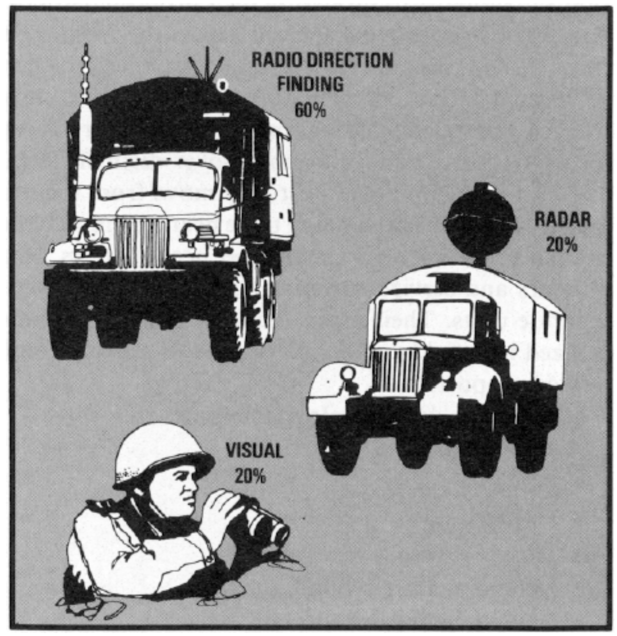


Figure 2. Comparison of Warsaw Pact capability to locate NATO artillery units.

• *Radio direction finding.* Radio direction finding (RDF) operations are an abundant source of targeting data for Warsaw Pact forces. Through triangulation, about 60 percent of the NATO artillery will be located by the signal of radiowave emitting equipment.

• *Radar, sound, flash.* Radar, sound, and flash ranging will be used to locate about 20 percent of the NATO artillery units. Currently, Warsaw Pact radars are technologically primitive, but efforts are underway to field a new system which may increase the number of targets located by this means.

• *Visual detection.* Location of about 20 percent of the NATO artillery units will result from visual detection, which includes reconnaissance, photography, and infrared imaging.

The question of survivability hinges on those measures by which a unit avoids detection, escapes engagement, or weathers an attack. A discussion of NATO artillery survivability tactics, employed by the US, British, Canadians, French, and Germans follows.

US SURVIVABILITY TACTICS

Survivability is inherent in the formulation of US tactics; therefore, measures are instituted at each organizational level to insure preservation of the force. The division artillery positions artillery battalions out of the path of the main enemy thrust, not only to insure uninterrupted support of maneuver forces but also to prevent the battalion from coming under attack by ground forces.

At battalion level, artillery units employ both dispersion and mobility to survive on the European battlefield. Artillery batteries are dispersed across the front, sometimes without support vehicles and personnel, which may be located in battery or battalion trains. With mostly tracked vehicles remaining forward, the battery is capable of frequent rapid movement over difficult terrain. The battalion command post may move from the headquarters/service battery area to be near a cannon battery or take a position near a maneuver headquarters. Headquarters and service batteries may not be employed as separate units. Their assets could be combined and organized into field and combat trains to provide combat service support.

US artillery units employ techniques to:

- Avoid detection.
- Disperse.
- Harden/improve position.
- Move.
- Defend against ground attack.
- Defend against air attack.

Avoid detection

To prevent RDF location, commanders should insure that the following communications security measures are employed to deter enemy direction finding and jamming operations:

• *Short transmissions.* Radio direction finding is most accurate when transmission length exceeds 25 seconds, allowing three or more RDF stations to intercept and fix the signal. Accuracy is the key word. Warsaw Pact forces, whose RDF accuracy varies, may refine target location errors before firing on the target. Short transmissions lengthen the target location process, thereby increasing the time a unit is free from attack.

• *Radios on low power.* The accuracy with which RDF stations can locate transmitters also depends on signal strength. Radar, for example, is easier to detect and locate than radio because of its strong signal.

• *Directional antennas.* Directional antennas (horizontal, polarized) assist in defeating Warsaw Pact RDF. When directional antennas cannot be used, FM antennas may be sited behind hills or buildings to decrease signal strength in the direction of the enemy.

• *Secure transmissions.* Secure transmissions do not prevent radio signals from being intercepted by enemy RDF equipment, but they are of some value because they create a less powerful radio signal. Secure transmissions also deny the enemy bits of information which could aid him in refining RDF locational data.

• *Wire.* Wire is used, when possible, to decrease requirements for radio transmissions. Realistically, wire communications are not always feasible below battalion level, except for intrabattery communications. The distance from battalion to battery to fire support teams (FISTs) and frequent moves by all units often preclude the use of wire communications except during the initial stages of a conflict.

• *Couriers.* Couriers are sometimes used to send routine, recurring reports, especially when two or more units can combine these reports for one courier run. Couriers are not a fast means of transmitting current tactical information in mechanized units because of the broad combat zones, the absence of authorized vehicles to transport couriers, and road traffic problems during combat.

Numerous techniques are used by US forces to degrade the effectiveness of enemy counterfire radar. Adjusted fire missions are avoided but, if they are necessary, bold shifts by the observer hasten entry into the fire-for-effect phase of the mission. Abbreviated registrations are used only when met + VE (meteorological plus velocity error) data cannot be used to achieve first round fire for effect. Massed fires of several units confuse enemy radar operations, especially if all units fire with the same time on target. All units attempt to fire the highest charge practicable, causing a low projectile trajectory which may pass under the scan of counterfire radar.

The US will employ several means to avoid detection by visual means. A few of the major ones are:

• Siting weapons and equipment to make use of natural cover and concealment.

• Camouflaging vehicles and installations to deny the enemy direct observation of the locations and activities of friendly units.

• Maintaining camouflage, noise, and light discipline.

• Selecting weapon locations behind hill masses or near buildings or trees to preclude direct observation by the enemy and to reduce the signature effects of firing.

• Conducting movements, when possible, during periods of limited visibility.

• Controlling the use of infrared night observation devices.

An ideal situation exists when an artillery unit deceives the enemy into firing on a position which is far removed from the actual location of the battery. Current methods of accomplishing this deception area:

• *Roving guns.* The use of roving guns may deceive enemy intelligence-gathering agencies as to the location and the number of US firing units. Self-propelled artillery units conduct roving gun operations for special missions and registrations. Towed artillery units normally conduct more extensive roving gun operations, as the comparably static combat environment in which they operate necessitates staying in position for longer periods of time.

• *Remoting of radios/antennas.* Radios and antennas are separated from the artillery unit location when time and resources are available. The radio operator can send and receive transmissions from a station established some distance from the radio, using a remote set which is linked with the radio component by wire. The advantage of this technique is that enemy forces may locate the antenna/radio location through RDF but, when they attack it, fewer US personnel and vehicle losses will result.

• *Dummy positions.* Dummy positions may be established with organic artillery equipment and materials indigenous to the terrain, and many techniques can be used to increase the effectiveness of the dummy position. Remoting radios to the dummy location and leaving vehicle tracks leading to the position are examples. In practice, US artillery rarely uses dummy positions, since they require coordination on an already crowded battlefield and therefore are a low priority commitment because of the austere shortage in personnel and equipment resources.

Disperse

Current US artillery doctrine calls for a minimum separation of 50 meters between medium howitzers in a battery position, when all howitzers are located in one position area. Weapons are generally positioned inside an area 400 meters long and 200 meters deep, since terrain gun position corrections do not provide an acceptable single-battery sheaf if guns are located outside that area. The fire direction center (FDC) and battery operations center (BOC) are normally positioned on opposite flanks of the battery to preclude destruction of both control elements by one attack. Combat service support (CSS) vehicles and personnel are dispersed in the battery position, located in a battery trains to the rear of the firing element, or consolidated with battalion CSS elements in the battalion trains.

Harden/improve position

Upon occupying a firing position, a battery will first accomplish those tasks necessary to conduct firing and will then improve its position by accomplishing passive and active defense preparations, to include hardening of key installations and equipment. Sandbags are placed around collimators and wheeled vehicle tires and wire is buried. As time permits, foxholes are prepared with overhead cover to protect crewmembers. A self-propelled artillery battery, which relies on movement to escape detection and attack, does not normally prepare parapets or "dig in" its howitzers. When possible, battery positions are selected behind hill masses to reduce the effects of fires from gun-type artillery.

For towed artillery units, moves are not as frequent, since the terrain in which the infantry forces are employed does not afford an attacker a great mobility advantage. Towed artillery pieces are dug in whenever possible, either by hand or with assistance from engineer units. (US Marine Corps artillery units utilize organic engineer-type vehicles, such as bulldozers and hydraulic scoops.)

Move

US artillery units that support mechanized forces rely on frequent, rapid movement from one firing position to another to minimize enemy detection and reduce the effects of an attack. Slow, vulnerable, wheeled vehicles are removed from the firing position, leaving tracked vehicles which can displace rapidly and move over rough terrain. The battery transports only combat-essential equipment, which remains loaded in the firing position. Ammunition remains on ammunition-carrying vehicles which are positioned directly behind the howitzer for immediate ammunition resupply and quick movement. These measures allow the battery to displace in the face of imminent attack in less than five minutes and make numerous moves in a 24-hour period. Normally, battalions plan to move no more than one battery at a time so that support requirements can be met with the other two batteries in position to fire.

Defend against ground attack

Artillery units will normally attempt to avoid an enemy ground attack by moving to an alternate position. Only when circumstances prevent this tactic will the battery defend from its firing location. Based on the assumption that enemy ground attack could occur, preparations for defense begin upon initial entry into a position and continue until the unit departs for a new location. Likely enemy avenues of approach are identified and battery observation posts placed accordingly. Defensive fires, to be delivered on-call, are planned on avenues of approach to delay the attacking enemy. Enemy vehicles are to be taken under direct fire in planned engagement areas outside the battery perimeter by tank-killer teams, armed with the M72A1 light antitank weapon (LAW), and by howitzers firing from supplementary positions. Austere personnel shortages normally preclude manning all perimeter defensive positions around the clock; therefore, perimeter positions are prepared in advance and occupied when attack is imminent. A reaction force, a squad-size reserve constituted from battery personnel, is available to reinforce the perimeter or expel enemy forces that have penetrated it. Artillery unit commanders should attempt to offset the tremendous advantage in weapons range and ammunition lethality of WP tank and mechanized forces by planning to use every advantage the terrain affords the defender. If possible, firing positions are selected which preclude engagement of the battery by long-range, direct fires of Warsaw Pact mechanized units.

Defend against air attack

Artillery units have *area* protection against air attack which is provided by the divisional air defense artillery (ADA) battalion. Within the artillery battery, local air defense protection is achieved through active and passive defense measures. Passive defensive measures include proper camouflage and concealment of the unit (to avoid detection) and proper dispersion (to avoid presenting a linear target for an attacking aircraft). Early warning is accomplished through the use of observation posts and a link with the divisional ADA battalion's antiaircraft radar system.

Active air defense measures are used when enemy aircraft are visually sighted. These measures include engagement by attached Redeye ground-to-air missiles, positioned outside the battery perimeter on likely enemy air avenues of approach. Additionally, the fires of .50 caliber machineguns and other individual and crew-served small arms are directed forward of an attacking aircraft to create a concentration of fires through which the aircraft must pass. These measures provide adequate air defense protection while the artillery unit is in a prepared position. During movement, however, the artillery battery is more easily detected and therefore more vulnerable to air attack. To decrease this vulnerability, moving artillery units should plan emergency actions to improve their air defense posture such as dipersing air defense weapons throughout the march column. When attacked, vehicles move off the road and seek a covered and concealed position from which they can return fire.

This summary of US survivability tactics and techniques is introductory to the following contributions of Allied Liaison Officers, US Army Field Artillery School. They will explain the philosophy, tactics, and techniques of their artillery forces which are, in some cases, quite different from US artillery doctrine. It is important to note that differences in organization allow some nations to use artillery survivability tactics that are not feasible in those forces which lack similar assets. A comparison of key firing battery personnel is shown in figure 3.

Title	Reference	US	British	Canadian	French	German
Battery commander	Note 1	Captain	Major	Major	Captain	Captain
Executive officer	Note 2	Lieutenant	Captain	Captain	Lieutenant	Lieutenant
Forward observer	Note 3	NA	Captains (3)	Captains (3)	Lieutenants (5)	Lieutenants (2)
Reconnaissance/survey officer	Note 4	NA	E8	Captain	Lieutenant	Lieutenant
Fire direction officer	Note 5	Lieutenant	Lieutenant	Lieutenant	E8	Lieutenant/E7
First sergeant	Note 6	E8	E8	E8	E8	E8
Chief of firing battery	Note 7	E7	E8	E8	E8	E7
Gunnery sergeant		E7	NA	NA	NA	NA

Notes:

1. Except for the US, all battery commanders are full-time fire support officers for maneuver battalions.
2. The British and Canadian executive officer is titled "battery captain" (BK) and is second in command in the battery.
3. Except for the US, all batteries have organic forward observers whose efforts are coordinated by the battery commander. The French firing battery has *five* forward observers, one of which is in charge of two RATACs (moving target radars).
4. Except for the US, all batteries have an organic reconnaissance/survey officer whose principal function is to supervise the reconnaissance/survey section in preparation of firing position areas. In addition, the British and Canadian batteries have two 24-hour-duty command post officers who may also perform reconnaissance duties.
5. The fire direction officer in the British and Canadian batteries is titled "gun position officer" and holds the rank of lieutenant.
6. The British and Canadian first sergeant is titled "battery sergeant major" (BSM) and his principal duty is to supervise ammunition resupply of the battery.
7. The German position most similar to the US chief of firing battery is titled "platoon leader."

Figure 3. Comparison of key firing battery personnel.

BRITISH ARTILLERY SURVIVABILITY

by Lt Col G. S. Orr, British Liaison Officer

The British, like Americans, recognize the threat capability to locate firing positions and to react with extremely heavy counterbattery fire. All possible measures are adopted to prevent or delay enemy location of positions and avoid return fire.

The main threat to gun positions is seen as being from enemy multiple rocket systems. For example, a single BM 21 (figure 4) battery salvo can deliver, in only 30 seconds,

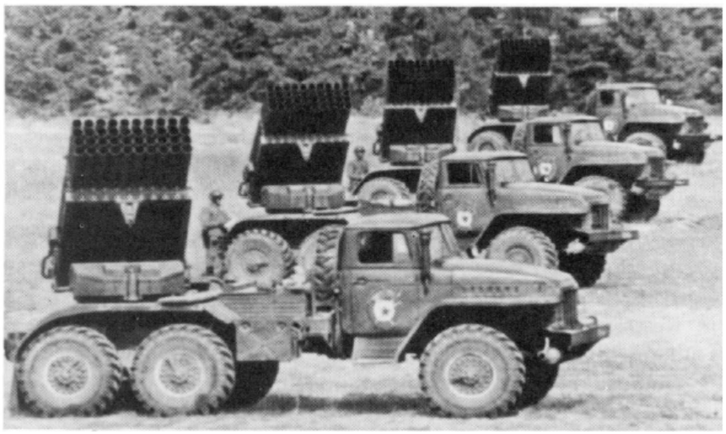


Figure 4. The Soviet BM 21 122-mm multiple rocket launcher can fire a 40-round salvo in 20 seconds.

some five tons of high explosive (HE) over an area measuring approximately 400 by 250 meters. Our guns are normally deployed in a battery area measuring 200 by 200 meters. Assuming threat accuracy is only sufficiently good to put their mean point of impact within 200 meters of our battery center there is a distinct possibility, with our normal present-size position, of losing four or more guns. This is obviously unacceptable, so some method of deployment that reduces the odds must be used.

Three basic options for improving survivability are as follows:

- Frequent moves.
- More widely dispersed gun positions.
- Digging in gun positions.

Movement

Since the British artillery is heavily outnumbered by Warsaw Pact artillery, our guns must stay in action for the maximum possible time. Some survival moves will be inevitable, but frequent moves made purely to avoid enemy return fire would be undesirable, since this would significantly reduce the proportion of our artillery that is in action at any time and would amount to self-induced neutralization of our guns. In general terms, two-thirds of our artillery should be ready to fire at all times.

Dispersion

With our current Field Artillery Computer Equipment (FACE), the maximum distance that any gun can be displaced from battery center is 299 meters. Hence, the maximum dispersion distance we could achieve in a single battery position would be approximately 500 by 500 meters.

We can increase this dispersion, however, by splitting the battery into two separate sections of three guns each and deploying them separately, each with its own section center and FDC. Alternatively, the two sections could be deployed separately, but sharing the same battery center and working from a single FDC. Any split below section level is seen as impractical on both technical and manpower grounds.

Note: *British firing batteries are organized with six guns and two fully manned and fully equipped FDCs.*

From a survival point of view, the two-section deployment greatly improves our chances (figure 6). Furthermore, two sections firing together will produce a confusion bonus as far as enemy sound ranging is concerned and degrade the accuracy of their locations. Using a two-section deployment, if the BM 21 MPI fired on the battery center or if one of the sections came under its 50-percent zone, the density of rounds we could expect on the battery as a whole would be reduced by as much as 6 to 1.

Digging in

Hardening of our gun positions will further increase our chances of survival. The drawback here is that we have no integral mechanical digging capability in our batteries and must, in most cases, rely on self-help. Even so, a certain amount of digging should be possible, at least on initial positions.

One option that we considered was a combination of digging in and frequent moves. The battery could occupy a well-prepared, dug-in, hide position, or possibly a village, with easy access to several adjacent firing positions. The battery could operate on a "shoot and scoot" basis with alternate sections; or on receiving a call for fire, the whole battery could move out from the hide position and fire, and then withdraw to the hide position. One obvious drawback of remaining in the hide position until there is a call for fire is the increased response time. A possible solution would be to keep one section ready in a firing position and then have it withdraw to the hide position as soon as it fired. As this section moves back, the other one moves out and prepares to answer the next call for fire from a different position. Although this concept does improve survivability considerably, it does have several disadvantages in that:

- A higher degree of training is necessary.
- It relies almost entirely on radio communication.
- Control would be difficult, particularly at night.

• It would almost certainly result in a reduced firing capability and degrade responsiveness to calls for fire.

Overall, the best solution would appear to be a combination of digging in and dispersion of two separate sections. Ideally, the two sections should be separated by at least 600 meters. Each section should have a well-prepared primary position and also an equally well-prepared alternate position that it could move to when required (figure 5). Even though this is considered the best option, there are problems:

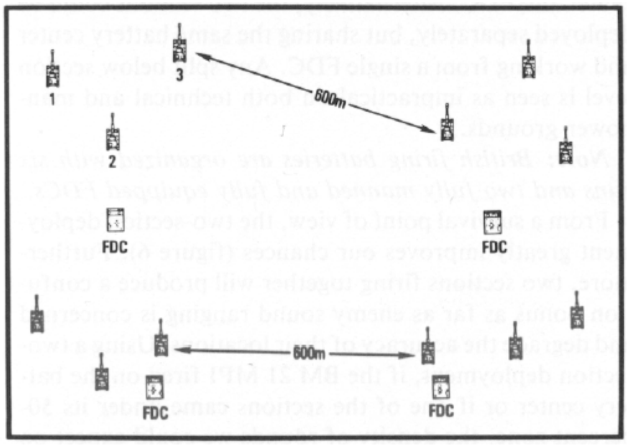


Figure 5. Proposed deployment of the British 155-mm battery.

• The survey and reconnaissance load is increased.

• Manpower needs are increased.

• Technical control is more difficult.

• More real estate is required.

• Local defense is more difficult.

• Use of line (wire) is more difficult (presently we use line on the gun position whenever possible).

• There is a lack of time to dig in.

At least the initial positions should be dug in, even if the guns have to be deployed above ground on subsequent positions. Villages may provide protection for firing positions without digging although control could be very difficult and arcs of fire (traverse) may be limited.

In conclusion, we believe the best way to increase survivability is to combine dispersion and digging in, possibly with the adoption of a two-section, four-position (two occupied, two prepared) deployment of our batteries. We are considering eight-gun batteries that are capable of splitting into two four-gun sections, since the weight of fire that a three-gun section can deliver is felt to be inadequate.

CANADIAN ARTILLERY SURVIVABILITY

by Maj. S. S. Takahashi, Canadian Liaison Officer

Concepts and techniques of battlefield survivability in the Canadian artillery are not significantly different from those of the US. The major variation is found in the number of guns available for operational deployment. Since Canada has fewer guns, we believe we must maintain maximum available firepower at all times. Mobility, then, as a technique for survival, is thought of only in terms of movement to an alternate position. Our guiding principles of survival are dispersion, concealment, and security.

Dispersion

Dispersion of batteries is determined by the nature of our operations and range of the guns. Ideally, firing units will be deployed within range of each other, so that the entire artillery force can operate under cover of its own weapons.

Proposed battery areas, approximately one-half to a full grid square in size, are selected by the highest artillery command (normally division artillery) and coordinated with the division operations staff. Within the selected area, we deploy the battery, with our guns about 50 meters apart.

Concealment

Every effort is undertaken to preclude disclosure of our gun positions. A concealment plan is integral to the deployment plan and includes the following:

• Restrictions on daylight activity such as occupation of gun positions, reconnaissance, resupply, and digging.

• Camouflage of all equipment and elimination of vehicle tracks.

• Use of hide positions unless the actual gun positions afford sufficient cover.

• Use of temporary and dummy positions.

• Control of electromagnetic radiations.

It should be mentioned that hide positions are normally occupied prior to the period of actual combat and that temporary and dummy positions are rarely used.

In our terms, *security* is that procedure which contributes to local defense of the battery perimeter.

Reconnaissance of battery positions is conducted with defense in mind. Consideration for selection of gun and command post locations include:

• Siting behind hill crests.

• Use of treelines and folds in the ground.

• Avenues of enemy approach.

• Quick evacuation routes.

• Staggering of guns.

In most cases we also select and conduct reconnaissance of alternate positions.

Immediately after occupation of the gun position, a priority of work is established for the defense of the position. Digging of shallow trenches, gun pits, and command posts are normally the first priority, followed by positioning of observation posts (OPs) and listening posts (LPs). Ammunition-carrying vehicles are positioned immediately behind howitzers and dug in. Each gun is allocated a defensive sector, and anti-armor positions are sited. Unit SOPs outline engagement procedures and the use of quick reaction forces.

During the employment period, standard techniques such as offset or temporary positions are utilized for registration, adjustment of fire, and harassing fire. For example, with respect to communications, standard security practices are used, wire is used at the battery level only, and dispatch riders are used between regimental (battalion) headquarters and the batteries.

In conclusion, it can be seen that the Canadian artillery concept of survivability does not differ dramatically from its US counterpart. The major difference in survivability is that Canadian artillery forces place less emphasis on mobility.

FRENCH ARTILLERY SURVIVABILITY

by Lt Col(P) Pierre Saint-Arroman, French Liaison Officer

The mission of French forces in Europe is seen to be the counterattack. To survive, the French Field Artillery mainly relies on mobility and self-protection.

Mobility

Mobility is used to increase responsiveness and to offset enemy counterfire capabilities in a very fast-moving combat situation so that our artillery can support the counterattacking combined arms division. Mobility is achieved through various means:

- Mounting our guns on the same chassis as our main battle tank, to allow for equal mobility.
- A second means is our tactical aim—to remain as short a time as possible in every firing position. We can do this because our guns, equipped with a 360-degree, power-driven turret, can fire immediately in any direction with little preparation. Additionally, our new optoelectronic goniometer reduces time for laying operations, which greatly enhance our goal of obtaining first round fire for effect. We do not intend to perform such complex and time-consuming operations as roving gun and offset registration. In order to leave a firing position immediately, we use short-range radio transmitters between the FDC and the gun sections, and never collocate guns and supply vehicles. With 42 rounds on board and firing only three to six rounds per fire mission, in most cases, our guns require infrequent resupply.
- Last, but not least, our training emphasis centers on "hipshoot" techniques. Our guns have automatic loading, our crews are small, and quick reaction is the rule. The use of radio sets for each gun speeds the establishment of command and control in the new position.

Figure 6. The French 155-mm automatic loading howitzer, firing a standard projectile, has a range of about 24,000 meters.

Self-protection

Since our artillery is very mobile and nonnuclear, we do not feel enemy counterfire is our main concern. However, when counterfire does occur, the light armor of our guns and combat vehicles is sufficient to endure the attack while we move quickly out of the counterfire area.

Conversely, mobility means obtrusiveness; so all our combat vehicles are equipped with an air defense machinegun. Also, in a fast moving, rapidly changing battle, unexpected encounters with small enemy armor parties are likely to happen; therefore, our GCT (155-mm, self-propelled howitzer (figure 6)) is built to fire at short ranges as fast as a tank. A 155-mm HE direct hit does not destroy a tank; however, it neutralizes its crew long enough for our guns to escape.

We *do* believe that the enemy will use mass-destruction weapons, particularly chemical, in a European major conflict; consequently, all our combat vehicles are equipped with a built-in collective air-filtered, pressurized system. To allow our crews to take full advantage of this kind of protection, without being overcrowded in the turret, we have reduced the crew to four members.

We apply all traditional survivability techniques, such as camouflage, light and noise reduction, perimeter surveillance, antitank portable weapons emplacements, and others, whenever the situation permits.

GERMAN ARTILLERY SURVIVABILITY

by LTC Ulrich Brinkmann, German Liaison Officer

The prime consideration for the survivability of the Federal Republic of Germany (FRG) field artillery units is the known enemy counterfire capability. We expect counterfires on our batteries within 15 to 20 minutes after the first rounds are fired from our positions. The primary emphasis on survivability is dispersion of fire units, rather than mobility. Frequent moves to avoid counter-fire would mean that some combat forces would have to fight without fire support. Since we have less artillery than the threat forces, frequent movement would only increase the problem. We may, in the future, be able to decrease our disadvantage in numbers or artillery by providing more responsive, flexible effective fires.

The introduction of TACFIRE/ADLER will provide us with a more flexible system which will increase our capability to rapidly mass the fires of widely dispersed artillery units. It has always been important to the FRG field artillery to mass the fires of at least one FA battalion to confuse enemy target locating radars and to obtain maximum affects on a target with the fewest number of rounds. As a result of our studies of enemy weapons locating radars, we also emphasize firing as rapidly as possible. Since our new FH70 155-mm howitzer (figure 7) is capable of firing three rounds in less than 15 seconds, we believe that, unless the enemy radar is oriented in the direction of our firing batteries, it will not be possible for them to accurately locate our firing units. We attempt to obtain acceptable effects from our fires by massing more units, firing three rounds each on a target, rather than firing more rounds from one or two batteries to get the same results.

Techniques

One technique of battery employment is terrain gun positioning within a battery area measuring 600 by 600 meters. A six-gun battery will occupy this position with each gun separated by approximately 300 meters. With this large dispersion, certain advantages are realized. Each gun becomes a point target for enemy counterfires. Enemy targeting accuracy of the battery may be unreliable and his tactical assessment may be invalid. This area is 18 times larger than the conventional 200 by 100 meter position; thus, the enemy counterfire effort must be 18 times greater to achieve the same results. There are, of course, disadvantages with wide dispersion of gun positions. These are:

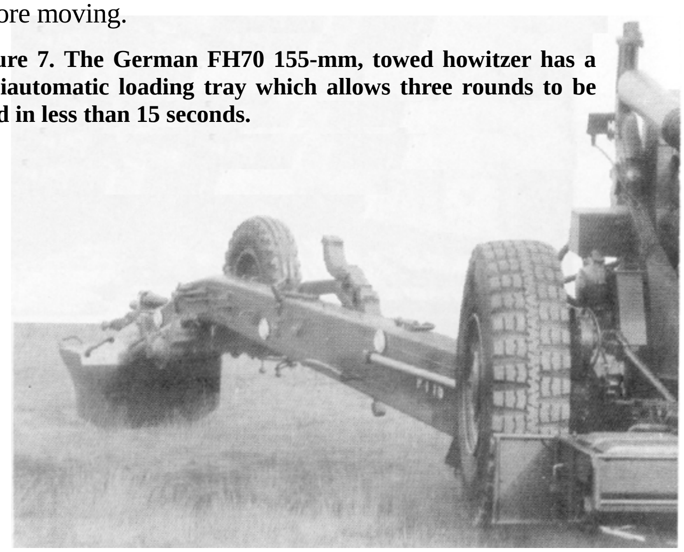
• The time required for reconnaissance and preparation of the position is lengthy.

• Survey requires more time and equipment because each gun must have an accurate location.

• Command, control, and communications (C^3) are more difficult. Each of our guns has a small, short-range radio which greatly reduces these difficulties.

• Ammunition resupply is more difficult. Our concept is to unload ammunition on the ground next to the gun position and place ammunition vehicles in a hide area away from, but adjacent to, the gun positions. If we must move rapidly from the position under emergency conditions, our gun crews may exceed the normal ammunition carrying capacity of the gun by loading as much of the unfired ammunition as possible into the gun before moving.

Figure 7. The German FH70 155-mm, towed howitzer has a semiautomatic loading tray which allows three rounds to be fired in less than 15 seconds.



• Security problems are increased. There is no easy solution to this problem. We think of the howitzer position, not as an island, but as an integral part of all the friendly forces on the battlefield. In so doing we can identify the weakest areas against enemy ground attack and strengthen them to the extent of the battery's resources.

• Dispersion over a wide area is highly dependent on an automated system of technical fire control. The FRG is fielding an automated system of technical fire direction at battery level which is similar to the US Battery Computer System (BCS). This system will allow rapid computation of firing data for each of the six gun locations, with automatic readout of fire commands at each gun position.

Another method of employing our batteries is to employ guns in pairs in an area which measures 300 by 600 meters (figure 8). The advantages here are similar to those of the first one discussed, except that enemy counterfire would have to cover an area only nine times as large as a normal battery position of 100 by 200 meters. This method reduces the disadvantages of the 600 by 600 meter employment technique. The survey requirement is half of the larger position, ammunition resupply is

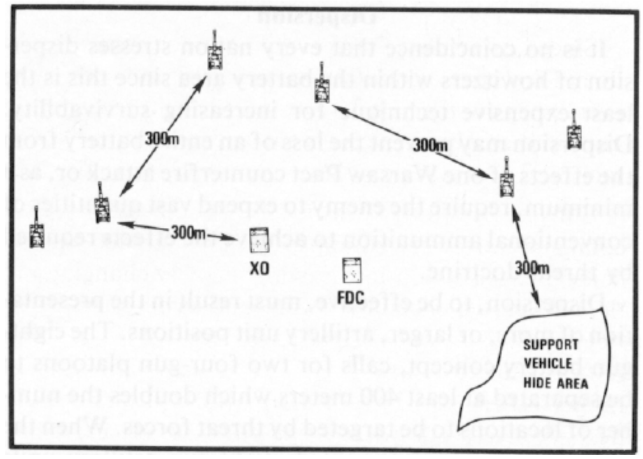


Figure 8. The German artillery battery deployed in an area measuring 600 by 300 meters.

easier, and security problems are reduced. Additionally, two howitzers located more closely gives us overlapping of communications. If the radio of one gun is inoperable, fire commands can be received from the other.

The artillery of the FRG, then, relies on dispersion, massed fires, and rapid firing for survival, rather than on digging in or moving frequently.

GENERAL DISCUSSION

Before discussing survivability tactics, it is important to reemphasize the conditions that drive these tactics in the European combat environment.

• The primary means of detecting NATO artillery units will be Warsaw Pact radio direction finding.

• Most NATO artillery combat losses will occur as a result of Warsaw Pact counterfire.

• Artillery units that attempt to defend against tank attack have small chance of success.

• Warsaw Pact artillery superiority requires NATO forces to maintain a minimum of two-thirds of its artillery in action at all times.

• Dispersion of artillery units across the battlefield and dispersion of howitzers within batteries are necessary components of survivability.

• Hardening howitzer positions and frequent movements to avoid detection and attack are key means of increasing survivability.

The fire unit and FA platoon are defined as follows:

• Fire unit—A fire unit is expressed as the number of howitzers required to obtain acceptable effects on an "average" target. Tests conducted by the British and the US have determined this to be a minimum of four 155-mm howitzers.

• FA platoon—The US now defines a platoon of howitzers as half of an eight-gun battery. In eight-gun batteries, platoons are separated 400 to 1,600 meters and are capable of operating independently.

Dispersion

It is no coincidence that every nation stresses dispersion of howitzers within the battery area since this is the least expensive technique for increasing survivability. Dispersion may prevent the loss of an entire battery from the effects of one Warsaw Pact counterfire attack or, as a minimum, require the enemy to expend vast quantities of conventional ammunition to achieve the effects required by threat doctrine.

Dispersion, to be effective, must result in the presentation of more, or larger, artillery unit positions. The eight-gun battery concept, calls for two four-gun platoons to be separated at least 400 meters which doubles the number of locations to be targeted by threat forces. When the concept is fully implemented, eight-gun artillery units will have most of the TOE equipment and personnel required to operate with dispersed platoons. The requirements for personnel and equipment to perform survey operations are an exception. Though the number of firing positions has doubled, there is no corresponding increase in survey assets.

For other artillery units, howitzers should be dispersed at least 100 meters and positioned in depth (figure 9).

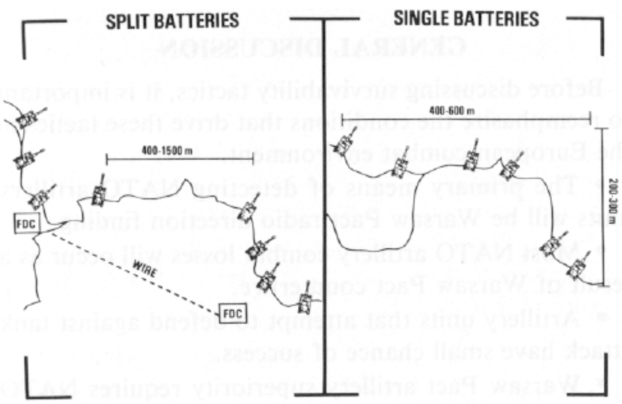


Figure 9. Dispersion of US 155-mm artillery batteries (eight-gun and six-gun).

Currently, US forces position howitzers parallel within a 200 by 400 meter area and compute terrain gun position corrections to achieve a standard sheaf on the target. Dispersion of howitzers beyond 100 meters requires that a battery compute individual piece corrections for each howitzer to obtain the standard battery sheaf upon which target effects tables are based. Separating howitzers in a six-gun battery by 100 meters requires technical fire direction procedures that treat each two- or three-gun element in a battery as one firing unit, each with its own "battery center." This will, in turn, cause an increase in survey requirements since each element should have an accurately surveyed center. The time for occupation of a firing position will increase, especially for the establishment of wire communications from the howitzer to the FDC.

To overcome the difficulties that wide dispersion causes requires a reevaluation of current methods and equipment. It may be acceptable to waive the requirement for a "standard" battery sheaf when the fires of several units are massed on a target. Standing operating procedures should state under what conditions speed of firing takes precedence over the requirement for a specific size battery sheaf. In those cases where the standard sheaf is required, FADAC can be used to compute data for each two- or three-gun position within the battery area. In the near future, the introduction of automated equipment such as TACFIRE and the Battery Computer System will increase the speed and ease with which this can be done.

Communications within the dispersed firing battery require rapidly installed, reliable equipment. The Small-Unit Transceiver (SUT) will fill this bill. Until US artillery units receive the SUT for each howitzer, an alternative to the current wire system is necessary. Assault wire, available through supply channels, may be a light, reliable alternative to the current, cumbersome wire system.

The US artillery units that will not receive eight-gun batteries require some augmentation if they are to successfully manage the problems associated with dispersion. The need for survey sections, possibly equipped with the survey instrument, azimuth gyro, lightweight (SIAGL) for 155-mm units, should be reinvestigated. The introduction of the Position Azimuth Determining System (PADS) will meet future battery requirements for quick, accurate, surveyed firing locations.

Two additional difficulties are caused by widely separating howitzers in a battery. First, larger position areas require intense coordination for available maneuver space, a management problem to be solved by artillery and maneuver operations and fire support coordination personnel. Second, a dispersed battery has a greater area to protect against ground attack. Imaginative use of available personnel to man observation posts (OPs), a means of communication for OPs, and a sound defensive plan can decrease, but not eliminate, these difficulties.

Hardening

An artillery battery that plans to dig in its howitzers must be prepared to expend a tremendous amount of time and personnel resources in the effort. In mechanized divisions, digging would almost surely have to be done by hand, since engineer equipment is not in the US Army artillery unit TOE, and engineer equipment from the divisional engineer battalion would be employed elsewhere. Additionally, self-propelled artillery units will have to move frequently just to provide continuous support to mobile, mechanized maneuver forces. If earth-moving equipment were made available, operators would be hard pressed to prepare enough positions sufficiently in advance of the rapidly moving artillery.

Towed artillery units, on the other hand, must dig in as much as time and resources allow. Since the forces that towed artillery support are less mobile than mechanized forces, the battle they fight will be less mobile and the need for indirect fire support more constant. These artillery units must remain in place longer and thus are more subject to attack. Divisional engineer assets should be made available to towed artillery units, but, if they are not, the unit must strive to harden its position and protect its personnel and equipment with available resources.

In training, British and Canadian artillery units succeeded in digging in all howtizers in a battalion by hand. This process was time consuming, and the fatiguing effects on personnel would certainly preclude this practice for every position. The proposed British technique for selecting and hardening two positions for each section in a battery may increase survivability by adding the capability for movement to and from protected positions.

For all artillery units, the cliché "something is better than nothing" applies to any protection that can be afforded unit personnel and equipment. Based on the axiom that a unit must continually improve its defenses until it moves, artillery unit commanders must establish work priorities based on analysis of threat capabilities and attempt to harden positions to the extent that time and resources allow. As a minimum, every effort must be given to digging in the FDC and guns in the initial positions.

US Marine Corps artillery units have organic engineer equipment in their artillery units and the British are investigating a similar option for their artillery forces. The US Army artillery should also have this equipment. Another suggestion which could improve the digging capability for self-propelled units is to place a dozer blade on the new ammunition carrier. This blade could produce an earth scrape to lower the silhouette of the howitzer and provide embankments to its front and sides. While this method would not completely protect the howitzer, it would greatly improve the survivability posture of a self-propelled unit that, caught unaware, is forced to "ride out" a Warsaw Pact counterbattery or air attack.

Movement

If one accepts the fact that self-propelled artillery units will not have the time required to dig in, then it becomes obvious that they must either disperse widely or move frequently to survive in a hostile counterfire environment. The order to move a battery may be based on the time a unit has been in position, on the number and type of missions fired from the position, or on tactical requirements. The key to movement is to coordinate the moves with the requirements for support of the maneuver force so that at least two-thirds of the available artillery units are prepared to fire at all times. The artillery must move when it *wants to*, not when it has to because of a counterfire attack.

Historically, movement has been done by battery, with two of the three cannon batteries in position to fire at all times. In the eight-gun battery, a more efficient technique is moving two four-gun platoons. The advantages of this technique are that it requires fewer howitzers to be out of action at any one time and increases the number of firing positions from which the artillery battalion can mass fires to confuse enemy counterbattery radar. Deploying in two echelons maintains the battalion's capability to mass half-batteries, a technique currently practiced by some six-gun US artillery units. It may also minimize the unit's losses to air attack. Most of the equipment required to perform these operations will be provided in the eight-gun battery TOE.

Cannon batteries must be made "light to fight" if they are to accomplish numerous moves to survive. Perpetual reconnaissance of new positions by battery advance parties and occupation of positions, which will closely resemble "hip shoots," are characteristic of movement to survive. Combat support vehicles will only slow the displacement of more mobile tracked vehicles. These vehicles and the combat service support personnel will be more effective if they are consolidated at a battery trains area, supervised by the first sergeant, or at the battalion trains under control of the battalion logistics officer. Ammunition must remain loaded on tracked ammunition vehicles. If ammunition for special contingencies is placed on the ground next to the howitzer, plans must detail evacuation or destruction procedures to prevent its capture by enemy forces.

There are disadvantages to frequent survivability moves:

- Susceptibility to detection and attack by enemy aircraft increases when artillery units move from a covered and/or concealed position. Enemy detection is more difficult and losses may be fewer if batteries displace in two echelons.

- Survey requirements increase. The need for surveyors in close support batteries and more efficient survey instruments are noted. If these are not forthcoming, units must rely on hasty survey techniques or accept some error in battery location.

- Equipment maintenance losses increase with the number of moves, and vehicle recovery operations require more coordination.

- All combat service support actions will require close coordination, as drivers of supply-carrying vehicles, without radios and poorly trained in map reading, will have difficulty locating rapidly changing firing locations.

Units may reduce these difficulties by establishing battery trains or battalion combat trains, which are more static, and using these as focal points for the direction of supplies to cannon positions.

• Frequent moves degrade a unit's capability for sustained combat operations, as time for crew rest is reduced.

• Finally, the competition for maneuver space becomes intense for artillery units that split batteries and make frequent survivability moves. Brigade and battalion fire support coordinators and artillery battalion operations officers must continually plan for new firing positions and look into the future to anticipate changes that must necessarily occur on a fluid battlefield.

The US artillery's doctrine of frequent movement to survive is *one* reason for development of PADS, SIAGL, SUT, BCS, and TACFIRE. These equipment developments also enhance the capability of artillery units to deliver responsive fires from widely dispersed or hardened positions.

Avoiding detection

Whether an artillery unit elects to dig in and accept an enemy attack on its position or plans to move frequently in an attempt to avoid the attack, it must make every effort to escape detection and deceive the enemy as to its location.

Radio is the Judas of the artillery. This has been said so often that our soldiers have become inured to the constant warning. But the fact remains that radio direction finding is the Warsaw Pact's best means to locate a NATO artillery unit. Soldiers can see a piece of trash that might spoil the unit's efforts to conceal itself or they can hear unnecessary noises that break noise discipline, but they can neither see nor hear the concentric circles of sound emanating from a radio antenna toward two or more enemy RDF stations. They are not made aware of the process of triangulation that pinpoints their location and may result in delivery of five tons of rocket ammunition on their battery position. Despite the well publicized fact that the Warsaw Pact conducts large-scale, radio-electronic combat which can cause loss of a high percentage of our command and control capability, we don't use our radios very well. This is not the fault of our units as much as it is a commentary on the equipment that is currently available. In the future, the integrated tactical communications system (INTACS) may provide reliable, secure, jam-proof, nearly RDF-proof communications at battalion level and below.

The technique of remoting radios deserves further discussion. Inoperable remoted radios cannot be replaced from the operator station, and radio frequencies can be changed only at the radio itself. Units that move more often do not have the time to remote radios for every position. Required, is a method of remoting antennas up to 1,000 meters from the radio location, a capability that doesn't currently exist, though it is well within the state of technology. Easy to erect, uncomplicated directional antennas would be of definite advantage in denying the enemy RDF locations. Long-wire base directional antennas are currently available, though their use is limited by the length of time it takes to strike and erect them in a new direction.

Now, and in the near future, artillery units must rely on current communication security procedures to defeat enemy radio direction finding and jamming. However, no communication security procedure will be effectively implemented unless the unit commander *demands* it.

The emphasis on rapid firing by German and French artillery units is a technique for avoiding detection by enemy counterbattery radar that requires study by US forces. If an enemy counterbattery radar cannot be reoriented toward firing units whose fires last only 15 seconds, then it is imperative that US forces develop equipment and techniques that take advantage of this weakness.

Defense against ground attack

There is a basic difference between maneuver and field artillery units that impacts on the adequacy of defensive preparations. When an infantryman prepares a defensive position, he is preparing to accomplish his primary mission—to defeat an enemy attack. When an artilleryman prepares defenses for a battery position, he must do so while accomplishing his primary mission of indirect fire support. Since artillery combat service support personnel are not usually available in the cannon position to dig in equipment and prepare positions for crew-served weapons, the artillery is limited, by time and resources, in what it can accomplish. Additionally, artillery positions are selected to accomplish the mission of providing indirect fire support and for unit defense. The commander will, however, subordinate defensive considerations in favor of mission accomplishment, if necessary.

An artillery battery faces a severe disadvantage in weaponry when forced to defend against a Warsaw Pact motorized rifle or tank attack. In range, lethality of ammunition, and mobility, a howitzer is inadequate against a tank or even a BMP, except under the most favorable conditions. The only antitank weapon in the artillery battery TOE of US units is the M72A1 LAW. Its maximum effective range of 200 meters is well within the effective range of every Warsaw Pact motorized rifle company weapon system except the 9-mm pistol. Studies which investigated addition of the Dragon antitank weapon to artillery TOEs concluded that, given current battery resources, the men and vehicles necessary to use and transport the weapon are not available. Development of an armor penetrating round for the self-propelled howitzer would be costly and would compound the basic load ammunition-mix problems caused by proliferation of types of artillery projectiles.

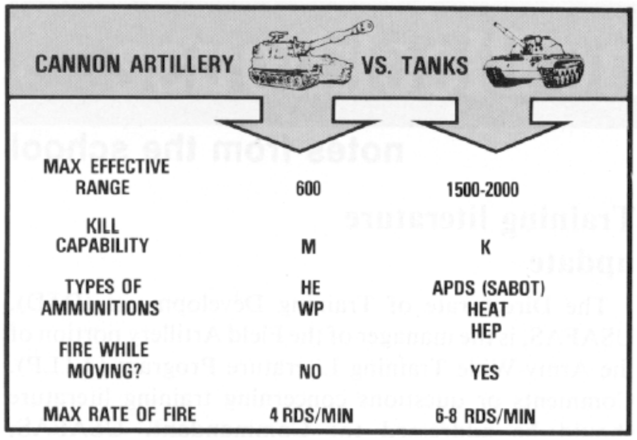


Figure 10. Comparison of the direct fire capability of the 155-mm howitzer and a Warsaw Pact tank.

The implication is clear. Artillery units must, if at all possible, avoid attack by enemy mechanized forces. Observation posts, intrusion detection systems, and intelligence channels must provide warning of an impending ground attack in time for artillery units to move to a safe position. If an artillery unit is surprised by enemy armored forces, its defense measures must include fires to deceive and slow the enemy so that the howitzers can leave the threatened area and continue their mission from a safe, alternate position.

Battery defense plans must also include the actions to be taken if the unit is attacked by partisan, guerrilla, or airborne forces and successful defense is possible. These plans should also take into account the effects that dispersion of howitzers has on perimeter defense. There is no doubt that some risk must be assumed by a unit that disperses to avoid enemy counterfires. The trick is to identify the minimal risk areas and concentrate on those portions of the perimeter which constitute the greatest threat. Provision for reconstitution of the battery is also an important defense consideration.

Summary

General conclusions can be drawn from this survivability review, not the least of which is that survivability of the field artillery in the environment predicted for combat in Europe requires constant study, evaluation, and formulation of doctrine. There are no "best" techniques for surviving. Valuable techniques for survivability of one nation's artillery force are appropriate because of their mission, organization, and equipment. The same techniques may not be useful for an artillery unit with different missions or force structure.

Current equipment developments have been discussed in terms of their impact on survivability. There have been indications throughout this article of the need for new equipment, more equipment, and more personnel. Although we could solve many survival problems with these assets, many of which are not unreasonable to request, the emphasis has been on techniques which can be implemented now, for it is now that they are needed. These include:

• Command emphasis on communications security procedures.

• Dispersion, to reduce the effects of enemy counterfire on an unfortunate artillery battery.

• Movement, to avoid counterfire attack.

• Hardening of positions for units which must remain in position to meet support requirements, and hardening for all units in their initial combat positions.

• Early warning of enemy ground attack so that Warsaw Pact mechanized forces can be avoided or to allow time for battery forces to be deployed to meet enemy partisan and airborne attackers.

The Field Artillery must face up to its survivability needs in providing the following:

• Survey equipment and personnel authorizations for eight- and six-gun M109A1 artillery batteries are required now. We can ill afford to wait for PADS.

• A bulldozer, an off-the-shelf item, needs to be organic to each firing battery, especially in towed artillery batteries.

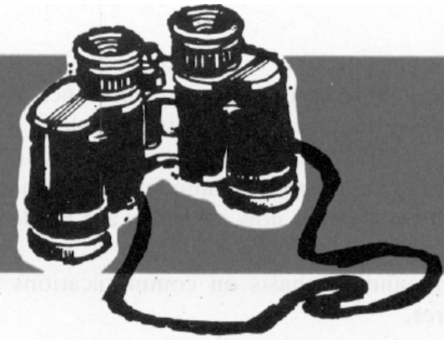
• The Small Unit Transceiver is vital to artillery survivability. Procurement efforts must be hastened.

• The capability to remote antennas would significantly decrease the enemy's capability to find our units through RDF. Currently, no known developmental or procurement program is ongoing to produce this capability.

• Units would increase the use of directional antennas if they were easier to reorient. Use of directional antennas can reduce enemy RDF capability by 85 percent or more.

These needs are not exotic, nor are they beyond the state of technology. They are relatively inexpensive. Beyond providing our artillery units with techniques they can use to enhance their survivability, the Field Artillery must concurrently develop and field the equipment that make these techniques 100 percent feasible.

As was stated at the beginning of this article, its scope is not meant to be all encompassing. There are, obviously, survivability techniques which were not discussed here. A fairly recent article in the *FA Journal* addressed a need for a field artillery survivability field manual similar to FM 90-2, Tactical Deception. Perhaps there is such a requirement; if so, input resulting from publication of this article may be a stepping stone to that end.



View From The Blockhouse

notes from the school

USAFAS Archives Program needs input

In July of last year the Morris Swett Library requested support for the USAFAS Archives Program. While a degree of response to that request has been apparent, during 1979 only 48 documents—32 of these since July—were forwarded to the Morris Swett Library for inclusion in the Archives.

The Archives Program provides the only formalized means for preservation and maintenance of historical documentation throughout the Field Artillery School. As such, it is an invaluable resource, both to those researching the past and to those looking to the future.

All artillerymen are urged to place increased emphasis on contributions to the Archives and to lend personal support to the maintenance of this vital historical program.

Documents forwarded for inclusion in the USAFAS Archives should be submitted under an Archival Data Sheet as shown below. For further information or assistance write Mr. Les Miller, Supervisory Librarian, Morris Swett Library, ATTN: ATSF-CT-TD, Fort Sill, OK 73503 or call him: AUTOVON 639-4477 or commercial (405) 351-4477.

Archival Data Sheet

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   b. Other Name(s) Known by Special Designation:
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Authorizing Official
(Name, Rank, Title)

Training literature update

The Directorate of Training Developments (DTD), USAFAS, is the manager of the Field Artillery portion of the Army-Wide Training Literature Program (ATLP). Comments or questions concerning training literature should be addressed to: Commandant, USAFAS, ATTN: ATSF-TD-TL, Fort Sill, OK 73503, or call AUTOVON 639-4679/4902 (MAJ Longhi). The following table reflects the current status of Field Artillery field manuals, training circulars, and ARTEPs.

Field Manuals	Short Title	Current Date	Remarks
6-1	FA TACFIRE	Sep 79	
6-2	FA Survey	Sep 78	
6-15	FA Meteorology	Aug 78	C1 TBP Jan 81
6-16	Tables for Artillery Meteorology	May 79	
6-16-1	Tables for Artillery Meteorology (Sound Ranging)	May 79	
6-20	Fire Support in Combined Arms Operations	Sep 77	C1 TBP Jun 80
6-20-1	FA Cannon Battalion	Jul 79	
6-20-2	Div Arty, FA Brigade, FA Section (Corps)		TBP Sep 80
6-30	FA Observer	Aug 78	C1 TBP Apr 80
6-40	FA Cannon Gunnery	Dec 78	C1 TBP FY 81
6-40-3 w/C3	Operations of FADAC	Apr 77	
6-40-4	Lance Missile Gunnery	Jun 79	
6-42(U) & 6-42-1(C)	FA Battalion, Lance	Aug 78	C1 TBP Dec 80
6-50	FA Cannon Battery	Jun 78	C1 TBP Jun 80
6-121	FA Target Acquisition	May 78	Revision TBP May 80
6-122	Artillery Sound and Flash Ranging	Apr 79	
6-141-1/2	FA Target Analysis and Weapons Employment	Feb 78	C1 TBP Sep 80
6-161	FA Radar Systems	Jul 78	C1 TBP FY 81
6-300	Army Ephemeris	Sep 78	Next edition TBP Sep 80

Training Circulars	Short Title	Current Date	Remarks
6-10-1	FA Communications	Feb 77	Will be rescinded with the fielding of FM 6-20-2 in 4th Qtr FY 80
6-20-4 w/C1	Counterfire	Feb 76	To be rescinded by FM 6-20-2
6-20-9	FA Cannon Btry Defense	Apr 78	To be rescinded by FM 6-50 in Jun 80
6-20-10	FIST	Dec 77	Will be rescinded by new TC FY 81
6-40-4	Fire for Effect	Feb 78	Will be rescinded by FM 6-40 TBP FY 81
6-50-1	FA 3×8 Bn		Fielding expected in Dec 80
6-50-2	FA Nuc Ops		Fielding expected in Sep 80

Training Text	Short Title	Current Date	Remarks
6-20-7	FAC/FIST Operation	Jun 79	

ARTEPs	Short Title	Current Date	Remarks
6-105	105 DS Cannon	Sep 79	C1 TBP 2nd qtr FY 80
6-165	GS Cannon Units	Sep 79	Revision TBP 2nd qtr FY 81
6-302	HHB Div Arty FA Bde	Jun 79	Revision TBP 1st qtr FY 81
6-307	TAB	Dec 79	
6-365	155-mm SP, DS	Sep 79	Revision TBP 2nd qtr FY 81
6-500	Nuclear Weapon FA Group/FA Detachment	Dec 79	Draft test edition
6-525	MLRS	Dec 79	Draft test edition
6-595	Lance	Dec 79	Revision TBP 3rd qtr FY 81
6-615	Pershing	Jul 79	Revision TBP 1st qtr FY 81

Field Artillery Officers Advanced Course profile

The Field Artillery School annually conducts four resident Field Artillery Officer Advanced Courses. Average class size is 130 students, including officers of both the Active Army and Reserve Components, the Marine Corps, and the Armor and Infantry Branches.

A brief profile of recent classes reveals the following data:

- Regular Army—60 percent.
- Reserve Officer Training Corps graduates—62 percent.
- US Military Academy graduates—26 percent.
- Officer Candidate School graduates—11 percent.
- Commissioned from other sources—less than one percent.
- Average age—27.3 years.
- Average years of commissioned service—5.6.
- Baccalaureate degrees—93.5 percent.
- Advanced degrees—8 percent.
- Successful completion of battery-level command—42 percent.

Field Artillery officers are generally selected for advanced course schooling between their fourth and sixth year of commissioned service.

Conference dates

Planning and coordination of the Senior Field Artillery Commander's Conference and the 1980 Fire Support Conference is currently underway; however, firm dates for both meetings have not as yet been determined.

When scheduling has been confirmed, appropriate dates will be announced via worldwide message.

Attachment or operational control?

In a recent discussion by attendees of the Field Artillery Pre-Command Course, the question arose as to the rationale of attaching a Field Artillery brigade to a division. Specific concern focused on the ability of the division support command to provide support for this kind of organization. Since the original brigade employment concept allowed for this problem (attachment would be less admin and logistics) a question was raised as to why operational control (OPCON) had not been used.

As contained in JCS Publication 1, "operational control" and "attachment" are defined as follows:

- **Operational control**—(NATO, SEATO, CENTO, IADB): The authority delegated to a commander to direct forces assigned so that the commander may accomplish specific missions or tasks which are usually limited by function, time, or location; to deploy units concerned; and to retain or assign tactical control of those units. *It does not include authority to assign separate employment of components of the units concerned.* Neither does it, of itself, include administrative or logistical control.
- **Attachment**—(DOD, NATO, SEATO, CENTO, IADB):

1) The placement of units or personnel in an organization where such placement is relatively temporary. Subject to limitations imposed by the attachment order, the commander of the formation, unit, or organization

receiving the attachment will exercise the same degree of command and control thereover as he does over units and persons organic to his command. However, the responsibility for transfer and promotion of personnel will normally be retained by the parent formation, unit, or organization.

2) The detailing of individuals to specific functions where such functions are secondary or relatively temporary; i.e., attach for quarters and rations or for flying duty.

Within the context of these standard definitions, it becomes apparent that the use of OPCON as a status restricts the flexibility of the div arty commander in terms of his authority to reorganize the brigade and assign tactical missions to the individual battalions. Attachment, with appropriate limitations on administrative and logistic responsibilities, overcomes this deficiency and appears to be the most doctrinally correct method of employment. (CAPT Swords, USMC, TCAD).

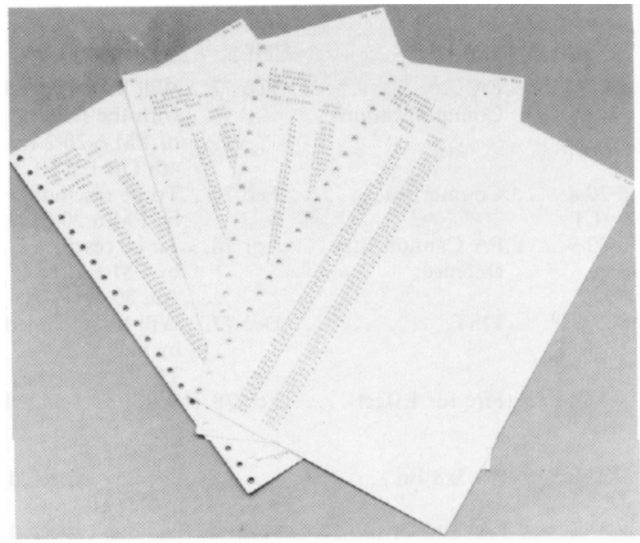


Figure 1. Computer printouts from the Ballistic Research Laboratory.

How GFTs get to the FDC

Graphical firing tables (GFTs), one of the most useful tools in the fire direction center, are basically a reduction of tabular firing tables (TFTs) into a form that provides a quick, easy-to-handle, easy-to-read means of acquiring firing data. Master drawings for GFTs are produced by the Research and Analysis Division, Gunnery Department, USAFAS, using data generated by the Ballistic Research Laboratory, Aberdeen Proving Ground, MD.

When a new weapons system is developed or a change is made to an existing system, new firing data is generated for GFTs and TFTs. This data is rounded off for publication of TFTs, but for GFTs it is left in raw form on computer printouts (figure 1). These printouts contain information on:

- Elevation.
- Fuze setting.
- Delta fuze setting.
- Drift.
- Fork
- 10-mil site.
- Time of flight (TOF).
- Meteorological (met) line data.
- Transfer limits.
- Range K.
- Fuze K.

Each piece of data for each function has a corresponding range and is developed for low angle, high angle, graphical site tables (GSTs), illumination tables, and other firing tables required for modern weapon systems such as improved conventional munitions (ICMs), Copperhead, and rocket assisted projectiles (RAPs). Data for the GFT is assembled according to charge, and possible ranges to be achieved by each charge are determined. This data is then applied to the master GFT drawings produced on a vinyl sheet that is legible and durable enough for reproduction and numerous printings. Separate double sized sheets are prepared to allow for accurate two-color printing (black and red).

Range scales for GFTs are taken directly from the C and D scales of a logarithmic slide rule. When the minimum and maximum ranges for a charge are determined, the ranges are set off on the C and D scales. The scale is then photographically enlarged or reduced to fit the master drawing, and a negative is made by the US Army Field Printing Plant at Fort Sill.

After the range scale is transferred from the negative to the master drawing, firing data may be transferred from

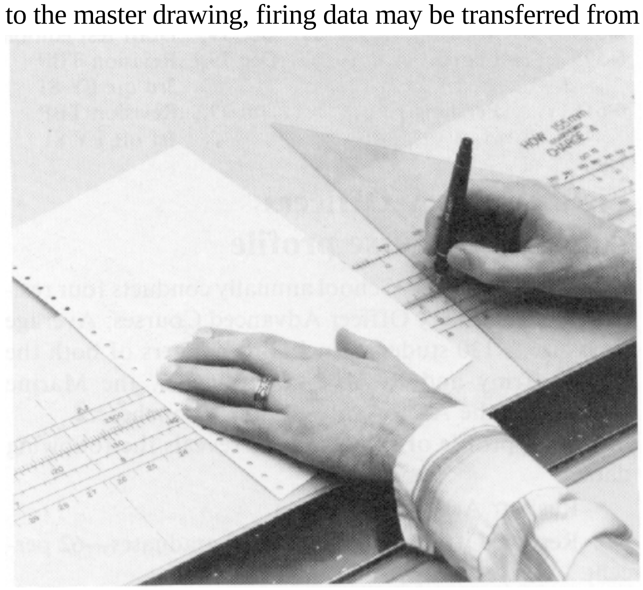


Figure 2. Data is transferred from printouts to master drawing.

the printouts to the drawing by finding the range on the scale that corresponds with the range for each piece of data (figure 2). This is accomplished for each function on both the low and high angle GFTs, each height of burst on the illumination GFTs, and for the target above and below scales on the GSTs.

When the master drawings are completed and checked, they are returned to the printing plant and reduced 50 percent. (The red portion is overprinted on the black on special paper.) After printing, the GFTs are trimmed (19 by 3½ inches) to fit the handmade "stick" used to mount the GFT. The printed drawing is glued to the "stick" with a special adhesive and is then covered with a protective lacquer. After allowing 5 to 10 days for drying, a handmade cursor is attached to the GFT (figure 3). The completed GFTs, along with carrying cases, are then crated for shipment to depots for issue to the field upon request.

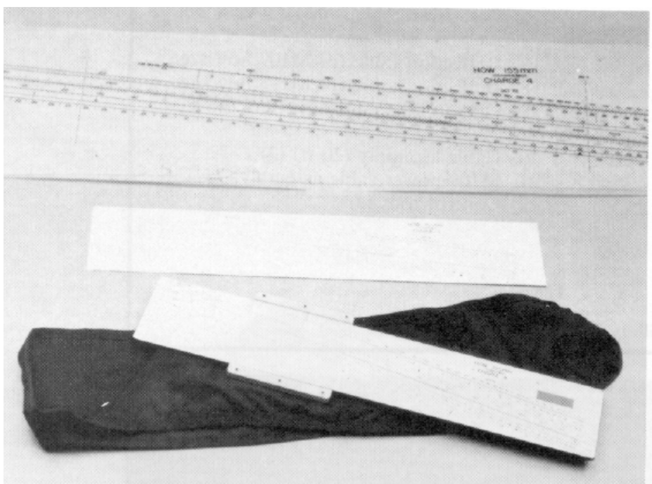


Figure 3. Master drawing (top), paste-on copy (center), and completed set.

In addition to the GFTs and GSTs, the Gunnery Department develops other graphical firing equipment and supporting literature for special situations; e.g., ballistic scales and cursors, Graphical Munitions Effects Tables (GMETS), Extended Range Protractors (RDPs). National stock numbers (NSNs) are also requested and catalogued into CTA-50-970s. The Gunnery Department periodically publishes additions or changes in firing equipment through the R&A Division Information Note #1, which is distributed to all Active Army, Reserve, and National Guard Field Artillery units. This note also addresses the status of TFTs (ordered through AG Publications channels), FADAC items, and selected plotting equipment. A copy of the R&A Information Note #1 may be obtained by calling AUTOVON 639-6108/3901 or writing:

Commandant
US Army Field Artillery School
ATTN: ATSF-G-RA
Fort Sill, OK 73503

Upon receipt of R&A Information Note #1, fire direction personnel must check for the addition of new GFT/TFT NSNs and have supply personnel promptly initiate requests for any new firing equipment.

The Gunnery Department is available to answer any questions on GFTs and will assist the units in ordering up-to-date firing tables for their weapon systems (Mr. Russell, GD)

The Artillery Direct Fire Trainer

In the November-December 1978 *FA Journal*, a short article appeared in the View From The Blockhouse section entitled "ADFT Fielded." Based on a telephonic survey with eight division artillery S3s during December 1979, it was discovered that only a few of our units are using or know how to obtain the Artillery Direct Fire Trainers (ADFT).

For the first time in the history of the Field Artillery, a device—the ADFT—has been developed to train howitzer sections on techniques used during direct fire missions for both moving and stationary targets. Designed to operate on a 1 to 10 scale range (e.g., 40 to 160 meters would represent 400 to 1,600 meters, and target speed 0 to 2.5 mph would represent 0 to 25 mph), the ADFT reduces training costs significantly and eliminates the requirement for ammunition, specially designed ranges, and transportation costs to and from ranges.

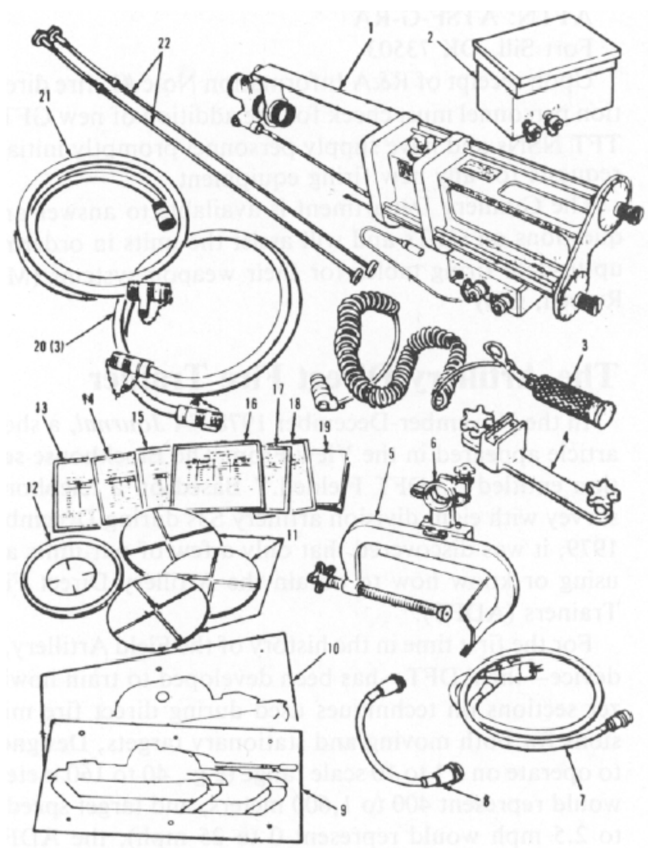
The ADFT kits are currently available for the following weapons:

- 105-mm howitzer M101A1 (towed).
- 105-mm howitzer M102 (towed).
- 155-mm howitzer M114A1/A2 (towed).
- 155-mm howitzer M198 (towed).
- 155-mm howitzer M109A1/A2/A3 (self-propelled).

A complete ADFT consists of the items shown in figure 1 plus the M55 Laser Gunnery Trainer (figures 2 and 3). The ADFT (less than M55) comes in two containers. One package (figure 4) carries all the items listed in figure 1, and the other contains the target support assembly and all attachments necessary for mounting it on a 1/4-ton trailer. The M55 laser is a separate item of issue and is packaged in its own container. The unit of issue for the ADFT and laser is as follows:

• *Europe:* One mounting adapter per 155-mm battalion; three M55 lasers per div arty; one mounting adapter and M55 laser per separate brigade and armored cavalry regiment.

• *Korea:* One mounting adapter per 105/155-mm battalion; three M55 lasers per div arty.



Legend:

1. Deflector optical assembly
2. Distribution box
3. Lanyard switch
4. Adapter assembly for M114A1/M114A2 howitzer
5. Mount assembly
6. Mount
7. Cable assembly (10 ft)
8. Adapter cable assembly
9. Target assembly, moving
10. Target assembly, stationary
11. Boresight target assembly (3)
12. Laser target assembly
13. Deflection table for M101A1 howitzer
14. Deflection table for M102 howitzer
15. Deflection table for M114A1/M114A2 howitzer
16. Deflection table for M109A1 howitzer
17. Deflection table for M109 howitzer
18. Deflection table for M198 howitzer
19. Operator's manual — TM 9-6920-357-10-2
20. Cable assembly (20 ft) (3) -
21. M109 power cable assembly
22. Control rods (2)

Figure 1. Components of the Artillery Direct Fire Trainer.

Figure 2. The M55 Laser Gunnery Trainer in carrying case.

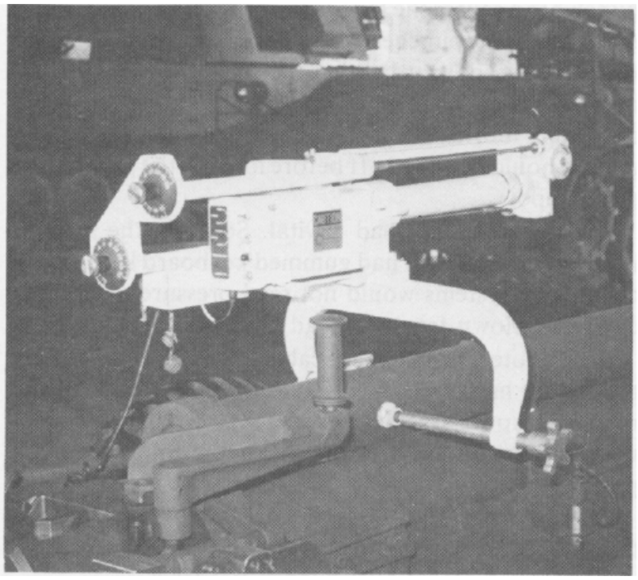


Figure 3. The M55 Laser Gunnery Trainer mounted on weapon.

• *All other areas:* One mounting adapter and M55 laser per three battalions (Active, Reserve, or National Guard) served by a training and audiovisual support center (TASC).

The M55 laser is not available for unit issue, but is held by local training and audiovisual support centers. As such, several FA units have reported that on occasion they have been unable to get the M55 laser for ADFT training because tankers, who also use the M55 to train their personnel, have already signed for the laser.

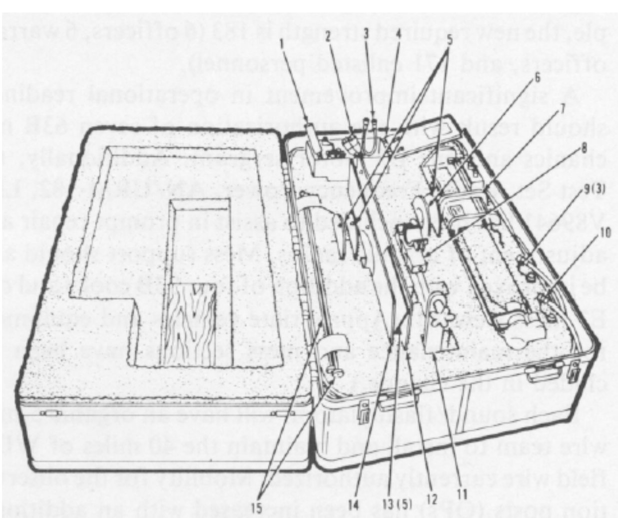
The M55 Laser Gunnery Trainer, which is powered by any 24-volt direct-current source, is a helium-neon gas type laser that produces a single burst of intense red light five-eights of an inch in diameter each time the boresight/off firing switch or lanyard switch is activated. This highly visible red "spot" shows how accurately cannoneers are tracking and engaging targets. The laser may require warm-up operation in the continuous mode from 30 seconds to 30 minutes and should be activated for at least 30 minutes every 25 to 30 days to insure proper functioning.

Although the M55 laser is considered eye-safe when used in the flash mode operation with retroreflective coated targets, there is danger of eye damage out to 4,000 meters when it is operated in the continuous mode or if the light is reflected from a mirror-like surface. Therefore, laser warning signs must be posted and a laser range danger fan must be constructed in accordance with the operators manual and AR 385-63.

In September-October 1975, the US Army Field Artillery Board conducted Operational Test II for the ADFT, and it was determined that soldiers trained on the ADFT displayed more confidence, motivation, and accuracy than those trained in the traditional manner. It was also determined that using the ADFT will result in substantial savings in ammunition costs.

The ADFT is an excellent piece of equipment which field artillerymen should start using. Units should find out who is holding the mounting adapter kits and obtain the M55 lasers designated for the ADFTs from their local TASC. The laser is easy to mount and operates on all weapons systems (TM 9-6920-357-10-2).

The United States Field Artillery School recently completed production of an 18-minute film entitled "Use of the Artillery Direct Fire Trainer (ADFT)" which should be available in the very near future at div arty and separate brigade levels. (SSG Cone, WD)



Legend:

1. Lanyard switch
2. Cable assembly (10 ft)
3. Adapter cable assembly
4. Distribution box
5. Boresight target assembly (3)
6. Laser target assembly
7. Deflector optical assembly
8. Mount
9. Cable assembly (20 ft) (3)
10. Cable assembly
11. Adapter assembly for M114A1/M114A2 howitzer
12. Target assembly, moving
13. Deflection tables
14. Target assembly, stationary
15. Control rods (2)

Figure 4. Carrying case for the Artillery Direct Fire Trainer.

COUNTERFIRE SYSTEMS REVIEW

DM60 problems?

The Survey Electronic Distance Measuring Equipment (Infrared) DM60 was originally purchased as an off-the-shelf, noncombat-hardened distance measuring instrument. Since its issue, the Counterfire Department (CFD) and the III Corps Artillery at Fort Sill, have discovered that the DM60 has several maintenance deficiencies to include the following:

• Instrument is not moisture resistant; i.e., condensation forms during high humidity.

• Point set knob is inoperative.

• Instrument will not measure.

Because of these and other suspected shortcomings in the DM60, CFD is currently conducting an analysis of the maintenance history of this equipment to further determine and provide field solutions to other maintenance-related problems experienced worldwide.

Units that have experienced difficulty with the DM60 are asked to contact CPT Roe (AV 639-2805) or Mr. Alexander (AV 639-6616) at the Counterfire Department, USAFAS or write: Commandant, US Army Field Artillery School, ATTN: ATSF-CF-SV (CPT Roe), Fort Sill, OK 73503.

OL-192/GMD-1 update

On 15 February, this year, the Counterfire Department began training soldiers in the Field Artillery Met Crewmembers Course (FAMCC) with its recently acquired complement of Meteorological Data Processing Groups OL-192. As a result of this training, the following maintenance "tips" have been forwarded to Communications and Electronics Material Readiness Command:

• A "gummy" buildup of chad and lubricant at the punch head causes the tape feed sprocket to tear out and not feed out the punched tape. More frequent cleaning of the punch head, insuring that the chad box is empty and in place when displacing, and using only the proper amount of lubricant will correct this problem. Any excess grease should be wiped off before loading the punch with paper tape.

• The control of chad is vital. Some of the systems received by USAFAS had gummed keyboard keys due to chad. Two systems would not read pressure tapes until chad was blown from the read head holes (Error 322).

• To protect the interface cable from being crushed by the sliding hardware, insure that the cable loops to the right and upward—not underneath the function box—when the computer or reader is returned to the traveling position.

Any defective OL-192 Artillery Met Program tapes are to be returned directly to:

US Army Combat Surveillance & Target Acquisition Laboratory
ATTN: DELCS-S (Mr. Ray Bellucci)
Fort Monmouth, NJ 07703

Replacement tape(s) will be in the return mail to your section. The intended requisitioning of tapes and other OL-192 components has been delayed, and the SLAC deck and procedures as stated in the OL-192 Maintenance Support Plan has slipped. It is vital that suspect magnetic program tape cartridges be returned to CSTA Laboratory for analysis.

Target acquisition battery DA TOE changes

The Department of Army TOE 06-307H published on 15 April 1980 reflects several important changes in the organization of the target acquisition battery. For example, the new required strength is 183 (6 officers, 6 warrant officers, and 171 enlisted personnel).

A significant improvement in operational readiness should result with the authorization of seven 63B mechanics and one E7 motor sergeant. Additionally, the Test Set, Radio Frequency Power, AN/URM-182, Line V89641 has been included to assist in prompt repair and adjustment of organic radios. Mess support should also be improved with the addition of four 93B cooks and one E7 mess steward. (Appropriate vehicles and equipment for the maintenance and mess sections have been included in the change.)

Each sound/flash platoon will have an organic 5-man wire team to install and maintain the 40 miles of WD-1 field wire currently authorized. Mobility for the observation posts (OPs) has been increased with an additional ¼-ton vehicle with trailer, which now gives each OP two ¼-ton vehicles with trailers.

Mobility of the survey parties has also been improved in that each survey party will now be authorized two ¼-ton vehicles and one 1¼-ton vehicle with trailer.

These DA changes may not be incorporated into major commands' (USAREUR, FORSCOM, EUSA) modified tables of organization and equipment (MTOE). However, since Department of Army does recognize these requirements, if your next MTOE change does not reflect these actions and you desire assistance please contact the Counterfire Department as follows:

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-R (CPT Watson)
Fort Sill, OK 73503
AUTOVON 639-4787/1108/2408 or commercial 1-405-351-4787/1108/2408.

Meteorological equipment repair tapes

In the November-December 1979 *FA Journal* the Counterfire Department reported that TV tapes on the repair of meteorological (met) equipment would be issued by January 1980. January is long past and the tapes are not yet issued; however, there is a light at the end of the tunnel. Development of master tapes has been completed and approved, and upon receipt of sufficient 60-minute blank tape cartridges, copies will be made by the Fort Sill Training and Audiovisual Support Center (TASC) and distributed worldwide to TASCs that support met sections.

User test conducted for A17E-12 training device

An on-site user test is being conducted by the US Army Field Artillery School and the US Army Field Artillery Board on the A17E-12 organization maintenance training device. The A17E-12 was designed by Hughes Aircraft Company to simulate the Firefinder AN/TPQ-36 radar system. Objectives of the test are to:

- Make an assessment of the reliability/maintainability characteristics of the device.
- Determine the extent to which the device satisfies the training device requirement.
- Determine whether the device permits effective transfer of training to the radar operational hardware.
- Provide data to assess the overall suitability of the device for use in the academic environs of Fort Sill, OK.

Begining 7 April, the test will last approximately five weeks and involve eight student players who have attended a three-week prerequisite Firefinder Operator Course. Students will receive formal training on selected organizational maintenance tasks, using the A17E-12 Trainer and, after completion, will be expected to perform maintenance on the actual Firefinder radar system.

The final portion of the on-site user test will be a learning transfer test to determine whether students can apply A17E-12 training to actual radar equipment. If the training is effective, the A17E-12 will be used in resident Firefinder AN/TPQ-36 organizational maintenance instruction beginning later this year.

Marine Corps Artillery Commanders Update

1st Marine Division	**2d Marine Division**	**3d Marine Division**
Col R. J. Henley 11th Marine Regiment	Col M. D. Julian 10th Marine Regiment	Col H. E. Davison 12th Marine Regiment
Lt Col T. E. Gnibus 1st Battalion, 11th Marines	Lt Col E. M. Asanovich 1st Battalion, 10th Marines	Lt Col R. R. Wright 1st Battalion, 12th Marines
Lt Col H. P. Pate 2d Battalion, 11th Marines	Lt Col B. R. Francis 2d Battalion, 10th Marines	Lt Col F. H. Douglas 2d Battalion, 12th Marines
Lt Col D. S. Drum 3d Battalion, 11th Marines	Lt Col J. F. Lloyd 3d Battalion, 10th Marines	Lt Col J. Pipta 3d Battalion, 12th Marines
Lt Col C. J. Horn 4th Battalion, 11th Marines	Lt Col D. F. Sortino 4th Battalion, 10th Marines	
	Lt Col R. A. Browning 5th Battalion, 10th Marines	

Development of Pershing II

by MAJ Robert L. Shearer

The recent approval by the North Atlantic Treaty Organization (NATO) to deploy the Pershing II missile system in Europe caught the attention of a large and diverse group. As most artillerymen recognize, there was a serious effort by the Soviets to negatively influence the deployment decision. The resulting political tension caused what must be considered a media blitz for a highly sophisticated weapon system which traditionally carries a low level of public interest.

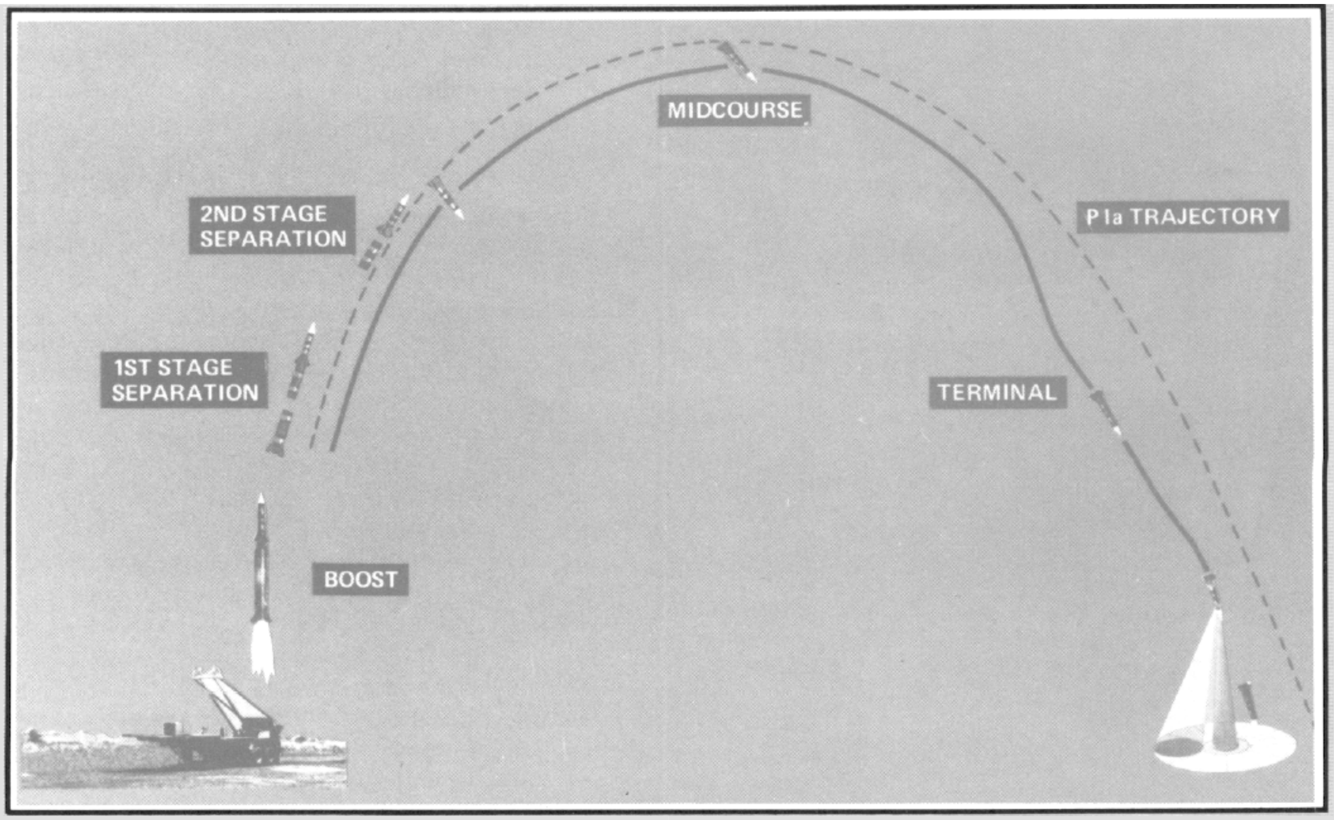
Although the Pershing II weapon system has been under development since the early 1970s, there has been little international interest in the system except for perhaps one important characteristic—its extended range.

The Pershing system has been deployed by the US in Europe since 1963 as the Army's contribution to the Theater Nuclear Force. Replacing the Redstone missile, it was developed and deployed as the field army nuclear component to complement the shorter range Honest John and Sergeant systems in support of the division and corps. It is smaller than the Redstone, is highly mobile, and uses a solid propellant. With its 400-nautical mile range, new interservice agreements were required with the Air Force since Pershing operates in the fringes of a region which previously was restricted to aircraft and strategic missile systems.

Two significant actions occurred at the time Pershing was deployed to Europe. First, theater forces were reorganized, replacing the field army with the theater army. A second significant action was tactical recognition that the Pershing missile system could offer a cost-effective alternative to aircraft which had previously provided quick reaction coverage of targets. This coverage (called the Quick Reaction Alert (QRA)) acted as a deterrent against surprise nuclear or overwhelming conventional attack of the alliance by Warsaw Pact forces; as such, Pershing gave some new and unique capabilities to the Supreme Allied Commander, Europe (SACEUR). For example, as a ballistic missile which could launch in a time frame comparable to aircraft (but have a much shorter time of flight), it could be used against time-sensitive targets and not conflict with the aircraft which would be arriving later. Additionally, the initial missile strike would increase aircraft survivability by reducing capabilities of enemy air defense systems.

Although this missile system provided an essential part of the European theater nuclear force, its ground support equipment, required for cross-country mobility, needed improvement for the QRA role. A subsequent decision to develop new ground support equipment while retaining the existing missile became the model for improving other existing weapons. Thus Pershing la, in the field today, plays a key part of the theater deterrent force as its posture on QRA sites provides a highly visible capability to respond to aggression.

The need, however, for improved systems in the theater nuclear force has continued to develop to support the national policy of flexible response to any level of aggression. Weapons currently deployed, to include the Pershing la, used relatively large yields to compensate for delivery errors and accomplish required damage levels. Since technology was available to provide the accuracy required, development of Pershing II was initiated.



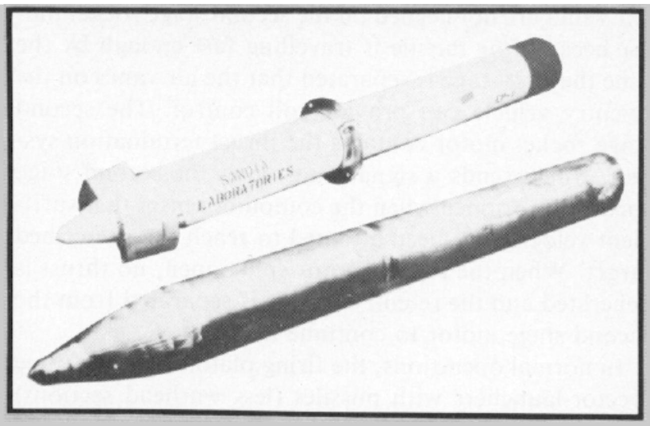
PIa-PII trajectory comparison.

The required accuracy to exploit improved ability to accurately locate targets and high effectiveness with smaller yields was accomplished by a terminal guidance system. The advanced development phase during 1974 through 1978 validated the feasibility of using terminal guidance on a missile system. Although this was the first free-world terminally guided ballistic missile, the validation was accomplished with a minimum of public attention, culminating with the firing of five Pershing la missiles with the Pershing II re-entry vehicle installed.

The guidance system for Pershing II is similar to that of the current Pershing la system during most of the missile flight. Both are inertially guided throughout the boost phase and both have two solid propellant rocket motors. Differences occur however with the separation of the re-entry vehicles from the last booster section. For example, in Pershing la the separated re-entry veicle follows a ballistic trajectory to the target without further guidance since the guidance package remains on board the booster motor. In Pershing II, the guidance package remains with the re-entry vehicle and provides inertial guidance capability through the entire trajectory to impact. The re-entry vehicle has thrusters to provide attitude control outside the atmosphere and air vanes for control once the re-entry vehicle returns to the atmosphere. It is during the final stages of the trajectory that the greatest difference between Pershing la and Pershing II becomes obvious.

The radar in the nose of the re-entry vehicle is engaged during the final portion of flight and maps the terrain in the region of the target area. The computer converts the radar image to a digital representation of the target area and then compares this "live scene" to a previously stored reference. This reference is prepared before flight by a computer from a digital representation of the entire land mass of the region. The computer in the missile can identify the target on the reference, compare the trajectory it is actually flying (determined from the live radar return), compute the adjustments necessary to hit the target, and apply these corrections through air vanes on the re-entry vehicle. This *search, compare, correct* routine is repeated several times during the final phases of the trajectory. This guidance scheme is one of the most accurate available since it guides to a live radar picture of the actual target area.

In addition to its accuracy, the Pershing II re-entry vehicle can control its final maneuvers. This capability is essential for demonstrating the feasibility of delivering one of the two warheads being developed by Department of Energy concurrently with the Department of Defense's development of the missile system. This new



Earth penetrator before and after actual firing test.

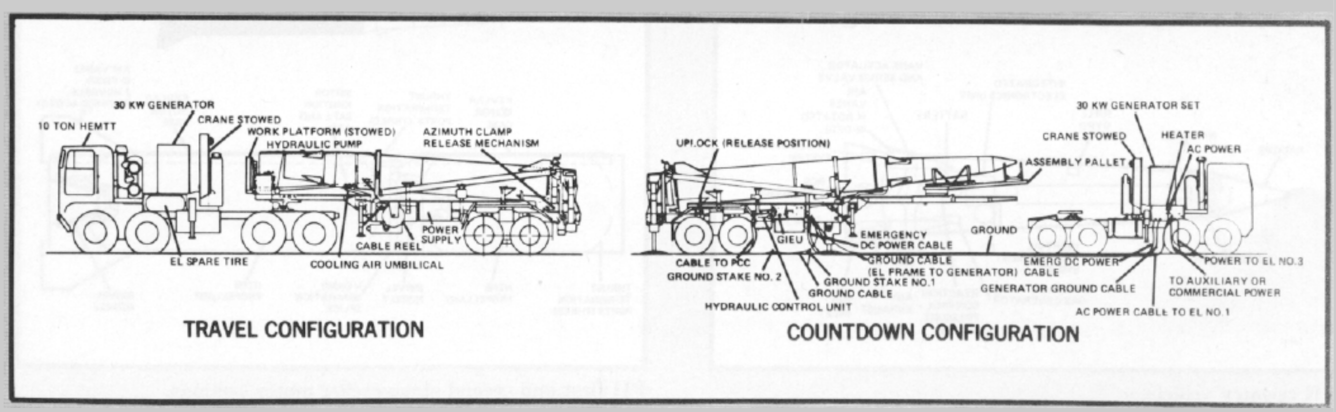
of the missile system. This new warhead penetrates deep beneath the surface of the earth before detonating and provides a capability to destroy very hard and underground targets without relying on the large surface or airburst weapons which would otherwise be required. Pershing II is currently the only free-world system which is capable of delivering this type warhead.

In late 1978, the Army completed test flights on the reentry vehicle, which demonstrated the feasibility of attaining the accuracy required for the system, and was then ready to proceed into full scale engineering development as a part of the theater nuclear force modernization program. At that time the Pershing II maximum range was still 400 nautical miles and would probably have retained its relative anonymity had it not been for two new long-range Soviet weapon systems. These Soviet weapons systems, the TU-26 backfire bomber and the SS-20 intermediate range ballistic missile, had the capability to strike NATO forces from bases within the Soviet borders. In response then to the need to upgrade the NATO long range theater forces, the Army agreed to upgrade the Pershing II to the Department of Defense range requirement of something in excess of 400 nautical miles.

With the Pershing II guidance scheme, it was possible to accomplish this range adjustment and at the same time provide the same accuracy regardless of range. The Army team went into high gear to provide an integrated weapon system which would not only provide the range and accuracy required but would also reduce the amount of equipment in the Pershing units, simplify the operational requirements, and provide the battlefield endurance required of a system which must survive the initial conflict and still be capable of providing nuclear fires when required.

The decision in December 1978, by the Department of Defense, to enter full scale engineering development of a Pershing II missile system with a range in excess of 400 nautical miles sparked the beginning of the increased public interest in Pershing. The system now in development is designed around the basic elements of the Pershing organization, erector-launcher, and firing platoon. The erector-launcher used for Pershing II is the same launcher that was fielded in 1969 and is used today for Pershing la. For Pershing II, however, the launcher will be modified to accept the new Pershing II missile and a new 10-ton tractor/support vehicle. There are three launchers in each firing platoon and each will be capable of operating independently should the need arise. A separate vehicle is required per platoon in the Pershing la missile system to transport a fire data computer and system countdown power source. Missile assembly and repair requires still another platoon level vehicle, the 5-ton wrecker. With Pershing II, these vehicles are not needed since the 10-ton tractor which pulls the semitrailer erector-launcher will also carry a 30-kilowatt generator and a material handling crane.

The Army standard diesel engine generator mounted on the tractor provides the required electrical power for the erector-launcher and the missile for both countdowns and standby power. The material handling crane provides the lift for assembly and maintenance replacement



Pershing erector-launcher modified for PII.

of missile sections. Having the crane on the tractor also eliminates the requirement for the separate small davit on the Pershing la erector-launcher. The requirement for conditioned and high pressure air to conduct countdowns has been totally eliminated so we won't need the complex Pershing power station. Thus the three Pershing II self-contained erector-launchers require fewer personnel and less equipment and improves survivability on the battlefield.

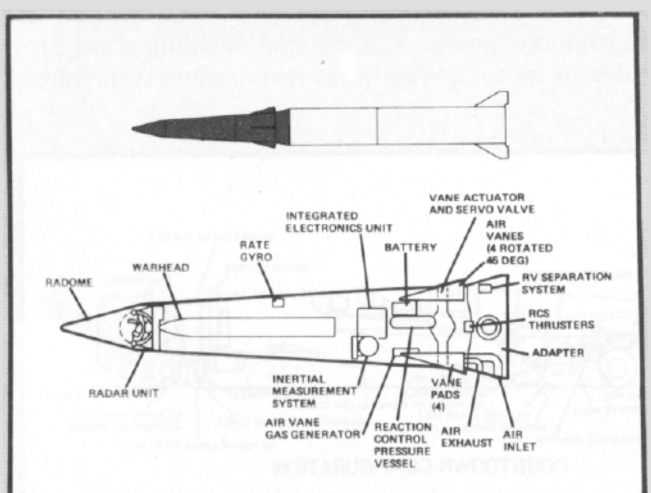
The new missile for the long range Pershing II consists of the same re-entry vehicle previously described, with only minor changes to accommodate the increased range capability, resulting in an increased time of flight, which means that electrical and pneumatic devices must function for a longer period of time.

The two new rocket motor sections use a propellant similar to the one used in the Patriot air defense system to provide the greater thrust required to achieve the increased range. The Pershing II motor sections have the same diameter and nearly the same length as their Pershing la counterparts; however, due to the increased weight of the new propellant, they weigh significantly more than Pershing la motors. To keep the total weight as low as possible, the motor cases are constructed of Kevlar, a lightweight material which is even stronger than fiberglass or steel of equal weight. Kevlar is also used for the structural walls of the missile motor sections with skirts attached at the front and rear to keep the outside dimensions smooth. The rocket motor nozzles, which are designed to provide thrust, are attached to the aft skirts and are part of the control system which also helps reduce weight. The direction of the thrust can be changed to provide up and down (pitch) and left to right (yaw) control. To guide the missile along the desired trajectory, air vanes on the first stage rocket motor provide the necessary roll control and stability in the early part of flight.

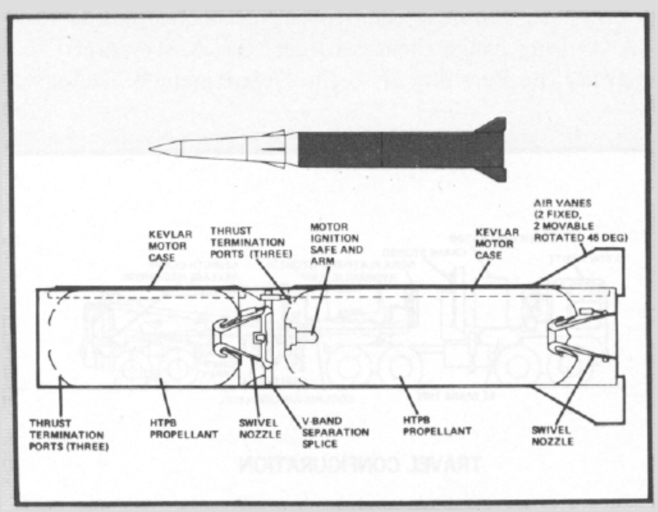
Air vanes are not needed on the second stage rocket motor because the missile is travelling fast enough by the time the first stage is separated that the air vanes on the re-entry vehicle can provide roll control. The second stage rocket motor contains the thrust termination system, which sends a signal that blows the second stage rocket motor open when the computer senses that sufficient velocity has been attained to reach the prescribed target. When the rocket motor splits open, no thrust is generated and the re-entry vehicle is separated from the second stage motor to continue its flight.

In normal operations, the firing platoon has the three erector-launchers with missiles (less warhead sections) assembled at all times. The warhead section is mated only when required by the tactical situation, such as actual combat, periods of increased tension, or a Quick Reaction Alert status during peacetime.

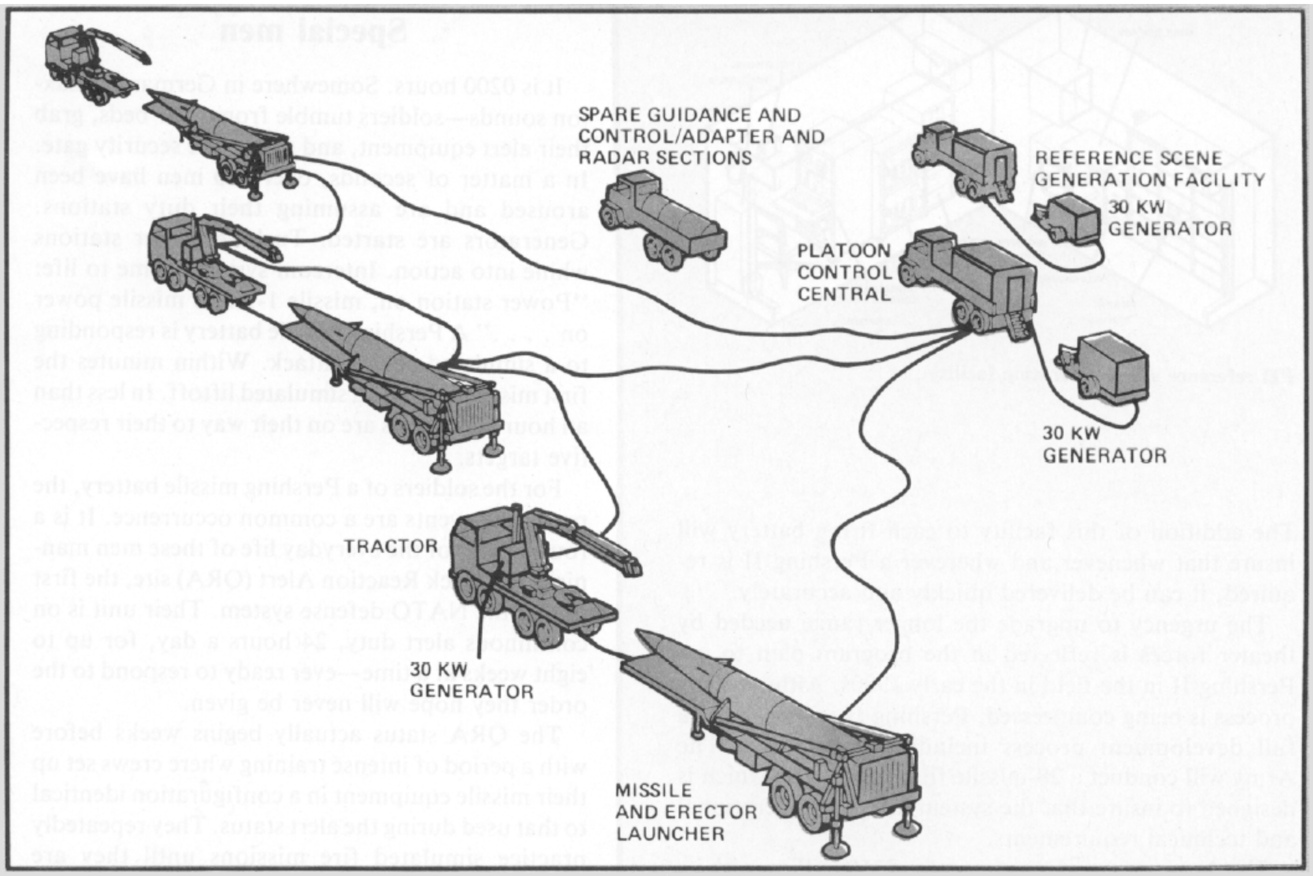
Although the erector-launchers are capable of independent operations, the usual tactical operation will be by platoon. A new piece of equipment for the Pershing II platoon—the platoon control center (PCC)—will provide the technical and operational control for platoon level operations. The PCC is based on an Army standard S-280 shelter which is designed to mount on a 2½-ton vehicle. In the Pershing II configuration, the PCC will include communications gear to receive nuclear and tactical command and control messages, control panels for technical control of countdowns, and launch control units to control the actual firing of the platoon missiles. The PCC will also contain additional operational and control equipment which will enable the platoon commander to accomplish all the required actions such as insuring that missiles are not launched until properly ordered. The PCC will be manned by three personnel—the platoon commander or officer-in-charge, the PCC operator, and the operations assistant.



PII re-entry vehicle.

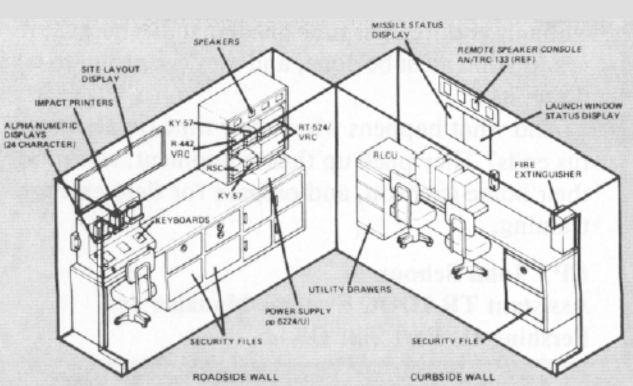


PII first and second stage rocket motor sections.



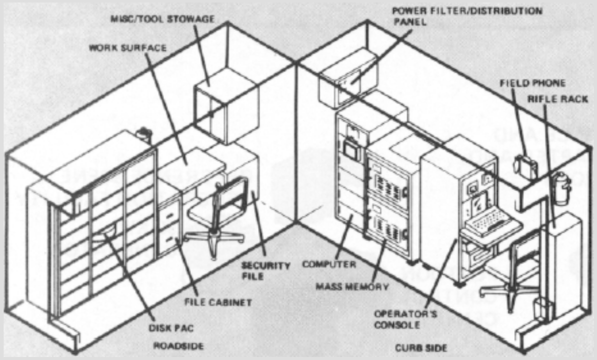
PII forward area hardware.

A fairly sophisticated computer, along with a supporting computer on the erector launcher, controls the missile flight and terminal guidance with scene matching and also controls most of the preflight operations. This computer system permits independent launcher operations and requires only one cable between the launcher and PCC which allows the platoon commander to control platoon operations from the PCC. With Pershing II, platoon reaction time is reduced in that all missiles can be counted down simultaneously rather than having to count each missile in sequence as in the Pershing la system. The Pershing II platoon package is designed to provide battlefield survivability and at the same time provide great operational flexibility.



PII platoon control center.

The only new equipment required outside the platoon for Pershing II is a new maintenance and repair van in the support unit designed to be compatible with the new equipment in the platoon. However, one additional item—the field computer system—is being developed to support Pershing II in the field. The field computer system will make the digitized reference scenes which must be inserted into the missile computer before flight to provide the radar scene matching process previously described. This facility, called the field reference scene generation facility, will supplement the fixed reference generation facility and provide the capability within the Pershing II units to fire on any target within range in a matter of minutes. This facility will not be a part of the platoon equipment, but will be collocated with one of the three platoons in the Pershing II firing battery. Reference scenes for preplanned targets will be generated in advance, but the field computer will provide the capability to update target lists, change targets, or fire on any target which may be developed during the course of the battle.



PII reference scene generation facility.

The addition of this facility to each firing battery will insure that whenever and wherever a Pershing II is required, it can be delivered quickly and accurately.

The urgency to upgrade the longer range needed by theater forces is reflected in the program plan to get Pershing II in the field in the early 1980s. Although the process is being compressed, Pershing II will undergo a full development process including flight tests. The Army will conduct a 28-missile flight test series which is designed to insure that the system meets all operational and technical requirements.

The Army executed a contract for $360 million with its prime contractor, Martin Marietta Aerospace, in 1979 for the engineering development of the Pershing II system. Procurement costs are projected to be more than double that, perhaps as much as one billion dollars; but, with the savings in personnel and equipment and the improved operational capabilities and survivability benefits, Pershing II will actually cost less in the long run when you consider the advantages it brings to the theater forces. Some advantages are:

- Sufficient range to cover the theater commanders area of interest.
- Drastically improved accuracy.
- Warhead yields small enough to significantly reduce civilian casualties while attaining military objectives.
- Earth penetrator warhead.
- Improved force reaction time.
- Savings in people and equipment.

These advantages also go a long way toward explaining why the Pershing II missile system has gained national and international interest.

MAJ Robert L. Shearer is Assistant TRADOC Systems Manager for Pershing II at Fort Sill, OK.

Special men

It is 0200 hours. Somewhere in Germany a claxton sounds—soldiers tumble from their beds, grab their alert equipment, and run to the security gate. In a matter of seconds, over 100 men have been aroused and are assuming their duty stations. Generators are started. Turbine power stations whine into action. Intercom systems come to life: "Power station on, missile 1-1 . . . missile power on . . . ." A Pershing missile battery is responding to a simulated enemy attack. Within minutes the first missile achieves a simulated liftoff. In less than an hour all missiles are on their way to their respective targets.

For the soldiers of a Pershing missile battery, the preceding events are a common occurrence. It is a routine part of the everyday life of these men manning the Quick Reaction Alert (QRA) site, the first line of the NATO defense system. Their unit is on continuous alert duty, 24 hours a day, for up to eight weeks at a time—ever ready to respond to the order they hope will never be given.

The QRA status actually begins weeks before with a period of intense training where crews set up their missile equipment in a configuration identical to that used during the alert status. They repeatedly practice simulated fire missions until they are trained and cross-trained to flawlessly perform every minute detail of missile launch procedures. Simultaneously their equipment is tested, inspected, adjusted, and polished until it is as near as possible to that ultimate state called perfection. Only then are they tested by expert personnel from Headquarters, 56th Field Artillery Brigade, to insure that their equipment and training proficiency meet the stringent standards demanded of their critical mission.

These are proud men, who work diligently at their daily tasks, because they know the importance of their duty and gain satisfaction in the knowledge that they are directly influencing world peace. They willingly endure their time on alert status because it is a job that must be done, and they are proud to be doing it.

And what happens when their time on alert status ends? They pack up their equipment, return to their home garrison, and prepare for field exercise training.

CPT John Schoor
Assistant TRADOC Systems Manager for
Pershing II, Fort Sill, OK

REDLEG NEWSLETTER

Changes to officer Centralized Command Selection System

New policies and procedures have recently been established to allow more flexibility and field commander involvement in the lieutenant colonel and colonel-level Centralized Command Selection System (CCSS). The major changes include adjustments to the command tour length and provide the major Army commanders (MACOMs) with options in tour length and increased participation in the field grade command slating process.

Command tour length in both the continental United States and overseas long-tour areas will be 30 months for those officers assuming command during FY80 and thereafter. Additionally, MACOMs will have authority to extend or curtail field grade commanders up to six months for reasons such as timing of training, inspections, tests, and facilitating follow-on assignments. The command tour length in overseas short-tour areas, both accompanied and unaccompanied, will remain unchanged. Officers who command battalions in short-tour areas who are subsequently chosen for brigade command will not command again in a short-tour area.

The MACOMs also will have a significant role in slating field grade commanders. Department of the Army will provide each MACOM with recommendations for the assignment for each officer selected for their projected command vacancies; however, the final decision rests with the MACOM commander. Other policies and procedures established include:

• Continued centralized selection of lieutenant colonel- and colonel-level commanders.

• Early assignment of command selectees to installations where they will command.

• Notification of primary and alternate selectees of command selection through MACOM channels.

• Publication of command selection lists subsequent to notification of officers by MACOMs.

• Requirement for officers to state command desires when selected for promotion to lieutenant colonel and colonel.

• Requirement for designees not desirous of command to formally decline within 30 days following notification.

Army openings for ex-officers

In an attempt to acquire additional company grade officers, the Army is offering some individuals an opportunity for return to active duty.

Separated officers in basic year groups 1973 through 1980 who hold specialties monitored by the Officers Personnel Management Directorate (OPMD), MILPERCEN, may apply for return to active service. (This does not include officers in the Chaplain Corps, Judge Advocate General Corps, Medical Department, or other specialty branches.)

The program is also open to ROTC officers who have never served on active duty and to officers who left the service because of a reduction in force (RIF). Active duty enlisted soldiers who have a reserve commission may also apply as long as they have less than 10 years active service.

Those officers selected for return to duty will incur a three-year active duty obligation. Those who accept active duty will be able to compete for voluntary indefinite status or RA, if they are otherwise qualified.

For more information, check chapter 3, AR 135-210. Applications must be sent through channels to Commander, US Army Reserve Component Personnel and Administration Center, ATTN: AUGZ-RCA-AD, 9700 Page Boulevard, St. Louis, MO 63132.

New SBP rules for Reservists

Families of eligible Reservists who died after 1 October 1978 before choosing an option under the Reserve Components Survivor Benefit Plan (SBP) (Public Law 95-397) may now be eligible for an annuity, according to a recent announcement by the Office of the Secretary of Defense.

Because of the delay in implementing the program, DOD officials believe that a number of eligible Reservists may have died before getting a chance to participate. For this reason, the Secretary of Defense has ruled that their survivors are qualified to receive an annuity under the plan.

Survivors are eligible if the Reservist:

• Was eligible to participate in the Survivor Benefit Plan on or after 1 October 1978.

- Died on or after 1 October 1978.
- Did not get a chance to elect an SBP option.
- Did not execute a statement of intent to participate under the deferred annuity plan.
- Did not already decline to participate.

This annuity is available to the late Reservist's spouse or to children under 18 (under 23 if they are students) if the spouse is also dead. Survivors have the option of receiving a reduced annuity immediately or waiting until the 60th anniversary of the deceased member's birth for full payment.

If the eligible Reservist executed a statement of intent before passing away, the annuity will be awarded under terms of that intent.

Those who believe they may be eligible for an annuity should contact the Commander, US Army Reserve Components Personnel and Administration Center, ATTN: AGUZ-RAS, 9700 Page Boulevard, St. Louis, MO 63132.

Army enlisted promotion criteria, FY80

For promotion to:	Minimum time in service	Minimum time in grade (Note 1)	Selection method	Selection level	Frequency of selection	Level of qualification
Grade E2	6 mo. (Note 2)	-----	Commanding officer	Unit	Daily/monthly	Fully qualified
Grade E3	12 mo. (Note 3)	4 mo.	Commanding officer	Unit	Daily/monthly	Fully qualified
Grade E4	24 mo. (Note 4)	6 mo.	Commanding officer	Unit	Daily/monthly	Fully qualified
Grade E5	36 mo. (Note 5)	8 mo.	Semi-centralized	Local selection	Monthly	Best qualified by MOS
Grade E6	7 yr. (Note 5)	10 mo.	Semi-centralized	Local selection	Monthly	Best qualified by MOS
Grade E7	None. Considered in determining zone	As announced in zone	DA board	Dept of Army	Annually	Best qualified by Career Management Field
Grade E8	None. Considered in determining zone	As announced in zone	DA board	Dept of Army	Annually	Best qualified by Career Management Field
Grade E9	None. Considered in determining zone.	As announced in zone	DA board	Dept of Army	Annually	Best qualified by Career Management Field

Notes: 1. May be waived by one-half.

2. Accelerated advancements permitted within percentage constraints for those with four but less than six months time in service.

3. Field commanders may promote soldiers with less than 12 months; limited to a percentage of assigned and attached E3.

4. Field commanders may waive to 15 months; limited to a percentage of assigned E3 and E4 who have at least 15 months but less than 24 months time in service.

5. Meet eligibility criteria and attain local list status based on 1,000 point standardized scoring system. Soldiers who meet the minimum time in service requirement are placed in the primary zone, and (hose requiring a waiver are placed in the secondary zone. Each month available promotions are determined by DA, and cutoff scores are then announced allowing that number of promotions to be made. Soldiers with the highest number of points in each MOS and zone (primary or secondary) will receive available promotions. E5 waived here at least 24 months but less than 36 months. E6 waived have at least 60 months but less than 84 months.

Board schedule

Selection boards (other than general officer) remaining in FY80 are tentatively scheduled as follows:

Project Manager	27 May - 28 May 80
CSM & CSM Retention*	3 Jun - 20 Jun 80
COL, RA, APL & CH	10 Jun - 27 Jun 80
CPT, AUS, APL	1 Jul - 25 Jul 80
SSC Screen	8 Jul - 8 Aug 80
US Army Sgts Maj Acad*	15 Jul - 11 Aug 80
CW 2/3/4/, RA	22 Jul - 30 Jul 80
CSC Screen	22 Jul - 29 Aug 80
E9 Selection*	3 Sep - 19 Sep 80
SSC Select	16 Sep - 17 Oct 80
CSC Select	23 Sep - 30 Oct 80

*Conducted at Fort Benjamin Harrison, IN

New Ready Reserve terminology

The Ready Reserve is divided into three major categories: Selected Reserve Units; Pretrained Individual Reservists; and the Training Pipeline.

• *Selected Reserve Units (SRU)* are those organized to serve as units upon mobilization.

• *Pretrained Individual Reservists (PIR)* includes trained individuals who have completed initial training and are not members of Selected Reserve Units. These augment Active or Reserve Units as fillers or replacements upon mobilization.

• *Ready Reserve Training Pipeline (TP)* consists of all Ready Reservists who have not yet completed initial active duty for training.

There have been numerous changes during the past year in the meaning of various terms applied to the Reserve Components (RC). The above list is not complete, but US Army Reserve officers should become familiar with the changes for they are intended to simplify understanding and improve management of the Ready Reserve.

FA accessions

Based upon United States Military Academy, Reserve Officers' Training Corps, and Officer Candidate School branch selections, the following statistics represent the Field Artillery's "share" of 1980 year group accessions:

Category	Males	Females	Total
ROTC (RA)	167	9	176
USMA	158	7	165
ROTC (other than RA)	413	21	434
OCS	213	7	220
	951	44	995

USAR retirement entitlement

"How much will I get when I retire?" is a question that few USAR officers are able to answer. Computing retirement points and figuring point value and the like are difficult to say the least. The Retired Officers' Association, 201 N. Washington Street, Alexandria, VA 22314 has a booklet which provides comprehensive information on Reserve retirement entitlements. The booklet, "Reserve Retirement Benefits," is free on request.

Commanders Update

LTC John C. Cartland
1st Battalion, 3d Field Artillery

LTC Richard Cunningham
4th Battalion, 4th Field Artillery

LTC Lenard L. Shlenker
2d Battalion, 11th Field Artillery

LTC Donald K. Griffin
1st Battalion, 13th Field Artillery

LTC Jerome R. Andersen
3d Battalion, 13th Field Artillery

LTC Elbridge W. Terry
3d Battalion, 19th Field Artillery

LTC Columbus Womble
3d Battalion, 34th Field Artillery

LTC Daryl Garner
2d Battalion, 35th Field Artillery

LTC David L. McKee
1st Battalion, 36th Field Artillery

LTC Max R. Barron
2d Battalion, 36th Field Artillery

LTC Ned W. Bacheldor
3d Battalion, 37th Field Artillery

LTC Ronald D. Steinig
1st Battalion, 38th Field Artillery

LTC Myron F. Curtis
1st Battalion, 41st Field Artillery

LTC Frederick Vanhorn
2d Battalion, 42d Field Artillery

LTC John F. Bahm
1st Battalion, 79th Field Artillery

LTC Robert F. Helms
1st Battalion, 319th Field Artillery

LTC Harold W. Nelson
2d Battalion, 377th Field Artillery

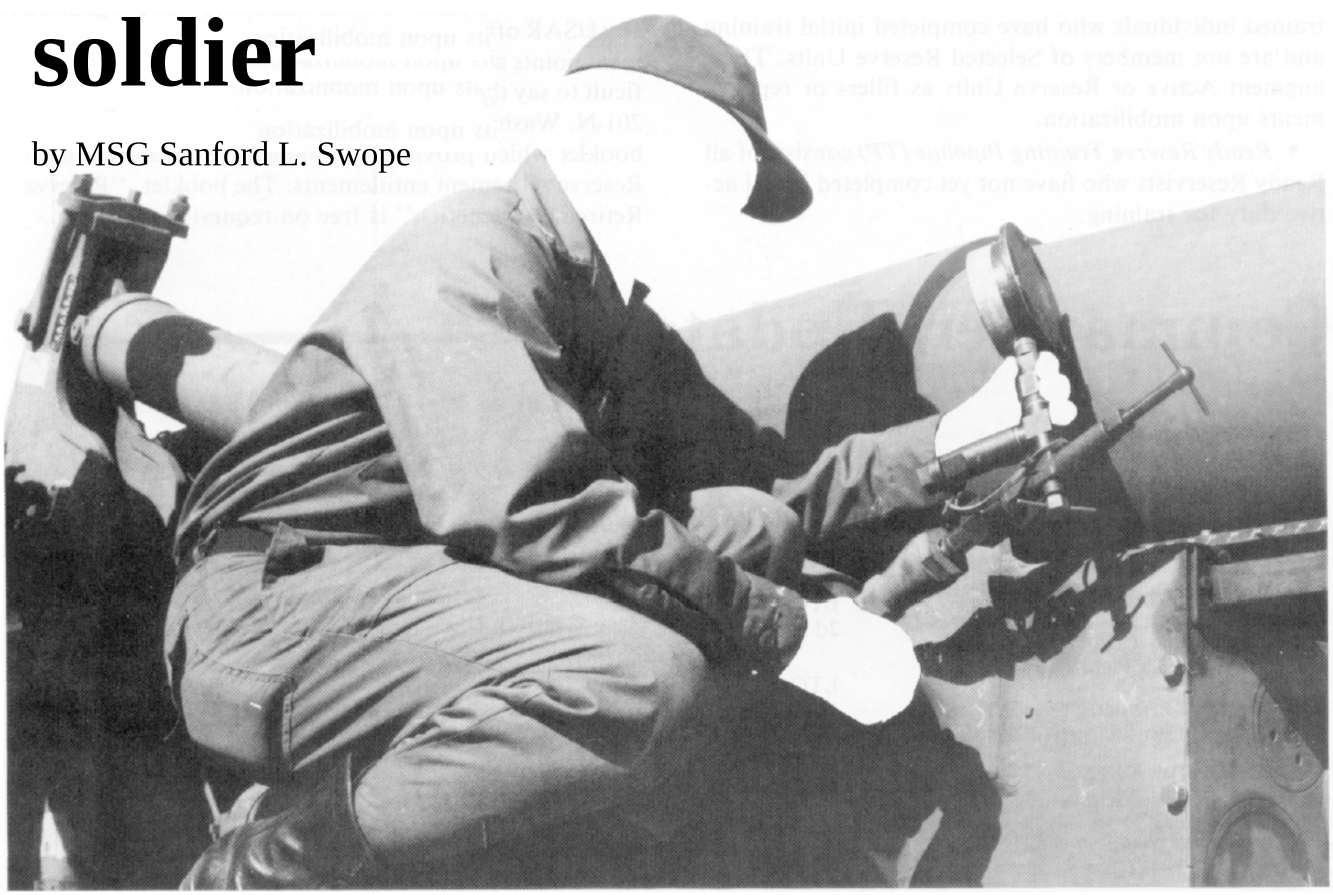
LTC Duane H. Myers
2d Cannon Training Battalion

LTC Richard Tragemann
3d Cannon Training Battalion

As pointed out in recent issues of the *Journal*, the Field Artillery must be able to assume an ever-increasing role on the modern battlefield. Here our sophisticated artillery weapons must be capable of delivering highly versatile support to the maneuver commander—but that capability can only be achieved if the equipment is properly maintained. During visits to field units, personnel of the US Army Field Artillery School discovered that some artillery units had serious maintenance problems—one of the reasons was the lack of school-trained Field Artillery Weapons Mechanics (MOS 13BU6). Well, where are these trained soldiers? Perhaps some of them may be "under cover" in your units.

Your artillery mechanic . . . the invisible soldier

by MSG Sanford L. Swope



What is an artillery mechanic?

A Field Artillery weapons mechanic is first an artilleryman since he or she receives the same basic training as all other 13Bs. However, prior to graduation and permanent assignment, some artillerymen are selected by DA Military Personnel Center (MILPERCEN) to receive additional training such as the five week FA Weapons System Mechanic's Course (FAWMC) at Fort Sill. Soldiers selected for the FAWMC receive intensive training in several areas. Basically, the course is organized as follows:

- Days 1-4: Course introduction, The Army Management System (TAMMS), publications, shop safety, and organizational repair parts supply procedures.
- Days 5-11: M102 and M114A1 howitzers—barrel and breech, carriage recoil mechanism, lubrication and inspection, and sight test and adjustment.
- Days 12-18: M109 system—cab and cab hydraulics, turret electrical checks, rammer, recoil, traverse and elevating mechanisms, barrel and breech, sight tests and adjustments, lubrication, and inspection.

• Days 19-25: M110 system—turret hydraulics, loader rammer, recoil spade system, recoil mechanism, barrel and breech, elevating and traversing, sight test and adjustment, lubrication, and inspection.

Upon completion of the course, the soldier should be capable of performing most organizational maintenance tasks peculiar to the armament and turret of the howitzer. The individual is then awarded an Additional Skill Identifier (ASI) of U6 which is annotated on official military personnel records.

Where are the artillery mechanics?

During calendar year 1979, approximately 160 artillerymen were trained at Fort Sill as FA weapons mechanics and subsequently awarded ASI U6. A records check indicates worldwide distribution of these soldiers; yet field commands continue to insist that they do not have sufficient FA weapons mechanics. Where then are these missing soldiers?

The answer to that question may lie in an examination of the Enlisted Personnel Management System. First-term soldiers are managed primarily in accordance with their PMOS and enlistment contracts. Assuming that the conditions of the enlistment contract are met, soldiers can be managed by the Additional Skill Identifier, but this requires a special effort. Additionally, the relatively low visibility of the U6 ASI coupled with the low density of soldiers holding that ASI may compound the problem. Finally, the U6 ASI is only valid through grade E4; therefore, soldiers promoted to E5 lose the U6 ASI.

Each year FA Weapons Mechanics are trained and sent to the field, but commanders continue to complain of shortages. Weapons Department, USAFAS, is currently polling all Active Army cannon units to determine the distribution of these mechanics. It is suspected that some units have an overage of artillery mechanics and are using them as 13B10s to fill undermanned howitzer sections; consequently, sister units are unable to fill their mechanic slots. There is also evidence suggesting that some units receiving 13B10U6 soldiers are not aware of the training received by the soldier.

What are the commander's alternatives?

The search for the FA weapons mechanic must begin at battery level. Obviously no commander wants to give up an effective soldier, but trained mechanics must be put to work maintaining our equipment. Appropriate assignment/cross leveling should be effected at div arty/group level and excesses reported. Additionally, shortages should be given the same requisition urgency/visibility given to PMOS specific mechanics (e.g., 63C), particularly in overseas units.

Our FA units have the ability to "help themselves" if they are short of FA weapons mechanics. If a unit is willing to provide TDY funds, it may contact the Directorate of Course Development and Training (DCRDT), Fort Sill, and request official sit-in spaces for mechanical training. Soldiers trained as sit-ins are qualified for award of the U6 ASI. Prerequisites for soldiers attending the course are:

- Must be qualified as a 13B.
- Have nine months or more remaining in service after completion of the course.
- Score of 100 in aptitude area FA and 95 in GM.
- Be in grades of E1 through E4.

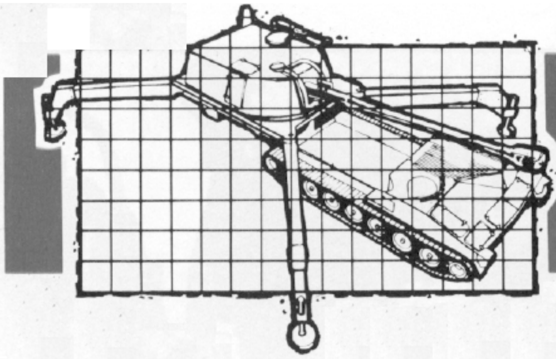
FAWMC student checking the hydraulic oil level on an M110A1 howitzer.

Is there relief in sight?

The advent of the Master Mechanic Program currently scheduled for implementation in October 1980 should solve the identification/training/distribution dilemma of the FA weapons mechanic. Artillery mechanics trained under the Master Mechanic Program will be awarded PMOS 45D10 and will be managed accordingly by MILPERCEN. Management by MOS rather than ASI should give more positive control and be more responsive to field needs than the current system.

Until this new training program is in full production, units may continue to suffer from the lack of properly trained personnel. The mission of the Field Artillery is a "today mission," and there is a need to shake the trees until those soldiers who already have the skills of the FA weapon mechanic fall out. Find them and put them to work!

MSG Sanford L. Swope is assigned to the Cannon Division, Weapons Department, USAFAS.



FA Test and Development

design • development • testing • evaluation

Enhanced Self-Propelled Artillery Weapons System (ESPAWS) study underway

Current Field Artillery cannon weapons systems exist as evolutionary products of WWII technology, and, while continuing improvements can be realized, the flat of the improvement curve is rapidly being reached. Accordingly, beginning in January-February 1979, studies were initiated in an effort to quantify existing system deficiencies in a 1990-2000 time frame and to conceptualize a system which would not only offset these deficiencies but would also, by capitalizing on current and anticipated technology, provide significant improvements in all areas.

Therefore the objective of ESPAWS, by definition, is not merely a new/improved firing platform design, but is also an FA systems analysis intended to identify ways and means of achieving the effect of additional weapons on the battlefield without necessarily increasing the number of delivery systems and/or manpower and, simultaneously, to improve operational availability and survivability. Ongoing studies include those to significantly improve the M109 howitzer, to evaluate foreign systems and technology, and to conceptualize a totally new system. Desired system characteristics will include:

- Automated fire control, loading, and ammunition handling.
- On-board position and direction determination.
- Interface with distributed data systems.
- On-board diagnostic equipment.
- Reduced manpower requirements.
- Improved reliability and lower repair times.
- Improved mobility and agility.
- Range of 0-30 kilometers beyond the line of contact.
- Increased maximum and sustained rates of fire.
- Improved hit/kill probabilities.
- Full operational capability in CBR and ECM/ECCM environments.

These characteristics, if realized, will allow employment of a random artillery force, providing fires on an area basis. Serviceability will be enhanced via random piece positioning (no battery groupings) and "shoot and scoot" tactics. Effectiveness will be enhanced by employment of the optimum number of guns per mission and "real time" responsiveness.

One-year concept definition contracts let in the fall of 1979 to Pacific Car and Foundry Company and FMC Corporation are progressing through concept definition, technology payoff identification, system benefits descriptions, and trade-off analysis. First quarter progress reports were rendered as of 28 February 1980. Norden Systems is evaluating M109 howitzer product improvement potential with first quarter status reported in April 1980. Foreign systems and technology are being evaluated by the US Army Armament Research and Development Command for future consideration. The Mission Element Needs Statement (MENS) was approved by DA in February this year and is currently being staffed by the Office of the Secretary of Defense (OSD). When approved by OSD, the MENS will serve as milestone zero (program initiation) in the materiel acquisition process and as an authorization for further study.

Analysis of the M109

Norden Systems of Norwalk, CN, under a $1 million contract from the Army Armament Research and Development Command is conducting an extensive analysis of the M109 155-mm self-propelled howitzer to improve the weapon system's overall effectiveness.

According to Norden representatives, studies of the more than 20-year old weapon will focus on command, control, communications, ammunition resupply, firepower, survival of the weapon on the battlefield, and crew reduction.

New Copperhead product manager

LTC Fred T. Mullens, formerly assigned as commander of the Ammunition Complex at Akizuki, Japan, has succeeded LTC Robert A. Nulk as product manager of the Copperhead cannon-launched, laser-guided projectile.

Lieutenant Colonel Mullens will report directly to the Project Manager-Joint Project Manager for Cannon Artillery Weapons Systems/Semi-Active Laser Guided Projectiles at the US Army Armament Research and Development Command.

New manager for Firefinder

COL John S. Chesbro recently became Project Manager for Firefinder, the Army's mortar and artillery locating radars program, the Platoon Early Warning System (PEWS), and the Remotely Monitored Battlefield Sensor System (REMBASS). These programs come under the direction of the Army Electronics Research and Development Command (ERADCOM), Adelphi, MD.

New bore cleaner available

A new product, now available to units through the national military supply system, not only breaks loose grit, rust, salt, etc. from metal surfaces but also lubricates and preserves them by providing a long-lasting thin film protective coating. This new product, called Break-Free CLP (cleaner-lubricant-preservative), is produced by the SAN/BAR Corporation of Santa Ana, CA.

Break-Free CLP has been tested on several weapons to include the M110 series 8-inch howitzers. Artillerymen at Fort Sill field-tested this product on the M110A1 8-inch howitzer and are "sold" on the item. SSG James L. Davis, platoon sergeant of A Battery, US Army Field Artillery Training Center, said: "Repeatedly this product has proved to be worth its weight in gold, in that it takes only a small amount to clean, lubricate, and preserve the tubes on the M110A1 8-inch howitzer and less time and energy to perform the required maintenance after firing. Recently, all eight M110A1 howitzers were borescoped by the 226th Maintenance Company. Many laudatory comments were made as to the outstanding condition of all eight howitzer tubes."

Break-Free was first used to clean primer vent holes, which ordinarily clog up with hard residue after seven or eight rounds, requiring the use of a mechanical reamer. Not only did the solution do the cleaning, but it also extended the time for the next cleaning to 17 or 18 rounds.

The moisture-displacing film deposited by the Teflon-based Break-Free compound is less likely to break down under heat and pressure as have other oils and lubricants. Nor does it attract dust, grit, and powder residue, a principal limitation of other lubricants and penetrating oils.

Nomenclature for ordering Break-Free CLP is as follows:

Item	Unit of issue	NSN
Break-Free CLP-7 liquid	Gallon	9150-01-053-6688
Break-Free CLP-5 liquid with trigger/sprayer	Pint	9150-01-054-6453
Break-Free CLP-1 liquid	1 oz bottle	9150-01-079-6123
Break-Free CLP-4 liquid	4 oz bottle	9150-01-079-6124
Break-Free CLP-3 aerosol	16 oz can	9150-01-079-6125
Break-Free CLP-2 aerosol	3 oz can	9150-01-079-6126

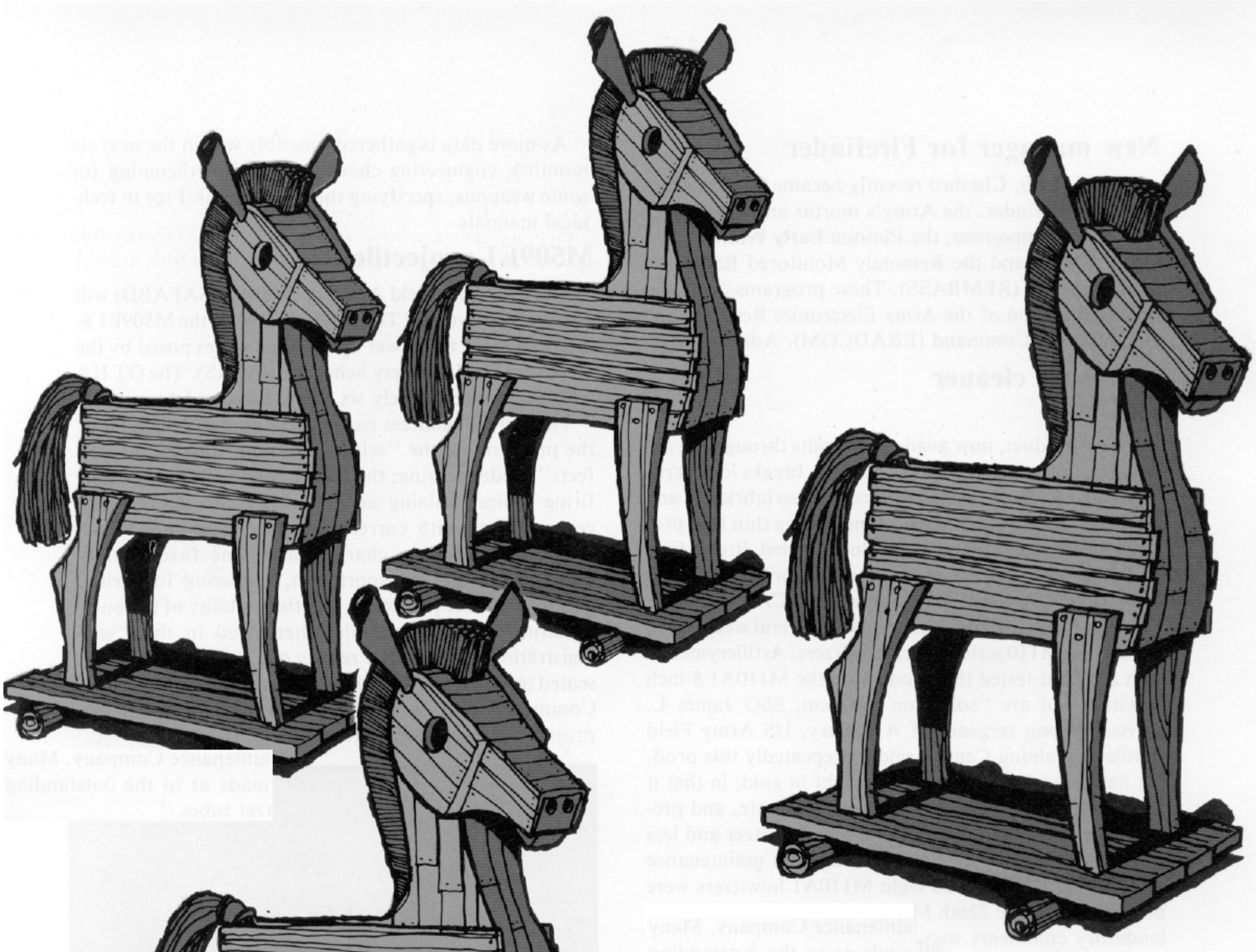
As more data is gathered (possibly within the next six months), engineering changes will be forthcoming for some weapons, specifying the use of Break-Free in technical manuals.

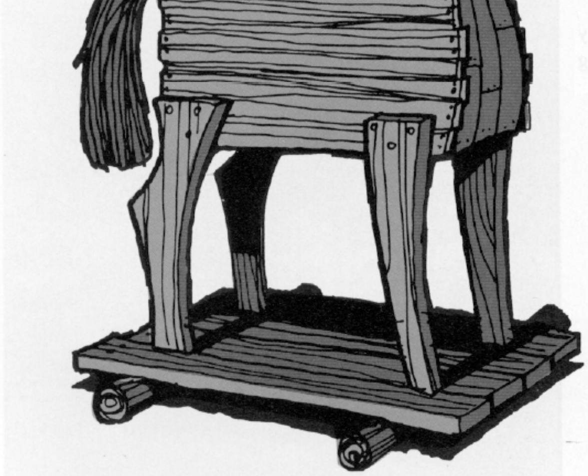
M509E1 projectile test

The US Army Field Artillery Board (USAFABD) will conduct Operational Test IIA (OT IIA) of the M509E1 8-inch projectile to answer operational issues posed by the US Army Field Artillery School (USAFAS). The OT IIA will take approximately six weeks to complete.

The test will address issues pertaining to reliability of the projectile in the "self-registration" mode and "effects" mode of firing; the accuracy and adequacy of the firing tables; training and maintenance requirements; compatibility with current and developmental 8-inch weapons, propelling charges, and time fuzes; safety during handling, transportation, preparing for firing, and firing of the projectile; and the visibility of the burst signature of the projectile when fired in the "self-registration" mode. The results of OT IIA will be presented to Headquarters, US Army Training and Doctrine Command, and to USAFAS for evaluation of the projectile's operational effectiveness.

The Republic of South Africa has recently added a new 155-mm towed howitzer to its arms inventory. The "G-5" shown here is air transportable and replaces the 25-pounder and 5.5-inch guns currently in service. As with other new towed artillery systems the "G-5" has an auxiliary motor which allows limited movement without its prime mover.





by Col (Ret) J. Tuck Brown

Wars are won by a combination of many factors and, because our most probable enemy outnumbers us in both men and weapons, we must fight with intelligence as well as brawn. Some factors like "cover and deception" operations greatly favor the smart fighter and, since countersurveillance plays a major role in cover and deception, an understanding of countersurveillance is essential to leaders at every level. The purpose of this article is to take a fresh look at the subject without unnecessarily repeating commonly known information. Particular emphasis is placed upon information of interest to professional artillerymen.

Countersurveillance

Countersurveillance planning

Four of the commonly recognized principles of war form a basis for countersurveillance planning:

- **Surprise**—We should strive to bias or confound the enemy (make him think we are where we are not or make him unsure as to our location).
- **Security**—A high proportion of critical strengths, such as our field artillery, must survive.
- **Economy**—Countersurveillance measures for each phase of an operation should be planned in advance and should incorporate the most cost-effective combination of means (deception, proper siting, passive blending, smoke, active measures, and neutralization) for that phase.
- **Simplicity**—The countersurveillance portion of the cover and deception plan must be easy to understand and to implement.

Perception

Various levels of perception (with examples) from low to high are:

- Detection (noticing an object).
- Recognition (ability to tell whether the object is a tank or a truck).
- Identification (ability to know whether an object is a T72 or an M60 tank).
- Discrimination (ability to distinguish between an M60 tank and a decoy).

Table 1 shows estimates of the relative resolution required of a scanning sensor (the higher the number, the better the sensor must be) for various levels of target perceptibility/discriminability. (Both distance and viewing time are held constant.)

Table 1 illustrates quantitatively that stationary objects can be *detected* relatively easily, but that recognition, identification, and decoy discrimination get progressively more difficult.

The relationships shown in table 1 are complicated by motion and/or glint (areas of increased backscatter or glare). As we know, the human eye detects a moving object more quickly than one which is stationary. However, a radar can detect a moving target more easily than a stationary target. Glint (caused by the sun striking a windshield, etc.) may be generated by moving either the sensor or the target. At radar frequencies the cross section of a truck may vary from 30 to about 3,000 m (within a very narrow field of view around the broadside aspect). This means that a radar on a moving platform which passes the truck can pick up a sudden significant signal increase. This glint tends to catch the operator's attention, and thus the truck is easily detected. However, motion or glint do not necessarily make recognition, identification, and decoy discrimination easier. Therefore, when motion or glint is involved, detection may be a hundred times easier than decoy discrimination.

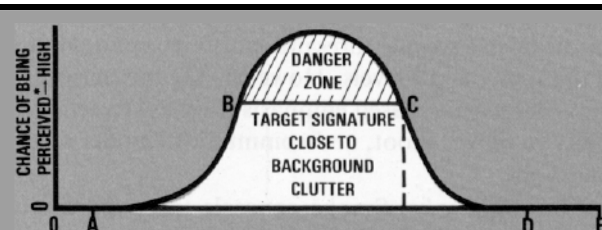
Table 1. Estimates of relative resolution required of a scanning sensor viewing stationary objects.

Levels of perceptibility/discriminability	Relative resolution required
Detection	1
Recognition	4
Identification	7
Discrimination—decoys vs item	14*

*This value is for a low-fidelity decoy. The number would be greater for a high-fidelity decoy.

Signal-level relationships

One way to visualize the relationships among sensor, target, and backgrouund is by the signal-level relationships shown in figure 1. This figure is generalized in that it applied to all sensors (visual, infrared, radar, etc.). The size of the "danger zone" in figure 1 varies with each sensor according to the conditions which affect that sensor. For example the danger zone becomes quite small if we are countering the eye at night or an infrared sensor during a rainstorm.



RELATIVE SIGNAL LEVEL AT EYE OR OTHER SENSOR – VERY HIGH

Legend:

O-A—Below minimum detectable signal (safe).
A-B and below the line B-C—Background clutter and target reflectance/emittance do not differ significantly (safe zone).
B-C above the line—Target reflectance/emittance differs significantly from background clutter (danger zone).
C-D—Temporary sensor incapacitation (spots before eyes, sensor saturation) (safe zone).
D-E—Permanent sensor damage (blindness, crystal burnout, etc.) (safe).
***Includes appropriate levels of detection, recognition, identification, and discrimination (decoy versus item).**

Figure 1. Chance of being perceived versus signal levels and background.

Countersurveillance measures

A great deal of judgment should be exercised when deciding which combination of countersurveillance measures is most appropriate. The measures used should

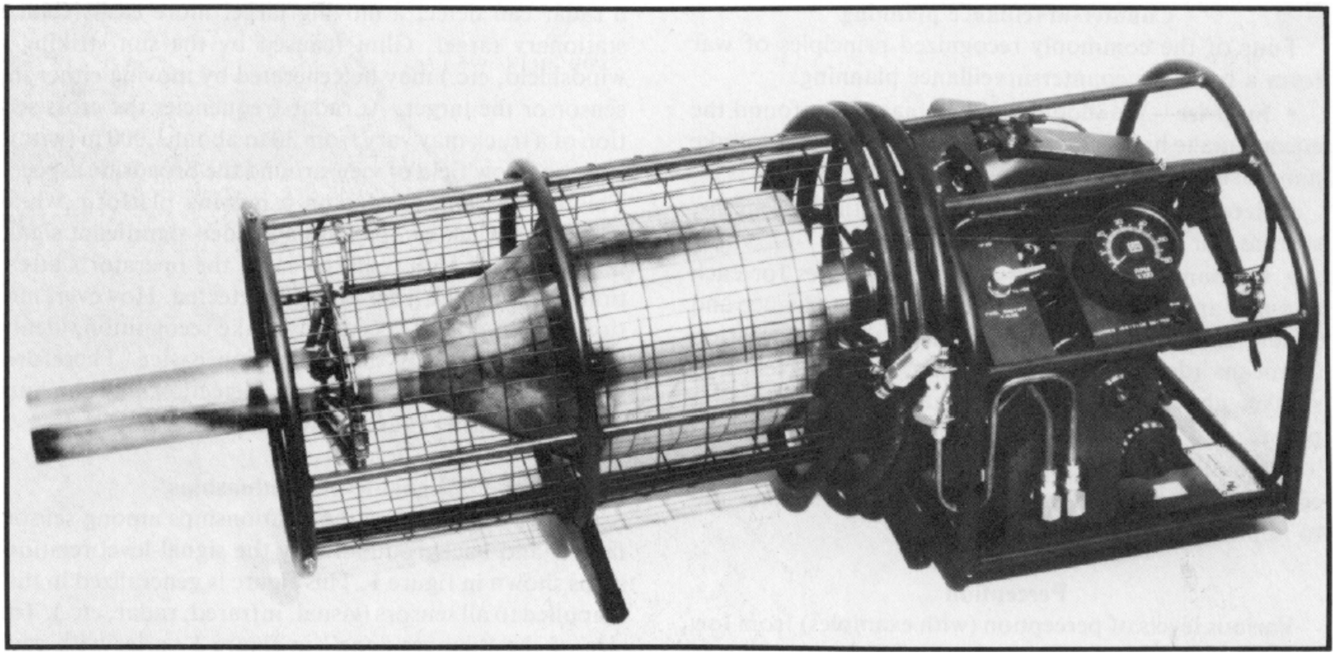


Figure 2. Lightweight (approximately 70 pounds) smoke generator being considered for use by the Army for large-area screening.

be cost effective, varied (to confound as many of the enemy as practicable), and coordinated with the overall operations plan (timing is all important to countersurveillance measures). Proper siting, passive blending (to include netting and disrupters), and neutralization of sensors by fire are measures presently given due emphasis by the Army at all levels. However, the measures listed below deserve increased emphasis if we are to retain our ability to move, shoot, and communicate under adverse conditions:

• *Use of smoke.* Smoke conceals target parameters and, if a large-area screen is used, even the existence of the target. Sufficient smoke will keep the target out of the "danger zone." For many situations a large-area smoke screen is by far the most cost-effective protection measure; e.g., to protect a pontoon bridge across a river or to screen an area containing activity (such as artillery firing) or an area where we want the enemy to think there is or soon will be significant activity. Proper use or large-area smoke could, for example, allow an artillery firing battery to move across open areas and into a position on a desert or flat plain and shoot without fear of visual observation by the enemy. Also depending on the tactical needs at the time, the artillery unit could come quite close to the forward edge of the battle area and thus engage targets further behind enemy lines. A lightweight (about 70-pound) smoke generator being considered by the Army for use in large-area screening is shown in figure 2.

• *Deception by use of decoys and disguises.* Deception is one of the most cost-effective countermeasures. Compared to detection, recognition, or identification, decoy discrimination is quite difficult for the enemy (table 1); therefore we should use numerous inexpensive decoys. Testing has determined that making decoys of field-expedient materials (figure 3) is expensive and time consuming and the resulting decoys are heavy and difficult to move. The most cost-effective way to make a decoy was determined later in a study involving "a tank" and "a towed howitzer" and in practical applications with the OH-58A helicopter and the M109A1, 155-mm self-propelled howitzer. The decoy concept found to be most

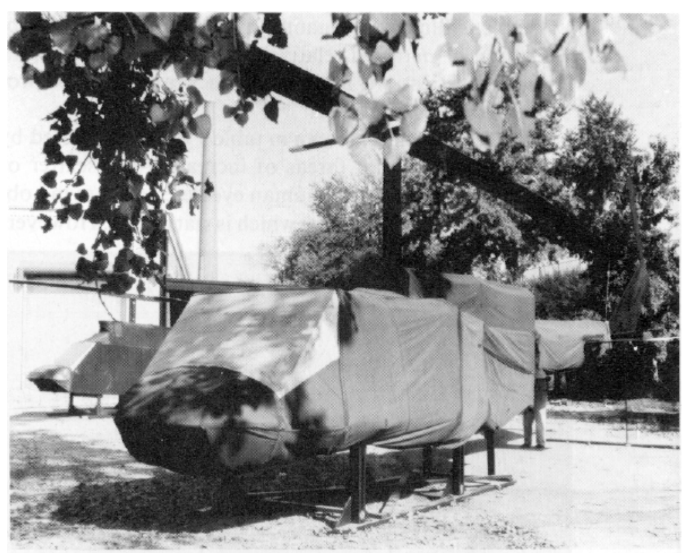


Figure 3. UH-1 helicopter decoys made of field-expedient materials.

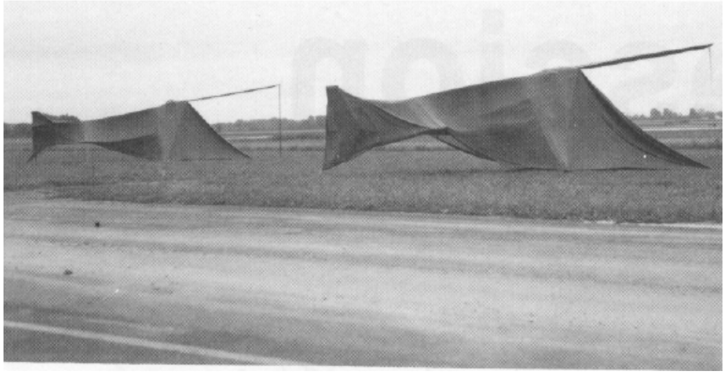


Figure 4. Complementary Blending/Disguise/Decoy Kits for OH-58A helicopter (at 25 meters). The Blending/Disguise Kit on the right covers a real OH-58A and weighs only 14 pounds. The decoy kit on the left weighs 34 pounds. Time required to deploy and stow is 15 minutes for the decoy kit and 10 minutes for the disguise kit.

cost effective was to use Complementary Blending/Disguise/Decoy Kits which included both decoy and disguise materials (the latter are applied to the real item). The design approach used in the complementary system is to fabricate a low-cost, easily erected decoy, and at the same time apply materials to selected portions of the real item so that it resembles the inexpensive one shown in figure 4. Both the decoy and disguise kits incorporate passive blending, and both can be made effective in infrared and radar frequencies as well as visual. The uncertainty as to whether objects are real slows down enemy photo interpreters and tends to confound enemy intelligence agencies and enemy pilots in ground-attack aircraft. Properly designed kits are easy to install and repackage for rapid emplacement and if mass produced would be inexpensive, lightweight, and durable. As to counter such techniques the enemy would be forced to either use more sophisticated sensors, observe from a closer range, or search for a longer period of time.

• *Increasing (by active or passive means) the significance of background clutter to approximate target reflectance/emittance.* This makes targets more difficult for the enemy to detect and identify. Inexpensive techniques for increasing background clutter include the use of flares and fires (against infrared sensors) and the scattering of corner reflectors made of wire to confound enemy radar operators.

• *Strong active measures to damage or saturate enemy sensors.* To protect his sensors the enemy may have to reduce sensor sensitivity; e.g., wear dark glasses. This reduced sensitivity makes it more difficult for him to find a target in background clutter.

Conclusions

As an artilleryman, your job is to move, shoot, and communicate, and to do these you must also be able to survive. Your ability as artilleryman to keep out of the "danger zone" depends on having a large, varied, and cost-effective assortment of countersurveillance measures.

At the present time the Army needs greater emphasis both in research and development and in training on large-area smoke screens, Complementary Blending/Disguise/Decoy Kits, increasing background clutter, and measures to damage or saturate enemy sensors.

The ideas and suggestions of James Rodems of Syracuse University Research Corporation and of George Wukelic of Battelle's Northwest Laboratories and of George Falkenbach of Battelle's Columbus Laboratories are gratefully acknowledged by the author. Additional acknowledgments are to the Camouflage and Topographic Laboratory of the US Army Mobility Equipment Research and Development Command and the Chemical Systems Laboratory of the US Army Armament Research and Development Command, as much of the information presented resulted from research funded by these Army Laboratories and managed by the author.

COL (Ret) J. Tuck Brown, a former instructor in the Department of Communications at the Field Artillery School, now manages the Tactical Technology Program at Battelle's Columbus Laboratories, Columbus, OH.

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Suppression

by LTC Fred Meurer

The Qualification Task Continues

Two of the key measures in the evaluation of any new weapon system's effectiveness on the "dirty battlefield" are its ability to suppress threat systems and its vulnerability to threat suppressive measures. While most combat models used in the evaluation of new systems make some attempt to account for suppression, these attempts are often based on arbitrary algorithms. The level of suppression achieved with any particular system is often whatever the senior man in the room says it is.

In an effort to quantify suppression in a more scientific manner, the US Army Combat Developments Experimentation Command (USACDEC), in 1978, completed a suppression study program for US Army Training and Doctrine Command (TRADOC). This program consisted of a series of methodology tests designed to examine the various aspects of suppression. During these tests, suppression was classified into three distinct categories. First, and easiest to classify, was physical suppression. This occurred when a soldier's ability to perform was degraded due to injury, death, obscuration, or other physical constraints over which he had no control. The other two types of suppression, reasoned suppression and unreasoned suppression, were not as easily separated and required skilled observers and controlled experimental conditions to differentiate between them. Reasoned suppression is based on a logical decision-making process which considers two major factors: The actual physical threat as perceived by the soldier and the requirement to successfully complete his mission. Unreasoned suppression is caused by immediately uncontrollable psychological and physiological factors such as panic, fear, or fatigue. Obviously, physical and unreasoned suppression cannot be safely simulated and controlled under experimentation conditions.

The ultimate objective of the suppression experiments was to quantify reasoned suppression for use by scientists in war games, model building, and decision theory. In order to address the questions of reasoned suppression, USACDEC's field tests had to eliminate, as much as possible, both physical suppression and unreasoned suppression. The USACDEC program attempted to quantify how the well-trained, well-led, disciplined soldier continually, perhaps automatically or subconsciously, weighs his mission requirements against the threat to his safety.

The initial phases of the suppression program consisted of small arms and indirect fire suppression experiments. Three of the series of tests in the program highlighted here are the Suppression Experiment (SUPEX), February 1977; Suppression Experiment IIIA (SUPEX

IIIA), June 1978; and Suppression Experiment IIIB (SUPEX IIIB), November 1978. Personnel involved in these tests were antitank guided missile (ATGM) gunners, with a mission of engaging a maneuvering armored element. (Individuals did not have the capability of engaging the base of fire placing suppressive fire on them.) The ATGM gunners were required to maintain continuous target tracking for a 15-second missile flight in order to achieve a "hit." Probability of suppression (P(S)) was defined as the probability that the average soldier would take cover and thereby interrupt his engagement as a direct result of an individual fire event occurring within a random sequence of fire events.

One objective of these tests was to determine what minimum radial miss distance (of the suppressive round from the ATGM gunner) was required to provide a probability of suppression greater than or equal to 0.9 and also 0.5 for each of the direct and indirect fire systems used. By applying the techniques of curve fitting to the test data, it was found that probability of suppression could be modeled with a logarithmic equation. This equation was a function of round type and radial miss distance (RMD). Varying these equations, it was then possible to solve for the required radial miss distance to achieve any desired probability of suppression.

A second objective of the tests was to determine what volume of fire was required to suppress the ATGM gunner 50 percent and 90 percent of the time. These probabilities were also developed for each of the test conditions and weapon systems.

While these experiments yielded a wealth of quantitative and qualitative data, none had been conducted with the test subjects in an open foxhole subjected to the detonation of live rounds. This was the goal of SUPEX III. The first phase of this test was devoted to determining whether a "safe" uncovered foxhole could be designed whereby the ATGM gunner could be subjected to the realistic tactile, aural, and visual cues associated with the detonation of fragmenting munitions.

Statically detonated 60-mm and 81-mm mortar rounds and 105-mm and 155-mm howitzer rounds were used as the suppressive weapons. During safety testing, fragments did enter the foxhole. Ultimately this initial test phase showed that suppressive effects of simulated munitions (equivalent TNT charges), in connection with a safe open foxhole, were superior to suppressive effects of live munitions or simulated munitions in conjunction with a safe covered foxhole. Based on these results, the record phase of the test was conducted using an open foxhole and simulated rounds (figure 1).

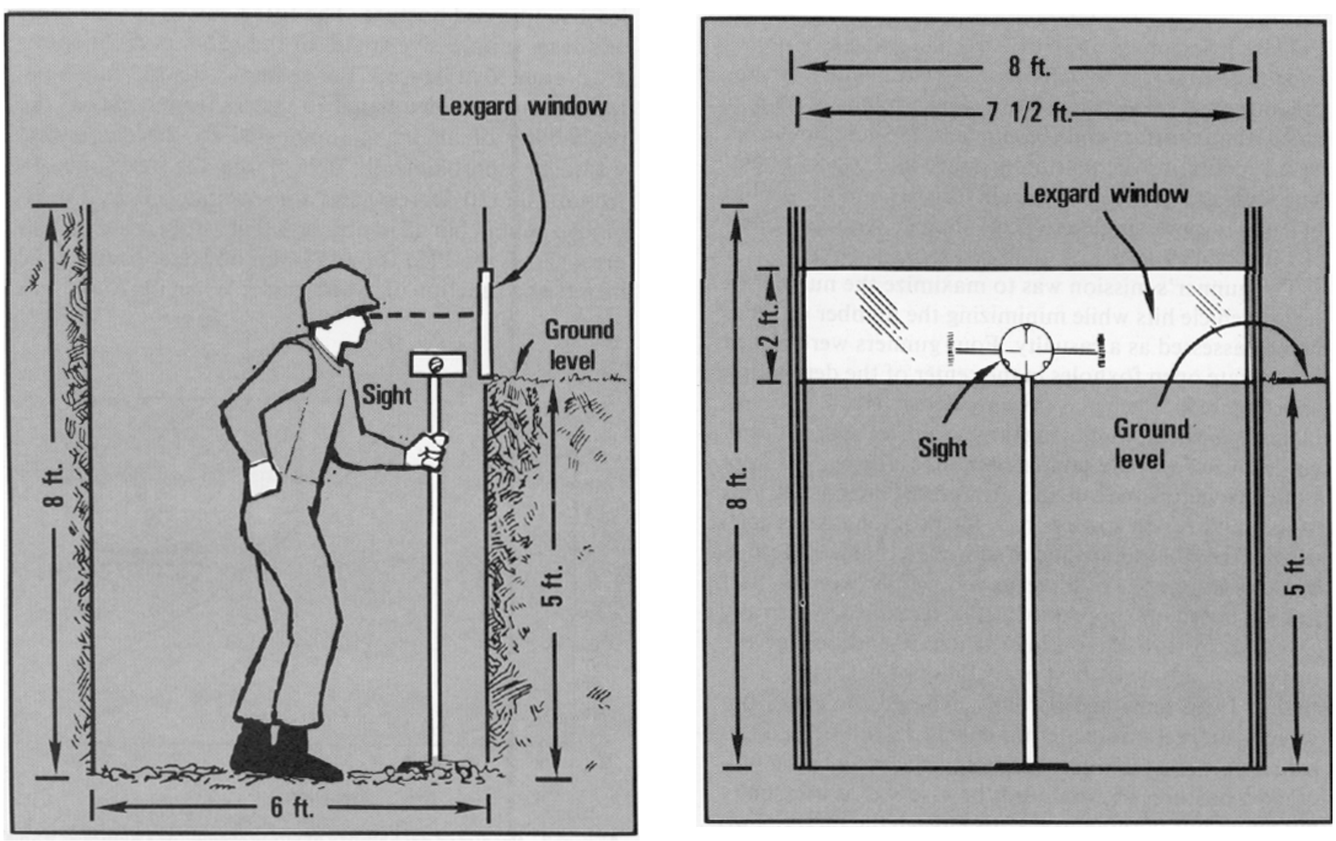


Figure 1. Foxhole/sight system.

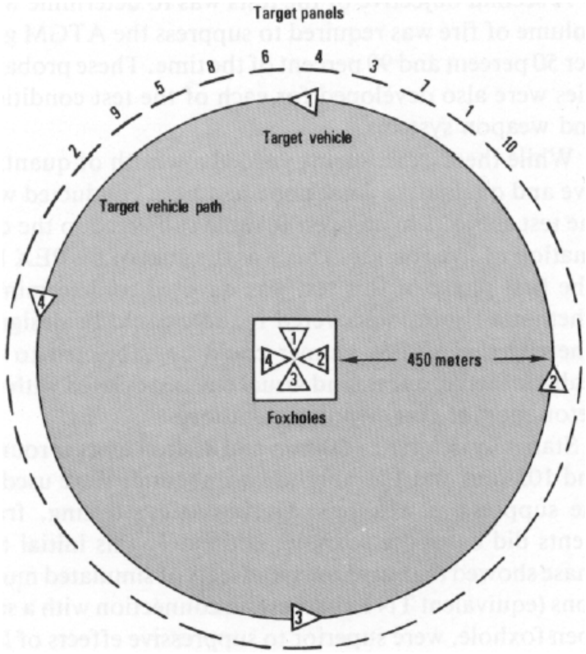


Figure 2. Player/target layout.

This second phase of SUPEX III had two major objectives. The first was to determine the probability of suppressing an ATGM gunner with single rounds of 60-mm and 81-mm mortars and 105-mm and 155-mm howitzers as a function of detonation distance and aspect angle. The second objective was to gain insights into the probability of suppressing an ATGM gunner with six-round 105-mm volley fires.

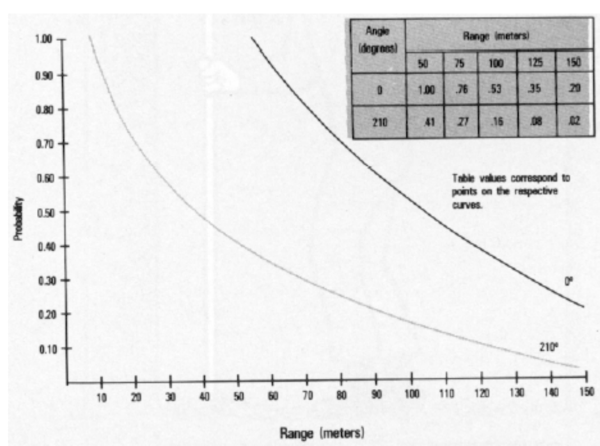
The gunner's mission was to maximize the number of target vehicle hits while minimizing the number of times he was assessed as a casualty. Four gunners were placed in separate open foxholes in the center of the detonation area (figure 2). Each player was to detect, track, and simulate engagement of moving target vehicles with antitank guided missiles while simulated indirect fire rounds were statically detonated on the ground surface at various ranges and aspect angles from his position. After each detonation, the gunner had to subjectively assess the hazard and assume one of three postures (fully exposed, partially exposed, or suppressed). If he remained in the fully exposed posture to continue to track and engage the target, he had the highest probability of becoming a casualty. If he remained partially exposed, he could observe the target but could not engage it, but he had less probability of becoming a casualty. If he went to the suppressed posture, he would not be assessed as a casualty but could not observe, track, or engage the target. Two seconds after the single round and one second after the volley fire detonations, casualties were randomly assessed based on the Joint Munitions Effectiveness Manual casualty probabilities. The probability of becoming a casualty included the following variables:

- Gunner's posture.
- Range.
- Aspect angle to the detonation.
- Size of the detonation.

The gunner's reactions to the detonation were automatically recorded and time-coded. The data was then analyzed to determine the effects of the detonations on the players' ability to perform the assigned mission.

SUPEX III findings

Single round detonations: For any given range and round size, the most suppressive detonations were directly in front of the player (0 degrees). The least suppressive detonation varied for each round size, but was always behind the player. According to player reports, this variation in suppression was due to the lack of visual information available to them from detonations behind them. The players indicated they used this visual information in conjunction with aural information to decide whether to assume a suppressed posture. If the visual cue was not available, they were inclined to remain in the least suppressed posture. The fitted curves for the most and least suppressive angles of the 155-mm detonations are presented in figure 3. For example, if a 155-mm howitzer round were detonated 75 meters from a player, the probability of his being suppressed by the detonation would be approximately 0.75 if the shell exploded in front of him (0 degrees) and approximately 0.25 if it exploded behind him (210 degrees). The "footprint" in figure 4 shows the P(S) for a 155-mm howitzer round at 50 meters as a function of aspect angle. When the round was



Angle (degrees)	Range (meters)				
	50	75	100	125	150
0	1.00	.76	.53	.35	.20
210	.41	.27	.16	.08	.02

Figure 3. Predicted probability of suppression for 155-mm at 0 and 210 degrees—single.

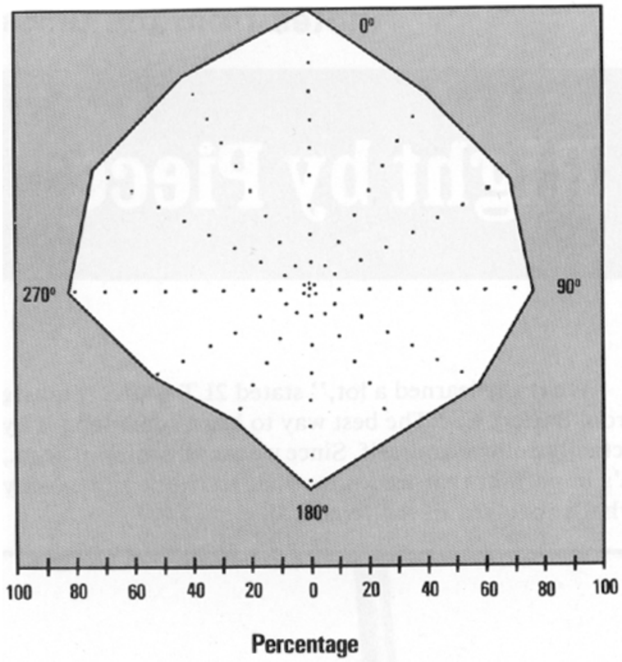


Figure 4. Percentage of time suppressed for 155-mm at 50 meters—single.

90 degrees to the right or left of the gunner, P(S) was approximately 0.8, while it was approximately 0.6 at 180 degrees and 1.0 at 0 degrees.

Volley round detonations: The most suppressive detonations during the volley fire were located to the player's front (0 degrees) and the least suppressive detonations were generally at 90 to 180 degrees. Again, the players reported that this differential suppressive effect was due to the relative lack of visual information provided by detonations outside their field-of-view. The observed data for the most and least suppressive angles for the 105-mm volley are presented in table 1. The observed probability of suppression was 0.88 at an angle of 0 degrees (directly to the player's front) for a 105-mm volley detonated at a range of 85 meters. Because of the investigative nature of volley fire, this data was not fitted to exponential curves. In comparing the suppressive reactions to a single round and volley fire at similar ranges, the volley fires were considerably more suppressive than single rounds. For 105-mm equivalent volley fires, the observed probabilities of suppression varied from 1.0 to 45 meters to 0.35 at 125 meters. Over similar ranges, the single round probabilities of suppression varied from 0.55 to 0.08. Similar results were observed with the 155-mm equivalent detonations.

Table 1. Probability of suppression for 105-mm volley

	Range (meters)					
	45		85		125	
Angle (degrees)	Probability	(sample size)	Probability	(sample size)	Probability	(sample size)
0	1.00	(7)	0.88	(8)	0.33	(6)
90	0.63	(8)	0.60	(5)	0.11	(9)
180	1.00	(7)	0.14	(7)	0.11	(9)
270	1.00	(6)	0.25	(8)	0.14	(7)

The results of the SUPEX series of suppression tests conducted by USACDEC has provided the analysts and modelers a statistically valid and realistic data base for a wide range of weapon systems. It is imperative that the testing and research into suppression continue. The SUPEX series is part of an ongoing program of testing and model refinement into the effects of suppression on the battlefield. Through this and other programs, all the branches of the military will be better able to design the weapons necessary for the soldier on the battlefield.

LTC Fred Meurer is Chief of Project Team IV, Deputy Chief of Staff, Experimentation, US Army Combat Developments Experimentation Command, Fort Ord, CA, and is also the test director for HELLFIRE Operational Test II.

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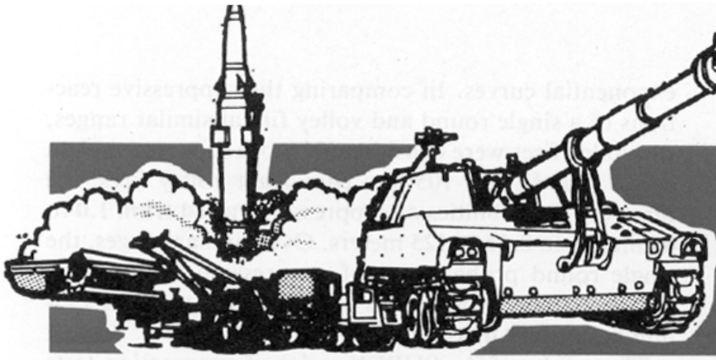


notes from the units

Right by Piece

Hands-on training for officers

FORT HOOD, TX—In an effort designed to improve overall unit maintenance effectiveness, motor officers of the 1st Battalion, 21st Field Artillery, were recently given a chance to accomplish many routine preventative maintenance checks and services (PMCS) normally accomplished by enlisted members of the battalion.

"By actually performing the maintenance checks, the lieutenants learned more about a howitzer than they possibly could by being in a supervisory position for a lengthy period of time," stated LTC D. Peter Gleichenhaus, 1-21st Commander.

Lieutenants from A, B, and C Batteries began the PMCS after a brief introduction, and when a problem on a howitzer was identified it was their responsibility to repair it. SFC Arthur L. Newton, unit project instructor, assisted the officers throughout the training. "The officers had many lubrication problems which were easily corrected, but the real test came when the spade cylinder broke. The spade cylinder is a very complicated part and it's very time consuming to repair."

Once the checks were completed, the officers road-tested the howitzers to make sure everything was working properly.

"We really learned a lot," stated 2LT Dan S. Ludwig from Battery C. "The best way to learn something is by actually doing it yourself. Since we are all motor officers, it's important that we know what to check and exactly what's involved in the repairs."

FORT RILEY, KS—SSG Richard Holmes, Battery A, 1st Battalion, 5th Field Artillery, is preparing to stretch a camouflage net over the "business end" of an M109A2 155-mm howitzer during field training at Fort Riley.

CAMP CASEY, KOREA—An artilleryman from A Battery, 1st Battalion, 38th Field Artillery, 2d Infantry Division Artillery, secures his 105-mm howitzer for firing during a recent field training exercise. Although temperatures dropped well below the freezing mark, the soldiers performed several fire missions under "realistic" combat conditions. According to LT Michael T. McCarthy, battery fire direction officer, "We did very well on this exercise. This whole mission was meant as a basic challenge for the 38th. It was good experience for them and definitely good training."

MLRS testing

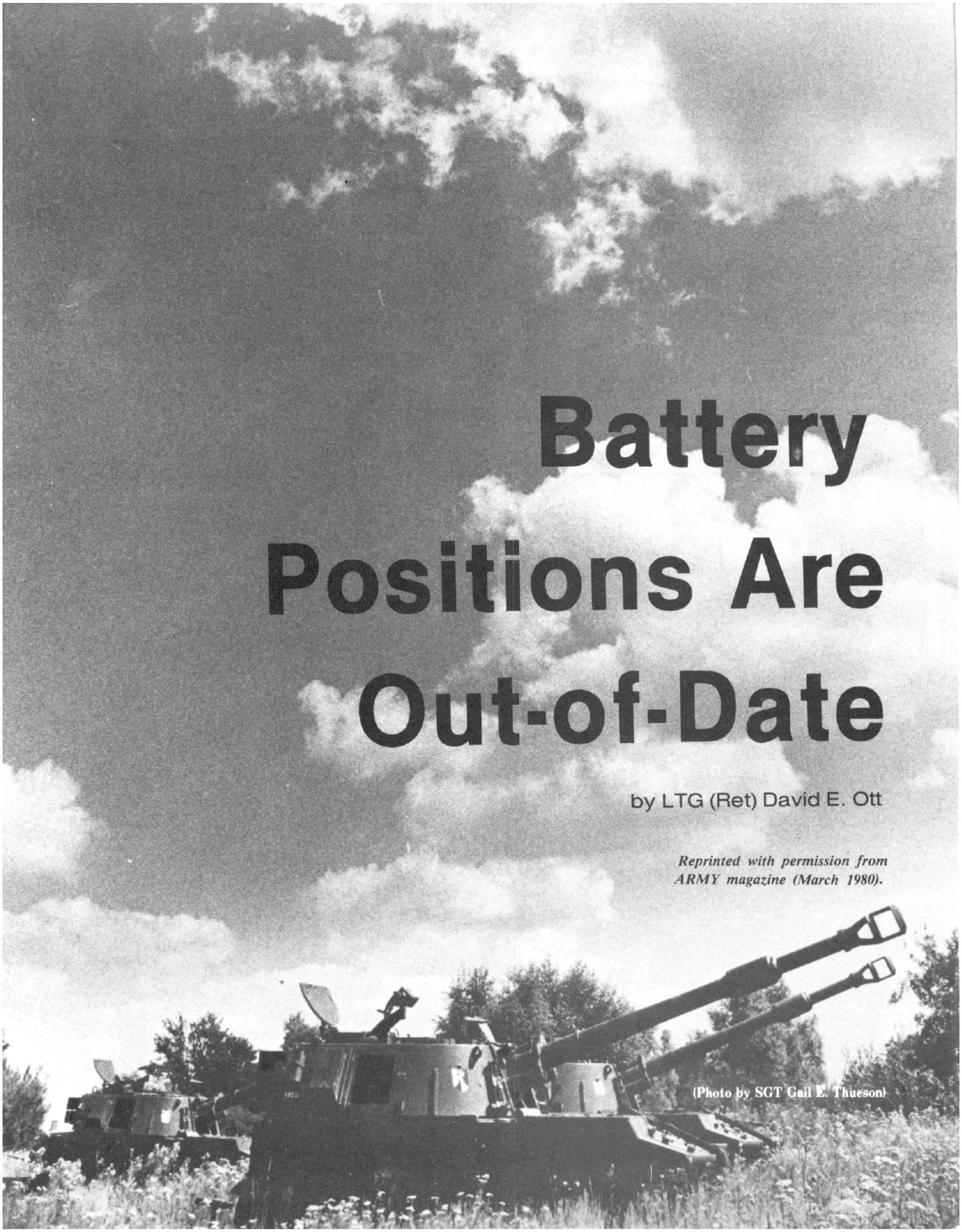
FORT SILL, OK—Under the leadership of CPT Kelly Cook, members of A Battery, 6th Battalion, 33d Field Artillery, 214th Field Artillery Brigade, recently put the Multiple Launch Rocket System (MLRS) through another important step in development during the first Operational Test conducted at Fort Sill and White Sands Missile Range, NM. The testing was part of the Army's competitive program between the Boeing Company and Vought Corporation to develop the MLRS artillery weapon on an accelerated basis for fielding in the early 1980s. The test was accomplished in two phases:

• The first phase, conducted at Fort Sill, demonstrated that the average soldier can tactically employ, fire (simulated at Fort Sill), and reload the MLRS in a timely and effective manner. Other major areas of this phase involved evaluating the MLRS mobility; command, control and communications (C^3) capability; reliability; availability; maintainability; supportability; survivability; and adequacy of training.

• To begin the second phase, the MLRSs were loaded aboard C-141 aircraft for travel to White Sands, which at the same time demonstrated the system's capability for air transportability. During this phase, evaluation continued in all areas in conjunction with live firing. A total of 24 rockets were fired both in single and multiple launches to demonstrate rocket accuracy, reliability, and submunition dispersal. Crews remained in the cab during firings to demonstrate the protective ability against contaminated air, noise, and shock.

Operational Test data will be combined with existing developmental test data and evaluated to determine whether the system is ready for production and which contractor will be selected for the next phase of development. Also, based on test results, the Department of the Army and the Department of Defense will determine whether to continue with the current accelerated development program and begin limited production.

FORT HOOD, TX—A gun crew from Charlie Battery, 1st Battalion, 3d Field Artillery, cleans the bore of their M109A2 155-mm self-propelled howitzer. The 1-3d FA of the 2d Armored Division recently became the second unit in CONUS to receive the improved M109A2 which features a new hydraulic rammer, a cupola to cover the panoramic telescope, and a modified interior for increased crew convenience. (Photo by John Sleezer)



Battery Positions Are Out-of-Date

by LTG (Ret) David E. Ott

Reprinted with permission from ARMY magazine (March 1980).

(Photo by SGT Gail E. Thueson)

Modern battlefield technology has vastly increased the vulnerability of artillery. The big guns would be less so if they were dispersed and kept moving.

One easy way to look at the battlefield is to see it as a group of targets. After all, a battlefield is characterized by weapons firing at targets. When one studies the targets array to be attacked in order to succeed, the field artillery batteries rank at the top of the list.

They are at the top for several exellent reasons:

- First, there are many of them. This is especially true if the target array concerns Warsaw Pact forces.
- Second, they are dangerous to our own forces.
- Third, they are vulnerable.
- Fourth, they have distinct signatures for an enemy to acquire and locate.

That batteries are plentiful on the battlefield needs no further statement. That they are dangerous should be equally obvious, but perhaps there is a point worth stressing to the generations of Americans whose combat experience is limited to Vietnam.

A heavy enemy cannonade on our frontline defenses will drastically reduce the effectiveness of our direct-fire antitank weapons, to include the effectiveness of our tanks. A cannonade introduces lethal fragments, smoke and shock, all very detrimental of our effectiveness, just as our cannonade cuts down on enemy capabilities.

This brief point is made to be added to the widely understood role of field artillery as a casualty-producer against any kind of exposed personnel and as a destroyer of many types of materiel. Yes, field artillery batteries are dangerous.

We are continuously working to make our battery positions hardened targets. Anti-fragmentation covers are being developed for ammunition resupply vehicles and for protection of eight-inch howitzer crews. Doctrine is moving toward keeping fire direction center (FDC) personnel inside their armored vehicles. Administrative elements of batteries are being located away from the firing position.

But we are a long, long way from having our firing positions invulnerable. Activity in the position area is part of present operations. Aiming circles are set up, crews are usually outside of armor protection much of the time, supervisors roam the line of metal, and most of the hatches on the armored vehicles are usually open.

We can do more to harden the battery position and we are working on it, but our battery positions shall remain vulnerable targets so long as we operate as we presently do.

And how about acquiring and locating a battery position? It is getting easier all the time as we drive technology toward helping us in this major effort. We can be certain our potential enemies are also harnessing technology to improve their capability of locating our battery positions. After all, a firing battery has a number of "signatures," some of which are unique.

Radar tracking of projectiles in flight can provide locations of firing positions. Sound bases are an excellent means of finding the guns, and flash bases still have utility for finding artillery. New sensors will soon appear on the battlefield and be able to locate heat sources, metal reflection of millimeter waves and possible seismic disturbances. The only prudent assumption for the future is that our positions can be located.

It is interesting to note that computer runs of war games show the vulnerability of our field artillery. One of the key factors in the decision to change the organization of direct support artillery—to eight-gun batteries split into two four-gun platoons—was the improved survivability of more, smaller positions.

(We must not let this change result in the attack of targets with a single four-piece platoon, but that's another story.)

Computer war games make multiple rocket launcher systems look great as long as the rocket system "scoots" immediately after launching its load of rockets. The rocket systems survive in an intense counterbattery environment, not because they are "hard" targets, but because they move before the counterstrike can be delivered.

We have talked quite a bit about displacing our firing batteries frequently, and we know that the more frequently they move the better their chances are of surviving. But frequent battery moves are a mixed blessing: obviously, a battery is out of the fight while it is moving, and a good airborne radar should be able to pick up battery moves and identify them.

We must do something better than shift batteries about. We must *do away* with battery positions.

Our field artillery firepower must come from individual weapons scattered about the terrain and moving individually, perhaps after every burst of rounds fired. The belt of artillery positions, two to 10 kilometers back from the forward edge of the battle area (FEBA), would thus become a polka dot of weapons moving, firing and moving again.

This is an intriguing concept and would certainly leave our potential enemy with a challenge. Our elusive guns would individually present very poor targets and, because of their constant movement, would be very difficult to destroy. It does not take much military skill or imagination to see that this concept would provide a vastly improved ability to survive.

The difficult part of the concept is to get responsive, massed fires from these darting cannons—responsive to provide immediate firepower to supported maneuver forces; to attack fleeting targets such as hostile shoot-and-scoot rocket launchers, and responsive to strike targets identified by acquisition means that cannot linger, such as helicopter-borne observers.

The massing of fires is critical if our field artillery is to maintain its effectiveness. The techniques that brought about responsive, massed firepower earned our artillery a sterling reputation in World War II, and these techniques have been improved by technology and are still the hallmark of American artillery. We must be able to continue the tradition—but with no more battery positions.

There are a number of new developments required to make the concept work, and all of them are ready for fielding now except for one: achieving a burst rate of fire. Even that is not too far off if we can accept a modest burst rate. So let's look at all the pieces in the concept and visualize the systems engineering to make it all work.

Starting with the cannon, we need for each piece to be semi-autonomous. It must be able to deliver several rounds in a burst and then scoot. It must be able to roll to a new position and be instantly ready to shoot again. To do this the cannon will have an on-board, inertial land navigation device and a north-seeking gyro.

Complicated? Not really; the production version of the general support rocket system will have it. The technology is here for that step and for the next: the on-board computer. Small, rugged microprocessors are the key and are in production now; they will make it possible for every cannon to have its own technical fire control (ballistic computation) built in.

So this new cannon moves around, always knowing where it is and where north is. Tell it where to shoot and it can do its own computations. It can roll into a clearing or to the side of a forest or village, fire a burst and move away before counterfire comes in. From time to time, this cannon will need to pick up ammunition and, while refueling, the coordinates carried in the land navigation system can be adjusted.

The battery fire direction center will direct the movement of the weapons as well as the firing. There will be no need to change the battalion and division artillery FDCs in this concept. They will simply function as they do today, hopefully with TACFIRE added, and send fire missions to the battery FDCs. Battery FDCs will receive fire missions from higher echelons or directly from observers in fire support teams.

The computer in the battery FDC will know which weapons are in position to fire and send the fire order on to them. The weapons will fire a burst of the size ordered and quickly move to a new location. They will report as soon as they are ready to fire again. If several batteries

Crews are outside of armor protection much of the time, supervisors roam the line of metal, and most of the hatches on the armored vehicle are usually open.

are needed to mass on the target, the higher level FDCs enter the operation and send out the orders.

During a surge operation, it may be necessary to take some risks and fire several missions before moving. Of course, this will invite counterfire, but the individual weapons, armored and buttoned-up, make poor targets, and the risk may be worthwhile to gain a higher volume of fire.

One part of the concept needs to be clear: the distances moved between firing positions. A displacement of as little as 500 meters should remove a weapon from the effects of counterfire, but perhaps a little more would be safer. So a firing battery will operate out of a battery area, rather than a battery position.

The size of the battery area will vary based on many factors, but it could average around 5,000 meters by 3,000 meters. In this battery area the eight medium or six heavy cannons will move about, and the fire direction center will control activity and may move around itself. There will be an ammo resupply point and an administration point. This latter point will have the mess, the personnel clerk, and the maintenance facility. It will be in heavy woods or in the heart of a semi-abandoned town and will have no radio transmissions from anywhere nearby.

So there it is: artillery cannons in individual positions, firing, moving, and firing again. Firepower will still be responsive and still be massed, but the enemy will not find targets. There will be no more battery positions.

LTG (Ret) David E. Ott is a former commandant (1973-76) of the US Army Field Artillery School and then served, until his retirement in 1978, as Commanding General of VII Corps.

notes from other branches and services

New combat clothing for Infantry

The Army has announced adoption of a new clothing system for combat infantrymen of the 1980s. Known as the "Battledress Clothing System," the new garments are designed for use in combat as well as in field training and garrison.

A major feature of the system is a new camouflage pattern that provides reduced detection by visual and near-infrared sensors.

The basic nylon/cotton blend uniform for wear in the temperate zone consists of coat, trousers, and cap. The coat is designed with breast and lower pockets, and the trousers contain the four standard top pockets as well as large thigh bellow cargo pockets. The uniform is designed to provide optimum body ventilation while maintaining military appearance.

To augment this uniform, a new earth-brown combat boot, made of water-repellent rough grain leather, is under development. The boot has a spike protective insole and a reinforced fiberglass toe for impact protection.

The complete system also includes a field jacket and trousers, poncho, helmet cover, wet weather parka and trousers, ballistic armor vest, and load-carrying equipment.

Chemical attack signal XM207

A new chemical attack signal which alerts soldiers to the presence of toxic chemical agents is currently in the engineering development stage at the Chemical Systems Laboratory (CSL) of the Armament R&D Command (ARRADCOM).

The device, designated the XM207, is a cylinder-shaped, hand-held, self-contained munition which is hand-fired by hitting a cap containing a firing pin against a percussion primer. This acton ignites a rocket that ascends to more than 500 feet where it ejects a payload consisting of a pyrotechnic whistle and three pyrotechnic stars. Soldiers are thus alerted to a chemical attack by either the audible signal or by the cluster of stars.

Current plans call for each company/battery size unit to carry eight XM207 rounds.

The signal munition is expected to be fielded in 1984.

TOW fired from British helicopter

In the first firings of TOW antitank missiles from a British Army Lynx helicopter, a gunner using a new roof-mounted telescopic sight scored hits with 100 percent accuracy.

The firings were part of a joint test program being conducted by Westland Helicopters, builder of the Lynx, and British Aerospace Dynamics Group, prior to equipping in-service British Army Lynx helicopters with the TOW missile system.

The airborne TOW missile system, including the roof-mounted sight developed for the Lynx, is being produced in the United Kingdom by British Aerospace, under license from Hughes Aircraft Company. TOW has been deployed with the air and ground forces of 30 other nations.

Lynx helicopters equipped with the TOW missile system will provide the British Army with a new-generation antitank weapons systems.

The 4th MPs capture FORSCOM's Eagle Award

The 4th Military Police Company, Fort Carson, CO, has received the coveted Eagle Award for FY79. This award is presented by US Army Forces Command (FORSCOM) to the military police unit which best exemplifies high standards for combat readiness and for achievements by the unit and its individuals. The 4th MPs were also selected to represent FORSCOM in the Department of the Army competition where they came in second.

During FY79, the 4th MPs particpated in an Emergency Deployment Exercise in Fort Lewis, WA, where they completed their annual Army Training and Evaluation Program with high marks. They also participated in other exercises within CONUS and in Germany, Alaska, and Panama.

According to LTC Dennis O'Malley, "The unit that receives this award can't do it without the support of the other companies in the battalion. While the 4th goes on these various exercises, someone has to perform their missions here."

XM1 Abrams tank

The XM1 Abrams is the first totally new tank for the US Army in over 30 years. The hull and turret are welded from cut and shaped pieces of armor plate whereas the M60 series tanks have cast hulls and turrets. The XM1 has a lower silhouette, better crew protection, greater speed, faster acceleration, and improved first round hit probability with its gyro-stabilized gun and fire control system. In addition to giving the tank greater power, the 1,500-horsepower turbine engine is quieter, smokeless, lighter in weight, and easier to maintain and repair than comparable diesel engines. The XM1 has the following characteristics:

Crew	4
Engine	1,500-horsepower turbine
Horsepower to ton ratio	25 to 1
Top speed	45 miles per hour (governed)
Acceleration (0-20)	5.8 seconds
Operating range	270 miles at 25 miles per hour
Combat weight	60.0 tons
Width	144.2 inches
Combat length	384.5 inches
Height	93 inches
Ground clearance	19 inches
Maximum vertical wall	49 inches
Horizontal trench	9 feet
105-mm ammo storage	55 rounds
.50 caliber ammo storage	1,000 rounds
7.62-mm ammo storage	11,400 rounds

In FY79, the Army contracted for 110 of the new tanks. Plans call for over 7,000 Abrams tanks to be built over the next eight years.

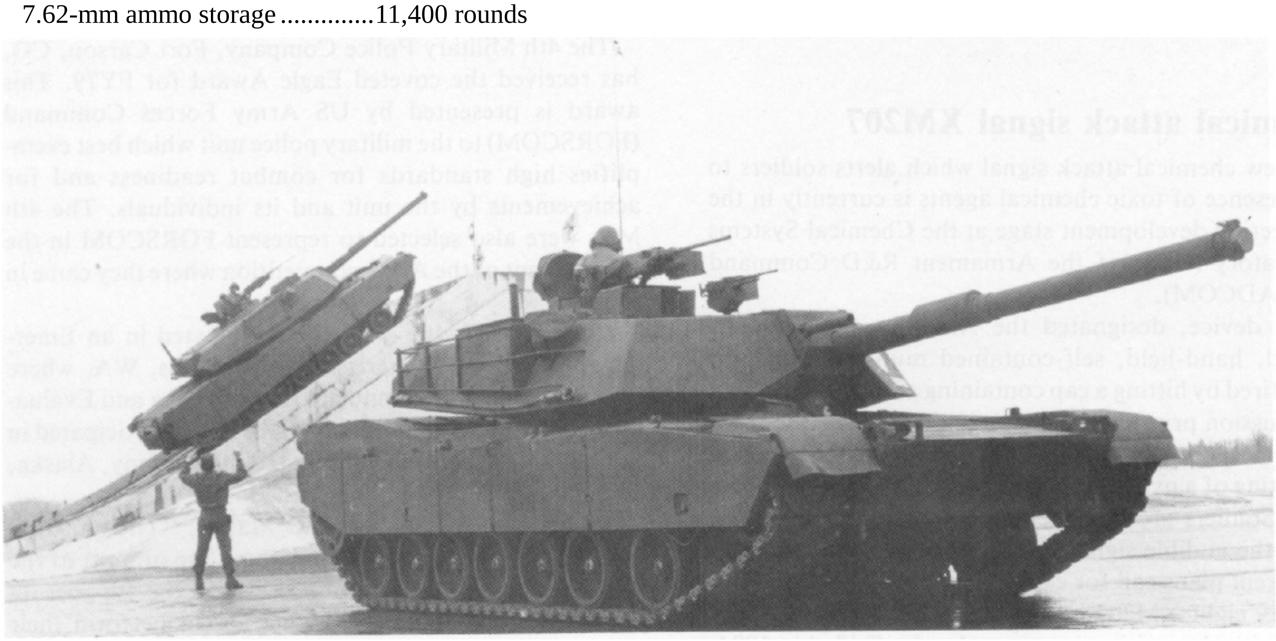
In addition to the XM1 Abrams, other major new weapon systems in development or production under the Army's Modernization Program for the 1980s include the Copperhead cannon-launched guided projectile, the M2 Infantry Fighting Vehicle, the M3 Cavalry Fighting Vehicle, the Black Hawk utility helicopter, and the Patriot and Roland Air Defense missile systems.

Assault Breaker program underway

The Army Missile Command (MICOM) has selected General Dynamics Corporation to supply airframes and seekers for the Defense Department's new Assault Breaker program. General Dynamics has received approximately $21 million for design and manufacture of infrared terminally guided submissiles for the 15-flight, technology demonstration program scheduled to begin in 1981 at White Sands Missile Range, NM.

Earlier this year, Martin Marietta Aerospace at Orlando, FL, was named integration contractor for the flight test program. In addition to furnishing the T16 booster, Martin Marietta will manufacture dispensers, integrate submunitions, and demonstrate the complete Assault Breaker system.

Assault Breaker is designed to defeat large-scale tank assaults with precisely aimed clusters of smart bomblets or terminally guided submissiles. Submunitions will be carried to the general location of enemy armor within a "load" missile, where they are then released and terminally guided to their targets.

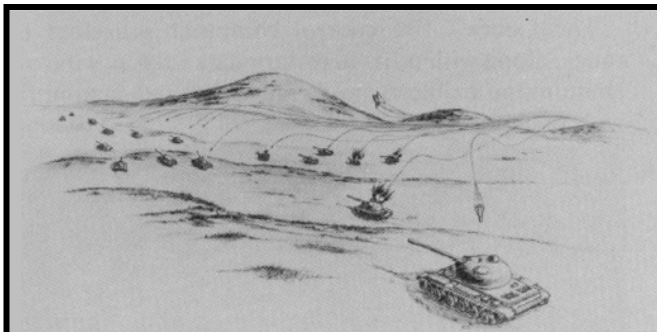


The XM1 Abrams tank. On the left, the tank is demonstrating its vertical climbing ability.

Hunter-killer Wasp missile

An air-launched missile that will be able to seek out and destroy enemy armor with almost total independence from the launching aircraft is under development for the US Air Force by Hughes Aircraft Company.

Called Wasp, the missile will have "lock-on after launch" capabilities—meaning that it is not necessary for the flight crew to have seen and designated a target prior to missile firing. After launch, Wasp initially will be programmed to fly to the target area where the enemy armor has been located and then a terminal guidance seeker will take over, identifying the armor and guiding the missile to an individual target.



In this artist's concept, a swarm of Wasp air-to-surface minimissiles each independently seeks out its own target from among a formation of enemy armor.

A major advantage of Wasp is that it will greatly increase the chances of survival of the attacking aircraft since it will be able to withdraw before exposing itself to heavy enemy air defenses.

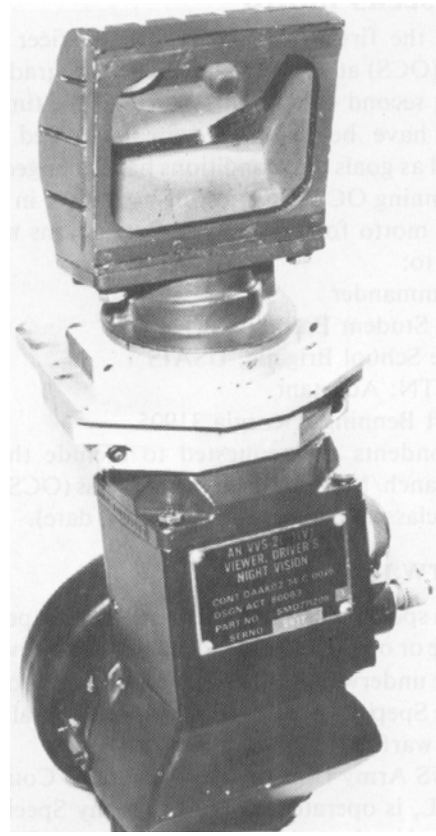
Wasp will be capable of operating day or night and in inclement weather. Despite its highly sophisticated capabilities, it will be a "minimissile," approximately one-fifth the weight of the nearly 500-pound Maverick air-to-ground missile.

Current operational planning calls for Wasps to be fired in clusters of 10 or more, with on-board computers directing each missile in the "swarm" to a different target.

Army to purchase IFVs and CFVs

The Department of the Army recently announced the decision to purchase 75 Infantry and 25 Cavalry Fighting Vehicles (IFV/CFV) which will be the initial production models of the new systems. Designed to replace the M113A1 in mechanized infantry and armored cavalry units, the first fighting vehicles are expected to be delivered by May 1981.

The IFV/CFV are designed to be compatible with the XM1 battle tank and are the same except for crew size, weapons, and capacity for storing ammunition.



A contract for 292 night vision driver viewers AN/VVS-2(v)1 for the XM1 tank has recently been awarded to Baird Corporation, Bedford, MA, by the Army Electronics Research and Development Command (ERADCOM). Included in the more than $2 million contract was a follow-on contract for 500 driver viewers AN/VVS-2(v)2 for the M60 tank. Delivery is scheduled for early 1982.

The AN/VVS-2 is a second generation electro-optic device which enables the tank driver to drive at night under "buttoned-up" conditions without any source of active illumination. The driver viewer is equipped with a biocular eyepiece which enhances the performance of the device both in driving and general surveillance.

Fort Bliss to establish new NATO school

The Department of Defense has recently confirmed that a new NATO school will be established at Fort Bliss this year to train European military personnel on maintenance of the Nike Hercules missile system. The school will be known as the Euro-NATO Nike Training Center.

The School's staff, which is expected to begin instruction this fall, will include representatives from several countries and the US.

Although the US Army is phasing out the Hercules, several European countries are retaining an improved version of the system.

The Nike Hercules missile system is designed to destroy formations of aircraft with nuclear and conventional warheads.

OCS seeks motto

Since the first class in 1941, the Officer Candidate School (OCS) at Fort Benning, GA, has graduated over 115,000 second lieutenants. During that time, various mottos have been adopted or borrowed and later dropped as goals and conditions have changed. Now the Fort Benning OCS is requesting assistance in selecting a suitable motto for the School. Suggestions may be addressed to:

Commander
5th Student Battalion
The School Brigade, USAIS
ATTN: Adjutant
Fort Benning, Georgia 31905

Respondents are requested to include their name, rank, branch/MOS, and current address (OCS graduates include class number and graduation date).

Underwater tests

When special warfare is mentioned, most people think of jungle or other land-locked training. However, there is a unique underwater school in Florida that is operated to train the Spepial Forces soldier the watery realm of modern day warfare.

The US Army Underwater Operations Course at Key West, FL, is operated by the US Army Special Forces. The school is a branch of the Special Forces School of the US Army Institute for Military Assistance.

The month-long course is not easy! Prerequisites require Special Forces qualified soldiers to complete 500-meter swims using breast or side stroke. Another "qualifier" requires hopeful divers to tread water for five minutes with their hands above their heads.

Other prerequisites test the soldier's strength and stamina. Underwater swims of 25 meters without surfacing helps prospective SCUBA divers for their retrieval exercise, where a trainee must bring a 20-pound weight from a depth of 15 feet to the surface.

Once a student has passed these tests, he is ready to being underwater operations. Here students learn how to use open circuit (compressed air) and closed circuit (oxygen rebreather) SCUBA equipment.

The course is open to enlisted men of the US Army Special Forces and warrant and commissioned officers on orders or assigned to a Special Forces Group. (SFC Ron Freeman, Fort Bragg)

Laser rangefinder for Cobra

A telescopic sight equipped with a mini-laser rangefinder that will enable Cobra gunners to direct cannon and rocket fire with deadly accuracy has recently entered production at Hughes Aircraft Company.

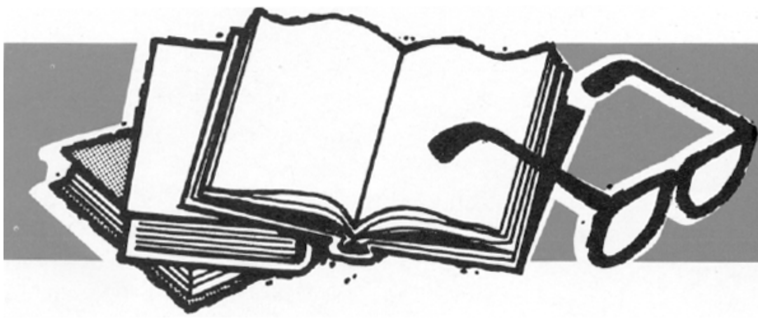
The improved sight, called the Laser Augmented Airborne TOW (LAAT) sight, is part of a modernization program underway to upgrade the performance of the US Army Cobra attack helicopters.

The sight unit for the Cobra's TOW antitank missile system aims cannon and rocket fire and guides TOW missiles, by providing a stabilized line of sight on the maneuvering helicopter. The laser transmitter was designed to fit the small available space between the gimbal assembly and the housing plate of the existing sight turrent.

In operation, the gunner sights a target and fires the laser. The beam, traveling at the speed of light (186,000 miles per second), reflects off the target and returns, providing accurate and almost instantaneous range information.

The Cobra's fire control computer processes the range, along with other necessary data such as wind and ammunition ballistics, to direct rocket and cannon fire with pinpoint accuracy.

Technician installs the telescopic sight (equipped with mini-laser rangefinder) in the Cobra helicopter. (Hughes photo)



Redleg Review

AMERICAN CAESAR: Douglas MacArthur, 1880-1964, by William Manchester, Little, Brown and Company, Boston, MA, 1978, 793 pages, $15.00.

William Manchester has created a vivid, at times startling, portrait of a man to rank with the world's military geniuses: Alexander, Caesar, Napoleon. "Unquestionably," Manchester says, "he is the most gifted man-at-arms this nation has produced." But, the author points out, for every outstanding MacArthur strength, there was a corresponding MacArthur weakness. Ultimately, his character would make his removal from command inevitable, but not until the end of a distinguished career stretching over three wars.

Although Manchester goes deeply into MacArthur's roots—the legacy left by his famous father and ambitious mother which led him to early fame at West Point—the greatest portion of the book is devoted to MacArthur's conduct of World War II in the southwestern Pacific.

After initial setbacks and unexplained lapses (MacArthur let his Philippine Air Force be destroyed on the ground, nine hours after learning of the attack on Pearl Harbor), he eventually placed the Japanese on the defensive in the southwest Pacific, finally stopping and then reversing their southward expansion in New Guinea. In his entire extraordinary Pacific campaign, he was sparing of manpower, sustaining only 90,437 casualties in the battles between Australia and Tokyo. In contrast, American casualties during the Battle of the Bulge alone totaled 106,502.

A generous, even brilliant ruler of occupied Japan, MacArthur is portrayed nevertheless as being out of his element in American politics, desiring the adulation of political life, but somehow lacking the understanding of press and public that might push him to the White House.

Fighting his last battles in Korea, MacArthur lost none of his daring nor his skill, but finally pushed his luck too far. Not only did he apparently fail to believe that the Chinese would enter the conflict, he also could not understand nor accept a modern concept of a limited war, fought for vague, even non-existent objectives.

As Manchester says, MacArthur "simply could not bear to end his career in checkmate," in a stalemate at the 38th Parallel. The diametrically opposed views of the soldier and the President on the conduct of the war made the Truman-MacArthur clash inevitable. Manchester provides some striking facts on that clash, even for those who may think they know the whole story.

American Caesar is a thoroughly researched, extremely readable portrait of a man of enormous genius and serious flaws. Despite the inevitable controversy over some of Manchester's conclusions, this book is certain to become a standard work in the field of military biography.

1LT Keith H. Dickinson is XO/C-E Platoon Leader in HQ Battery, 1-182d FA, Michigan Army National Guard.

B-26 MARAUDER AT WAR, by Roger A. Freeman, Charles Scribner's Sons, 1979, 192 pages, $14.95.

The Martin B-26 was well defined in a 1939 War Department requirement for "a medium bomber with high top speed (300 mph), heavy bomb load, impressive potential, and general superiority over European designs." It had graceful lines, small wings, and flush-riveted, wrinkle-free skin and was one of the best looking aircraft of its time. Although technically advanced, the B-26 was rushed into production before a prototype was built; consequently teething problems had to be resolved after delivery. Like many high-performance aircraft, it handled well but demanded constant attention as it was unforgiving of error. Experienced pilots found it superb, but the young pilots of WW II sometimes found it to be too much. With two strikes against it, the B-26 was sent to war where poor tactics nearly delivered the third strike. The loss rate as a result of teething problems, inexperience, and improper tactics earned it the names "Martin Murderer" and "Widowmaker." Fortunately the problems were recognized and solved, and the B-26 went on to become the bomber with the lowest loss rate and one of the most efficient of the war.

The book is typical of the "aircraft at war" series. It contains first person accounts by the men who flew and maintained the B-26, plus more than 250 pictures of the aircraft in action. Some of the pictures are remarkable. One memorable sequence depicts a bomb striking a low-flying B-26, knocking an engine off and causing the aircraft to collide with its wingman.

The text is interesting and well-written, and the author achieves his objective of telling the story of an airplane at war.

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

THE ARMED FORCES OF THE USSR, by Harriet Fast Scott and William F. Scott, Westview Press, Boulder, CO, 1979, 439 pages, $24.00.

The Red Army, as the predecessor of today's Soviet Armed Forces was called, has had a turbulent history. The first Communist armed forces organization began with the 1905 revolution when the Bolsheviks began to attract a following. In less than 50 years, the Soviet Armed Forces have reached the position of being considered as one of the world's two superpower military forces.

The Armed Forces of The USSR covers development of the Soviet military from 1905 to present, to include organization, manpower, military science, and command structure. Several comprehensive organizational charts and tables are provided, to include one that compares military ranks of the US and USSR. Even though a few photographs are of marginal quality, this does not detract from the overall content of this work.

A detailed bibliography and index wrap up the book to provide sources of detailed information about the Soviet Armed Forces.

This book is a highly recommended reference source for the Soviet military history buff or scholar.—Managing Ed.

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