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ARTICLES

EATURES

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SECRETARY OF THE ARMY:
Hon. Clifford L. Alexander Jr.

FIELD ARTILLERY SCHOOL
Commandant:
MG Edward A. Dinges
Assistant Commandant:
BG Robert C. Forman

JOURNAL STAFF
Editor:
MAJ John Dobbs
Managing Editor:
Mary Corrales
Art Director:
Bob Coleman

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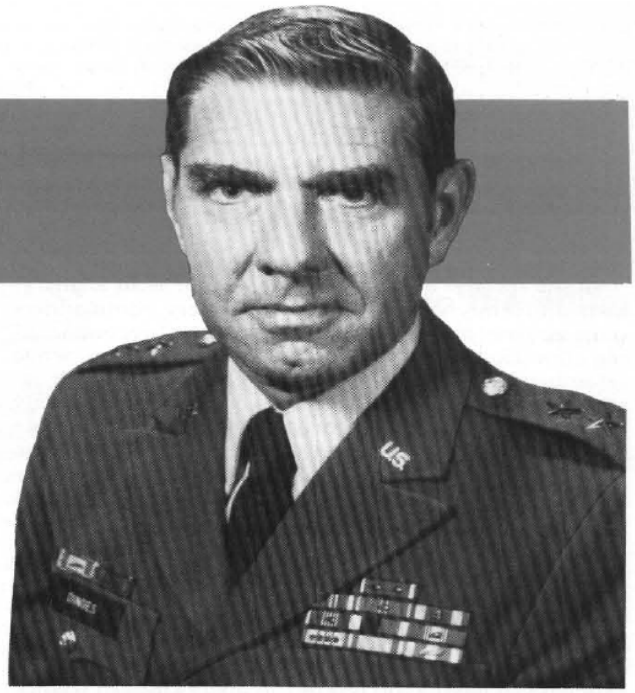
On the Move



by MG Edward A. Dinges

In my last "On The Move", I mentioned Fort Sill's on-going rethinking of the fire support function and noted the importance of getting all our talent involved in the combat development process.

Accordingly, last August I wrote to each of our senior field artillery commanders requesting their contributions to what is perhaps our major current force development study—the Fire Support Mission Area Analysis (FSMAA). Directed by the Department of Defense, this reexamination of doctrine, organization, training, and materiel will serve as the baseline for field artillery developments out to the year 2000 and beyond. Such a reexamination would clearly be worthless without the benefit of the ideas and practical experience of the field commanders who must routinely work around the deficiencies of our current fire support system.

The response of these commanders to my request has been both forthright and encouraging, particularly in the consistency among the concerns they expressed. In the belief that these are of equal interest to all field artillerymen, I thought it might be worthwhile to share with you our commanders' general perceptions of the future role of fire support and some of their specific suggestions for improvement of the field artillery. Let me begin by reporting some general comments, then turn to the specific development areas dealt with by the FSMAA.

General

Overall, our commanders expect the high intensity battlefield through the year 2000 to be characterized by:

- The predominance of heavy armor formations.
- Extensive employment of anti-armor missile systems.
- Highly mobile Threat forces, configured more for meeting engagements than as breakthrough formations.
- Very sophisticated target detection and communication systems.
- Possible use of high-energy laser weapon systems.
- Employment of chemical warfare by Threat forces.

On the European battlefield, NATO and Threat forces are expected to be roughly equal in the quality of weapon systems, but the Warsaw Pact will continue to enjoy a significant numerical superiority in tanks and artillery. War on such a battlefield will be violent and fast-moving; it will strain our logistics systems far beyond previous experience, particularly in ammunition resupply. Superior firepower will nevertheless be critical to overcoming our numerical disadvantage and achieving victory.

Of course, our commanders recognize that Europe is not our only potential battleground. Growing concern for the projection of forces in contingency areas like the Middle East and the Persian Gulf introduces a host of additional considerations, from rapid force deployability to sustainment of operations at the end of lengthy and vulnerable lines of communication. These considerations must be balanced against the need for armor protection, ground mobility, and heavy volumes of fire. And here again, the effectiveness of indirect firepower may be decisive.

Whichever the battlefield, our senior field artillery commanders foresee three concurrent and equally important artillery missions:

- Providing close support to the ground-gaining arms by destroying or suppressing enemy maneuver formations.
- Destroying or silencing enemy artillery to prevent it from damaging or interfering with our own maneuver formations.
- Interdicting advancing enemy second-echelon forces.

Commanders report that increased emphasis on the latter two missions has caused some concern among their maneuver colleagues, who worry about the availability of close support fires in the face of competing requirements. While this concern is understandable, it is also groundless; the function of fire support—whatever the particular target—will continue to be to support the maneuver

commander as effectively as possible. The diversity of field artillery missions simply reflects our growing technological ability to deliver a wide variety of new munitions against a much broader target spectrum than ever before.

Doctrine

In the specific area of doctrine, senior field artillerymen uniformly agree that corps artillery commanders must actively participate in the business of recommending allocation of corps artillery assets to division, while retaining control of sufficient artillery missile and air assets for deep interdiction. Division artilleries will directly control all divisional and corps cannon assets to execute close support, counterbattery, and shallow interdiction fires. Field artillery doctrine must clearly define and institutionalize these roles so that division artilleries can position and assign tactical missions to allocated corps artillery cannon units. At the same time, we must refine our understanding of the proper utilization of field artillery brigade and group headquarters.

At the battery and battalion levels, the composition of the basic load, complexity of new munitions, and proliferation of artillery ammunition types increase potential problems of having too few of too many kinds of rounds at each gun position and saturating unit transport capabilities. Some commanders urge the development of clear guidelines regarding the proper number of rounds of each type required by each firing unit. Others suggest reexamining the concept of assigning specialized unit roles (such as counterfire, interdiction, suppression, Copperhead, or nuclear missions) for specified time periods. All agree that in some fashion or other, the basic load must be simplified.

Other doctrinal issues believed to require more work include nuclear procedures and operations, battery survivability, and coordination of Air Force close support aircraft and Army attack helicopters in fire support tasks. With regard to the last mentioned, many commanders noted the need to upgrade the importance of brigade and battalion fire support officers. While the rank structure of the fire support officer is believed to be correct, senior field artillerymen argue that neither our assignment policies nor the recognition and rewards we attach to these positions reflect their importance. Their prestige must be improved, particularly in the eyes of supported unit commanders.

Organization

Turning now to force structure, commanders agree that a concerted effort must be made to restore the headquarters and headquarters battery at corps artillery level. Additionally, division logistical support capabilities need to be beefed up to accommodate corps artillery units operating in support of the divisions. Concurrently, logistical procedures require review and updating; some commanders feel upgrading of the divisional personnel support systems may also be warranted.

Training

Perhaps the most widely shared concern in this area is the need to increase the time allocated to field artillery and fire support generally in the curriculum of the Command and General Staff College. Another strongly expressed concern is that field artillery officers are not gaining the requisite field expertise in their formative years.

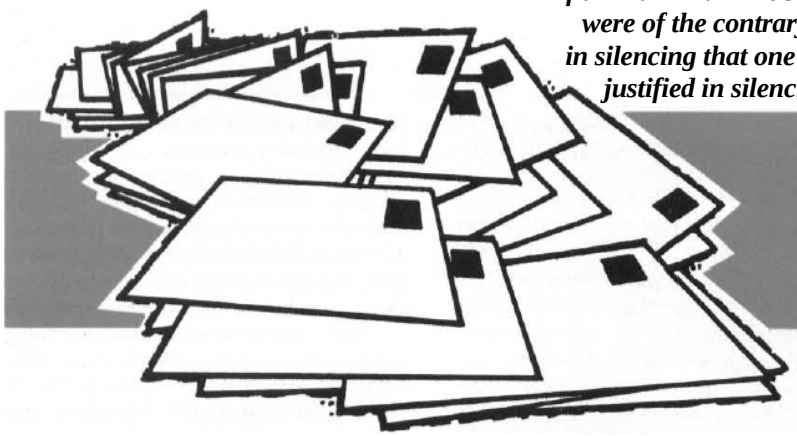
Materiel

Our field artillery commanders recognize that improvements in materiel are urgently needed. In addition to increasing the range of our weapons and their numbers in the force, we must place emphasis on developing smart fire-and-forget munitions capable of destroying armor on the move without relying on observed fire procedures or directed terminal guidance.

Further, to win the counterfire battle, we must be able to find the enemy's artillery and destroy it. While the Firefinder radars are a significant step forward, we must continue to improve our ability to detect enemy artillery and second-echelon forces. To enhance survivability, we must be able to operate from more dispersed positions. In turn, this will require individual howitzers to have their own locating and laying systems, as well as automated fire direction systems with reliable communications permitting burst transmission of digital fire commands. To survive in chemical and nuclear environments, our howitzers, ammunition carriers, and fire direction vehicles require self-contained pressurization systems to prevent internal contamination. And finally, to maintain the tempo of mounted combat, we must have new ammunition support vehicles with the armor protection, increased load-carrying capacity, and modern materiel handling equipment to ease the burden on our cannoneers and ammunition handlers.

It is hardly surprising that the concerns of senior field artillery commanders which I have highlighted here track closely with the objectives we at Fort Sill are trying to achieve through the FSMAA and other programs. I will continue to call on the advice and counsel of all of you in the field as we work together to build a field artillery second to none.

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

SEAD views differ

In the introduction to the article on suppression of enemy air defence (SEAD) which appeared in the September-October 1980 *Journal*, it was stated that the article represented the views of, among others, the Allied Liaison Officers at Fort Sill. This is not so. The Allied Liaison Officers did take part in the preliminary discissions on SEAD, but the article does not represent their views on the subject.

We believe there were two very important omissions from the article. First, the effectiveness of indirect artillery fire, when used in the SEAD role, was not considered in any detail. The only reference to this critically important subject was a list of vulnerabilities in one of the figures. The second omission was the absence of any detailed analysis of the accuracy with which enemy air defence weapons can be located by the various means at our disposal. This will, of course, be a key factor in determining whether or not indirect artillery will be effective against them.

We believe that indirect artillery fire will not be cost-effective in the SEAD role until we have new ammunition—such as anti-radiation projectiles—specially designed for the purpose. Until we do have an improved capability, would it not be more sensible to deal with enemy air defence weapon systems just like most other targets under the heading of target servicing?

The procedures outlined in the article are complicated, labour-intensive, wasteful in both ammunition expenditure and logistic effort, and, worst of all, unlikely to achieve any significant return. The majority of enemy air defence weapons could be suppressed just as effectively—and with much less planning and coordinating effort—by directing our fire at the formations or areas that they are deployed to defend. This can be very simply done using existing procedures and staff and without taking our guns off other tasks on which they are more urgently needed and more cost-effectively employed.

The subject of SEAD planning should be carefully studied before any new procedures are implemented. Currently, our most effective SEAD resources are aircraft and electronic warfare. Until indirect artillery fire is more effective in the SEAD role, is there really a valid argument for making the fire support coordinator the SEAD planner?

In summary, we believe that there will inevitably be occasions when indirect artillery fire will have to be used in the SEAD role. However, we do not believe that these occasions will be sufficiently frequent to justify the dedicated, complicated, labour-intensive and ammunition-expensive procedures proposed in the article. In most cases, SEAD could be accomplished much more easily—and just as effectively—by using present procedures and staff and regarding it as just another part of target servicing.

This letter represents, in general terms at least, the views of the Canadian, French, and German Liaison Officers in addition to my own.

G. S. Orr
LTC
British Liaison Officer
USAFAS
Fort Sill, OK

Your letter is well taken.

Perhaps the editor's comments preceding the SEAD article would have been more appropriate if it had stated: "The material herein represents the views, opinions, and best judgment of the principal authors within the Field Artillery School. Although the thoughts of subject matter experts, US Air Force and Marine Corps Representatives, and School Allied Liaison Officers were considered during development of this article, the material does not necessarily reflect total agreement among contributors as to specific doctrine/tactics to be considered in the suppression of enemy air defense."—Ed.

We need a fire support center

The purpose of this article is to examine fire support doctrinal responsibilities within the Army and to propose the establishment of a single fire support center within the US Army Training and Doctrine Command. The proposed center would serve as the Army's single voice in the development of fire support doctrine and related literature. Additionally, it would be responsible for preparing and conducting (or exporting) fire support training materials.

Proponency

Army Regulation 10-6 currently addresses the responsibilities of the several Army branches, and the proponency for developing fire support doctrine and plans for the Army is assigned to The Field Artillery Branch. As accomplished today, implementation of this proponency leaves much to be desired since it is fragmented among several TRADOC schools and agencies. There is no *one* voice for fire support. Most schools of the combined arms, in developing the fire support portions of their field manuals, often obtain much of their advice and input from on-station artillerymen. Many times this situation leads to varied interpretations of the fire support "party line"; consequently, we often find fire support described differently from manual to manual. Presently, there is no one single TRADOC agent speaking for fire support as there is for Infantry and Armor. There should be!

Short falls

A glance through current field manuals and other training literature for fire support reveals numerous short falls to include:

• *No correct definition of fire support?* Many of today's manuals leave the impression that field artillery fires are synonymous with fire support; therefore, some authors treat field artillery support as the total fire support effort. Some examples of this and other shortcomings in literature are:

1) FM 71-100 (divisional field manual), in describing the responsibilities of the division fire support coordinator, states: "He coordinates the delivery of field artillery fires." Yes, it is true; he does do that but only as *part* of the tactical

fire support effort. More correctly, he *merges* field artillery fires with the fires from other weapon systems (e.g., mortars, close air, and naval support).

2) FM 100-5, the Army's capstone field manual on operations, describes support for the offense and defense in separate chapters. At the conclusion of each chapter is a summary for field artillery and air support. There is no summary for fire support collectively—yet that's the way it is managed in combat.

3) Allied Tactical Publication (ATP) 35 (NATO literature) addresses tactical land force doctrine and all types of combat support except fire support. Not one line is devoted to this major element of combat power.

• *The air-land battle*. Most new field manuals developed within the combined arms community, in discussing combat operations, tend to separate discussions of indirect fires from those involved with the air-land battle. This separates close air support from other types of fire support; consequently, most of the doctrine involved in the air-land battle is developed independent of existing fire support doctrine which often results in conflict and confusion.

• *Close air support (CAS)*. In this area we find the fire support coordinator (FSCOORD) orchestrating CAS fires with other fire support. To do this, he must work closely with an assistant S3 (G3) for air and with a collocated air liaison officer (ALO) from the supporting air force. Actually, this is duplication of effort. The FSCOORD is capable of working directly with the ALO just as he does with naval gunfire liaison personnel, when that type of support is available. This would eliminate "the middleman"—the assistant S3 (G3)—and free that officer for other air and operations matters.

• *Joint air attack teams (JAATs)*. Recently, the Army has developed draft literature describing JAAT operations. (The JAAT is formed by joining attack helicopters with A-10 CAS aircraft.) Little attempt has been made to tie the FSCOORD into this team action, which seems strange since the military currently has others studying how it can best provide suppression of enemy air defense (SEAD) fires which normally are coordinated by a FSCOORD. Additionally, CAS aircraft are "head counted" as fire support assets; yet they must be excluded from that count when committed to JAAT operations.

• *NATO literature*. In this area, the lone US voice for fire support is the US Army Combined Arms Center (USACAC) member serving on the Land Forces Tactical Doctrine Working Party, Army Board, Military Agency for Standardization. As discussed earlier, the current edition of ATP-35 covering land force tactical doctrine pays small attention to fire support. Why? Because, in order for Fort Sill to get its views on fire support into this publication, the information must be presented to the working party by a surrogate, and USAFAS is one step removed from this literature action.

• *Training simulators*. Today, there are many computerized battle simulations in use for training; however, few of these emphasize the fire support aspects of combat. While considerable attention is given to maneuver, the air-land battle, intelligence, and logistics, very little training in fire support challenges are presented which is not in keeping with the thought that fire support represents a major element of combat power.

• *Terminology*. Even in simple fire support terminology, there are differences. For example, FM 6-20 is accepted as the Army's capstone field manual for fire support in combined arms operations, and, as such, its fire support terms and definitions agree with those found in approved military dictionaries and glossaries. Yet, many of these terms differ from like terms now defined in FM 101-5-1 which is but another indication of the need for one fire support voice in the Army.

How to improve

Since 1975, the Army has been working to improve its fire support posture at the "bottom" of the ladder—company and troop level. It has implemented the fire support team (FIST) concept, and each company size unit now has a fire support advisor and coordinator—the FIST chief. Additionally, enlisted forward observers and fire support specialists are now consolidated under the single MOS 13F. The time has come, however, to improve the higher rungs in the ladder. A step in that direction was recently taken when the recommendations of Close Support Study Group II were approved, but what else can be done?

Within TRADOC, there is a need for one agent to speak for all fire support—not just parts of it, as is the case today. The most logical candidate and best prepared Army facility to do this is the USAFAS and Fort Sill, where FSCOORDs and fire support specialists are trained. Here, instructor personnel from the Air Force and Marine Corps are present to represent the views of their respective services.

Military authors, instructors, and developers concerned with Army fire support operations should receive their guidance from this single center. For the first time, the Army would then have a central theme on what fire support is and can do and have one point of contact for those desiring fire support information. The Field Artillery Branch proponent for fire support outlined in AR 10-6 would then be implemented by the Fire Support Center Commanding General.

LTC (Ret) C. W. Montgomery
Lawton, OK

The "Priest"

Reference the photograph of the Priest self-propelled howitzer in your July-August 1980 issue, the Batchelor and Hogg book, *Artillery*, is correct in stating that the M7 was first developed by combining the lower chassis of an M3 Lee tank with a standard towed 105-mm howitzer. However, the vehicle in the photograph is actually a late production M7 or M7B1, built on the chassis of an M4 Sherman tank. Many points identify it as such: The suspension system and other later tank components such as the single piece differential and final drive housing. The M7 was powered by a Continental 9-cylinder radial engine, and the M7B1 by a Ford tank engine. Without a photo of the rear deck and engine compartment doors it is not possible to determine which of the two this vehicle is.

Congratulations to the 1st Battalion, 3d Field Artillery, for preserving this very historic vehicle.

Ronald L. Kirshman
LTC, QMC
Professor of Military Science
Western Michigan University

Whatever it is, it's a grand old weapon.

Field Artillery in the Guard and Reserve
How much? How good?

Today, more than 50 percent of the US Army's Field Artillery is in the Army National Guard (ARNG) or the US Army Reserve (USAR). A breakdown of the Field Artillery organizations within the Guard and the Reserve is shown in figure 1. (The bulk of the combat and combat support units are in the ARNG, while the combat service support units are primarily in the USAR.) These "How much?" figures are based on a recent US Army Training and Doctrine Command (TRADOC) chart.

Now to the question of "How good?" are our Reserve Components. Here, a several volume book could be written on how good the Guard is or isn't. Perhaps a more appropriate question would be "How good should or can they be?" To answer this question, one needs only to look back on the early days of the Vietnam War when Guard units were designated part of the Selected Reserve Force (SRF). These SRF units were manned and equipped at 100 percent authorized strength and were authorized additional training assemblies and full-time personnel to provide the necessary support. After approximately a year of intensified training, several Field Artillery battalions passed not only the battery but also the battalion Army Training Tests. Additionally, there were no restrictions on fuel or ammunition in those days. The point is that given the resources of personnel, equipment, time, fuel, ammunition, and adequate full-time personnel, an acceptable readiness condition can be achieved.

Current recruiting problems are well publicized and, as such, perhaps the only area worth comment is that acquiring the necessary personnel is the biggest problem unit commanders have today. Every day you can read or hear someone say the answer to retention is good hard training, but the solution to good training is to have at least an adequate full-time training staff. It doesn't matter whether Guardsmen on full-time duty or active component soldiers fill slots such as the S3, assistant S3, or operations sergeant, but it is a *must* to have a full-time Training Noncommissioned Officer in each unit to properly manage the training administration and to prepare for future training. Another *must* is that funds be provided for noncommissioned officers to attend a basic course. We don't expect a second lieutenant to perform until he has been to the basic course, so why expect an NCO to learn a new job on his own overnight. The question of time, or time to train, is without a doubt the most critical. It has been said many times that Reserve Components have 39 days to train each year. Wrong! True, there are 39 days available when you count the 12 weekends (24 days) and the 15 days at Annual Training (AT), but you can delete approximately five days from Annual Training for travel to and from, middle weekend, preparation for movement to home station, and such things as physical training, parades, etc. Also, on the 12 weekends, activities such as preparation for movement to the Annual Training site, preparation for and conduct of Adjutant General Inspections, weapons qualification/familiarization, maintenance after Annual Training, not to mention support to civil authorities, all take from actual training time. A realistic estimate is that the average unit has about eight weekends to train for their TOE mission. That's 16 days plus 10 days at Annual Training for a total of 26 days to train for and conduct Skill Qualification Tests and at least battery-level ARTEPs.

Now, let's take a look at equipment. There are some Guard units equipped with the obsolete 8-inch towed howitzer and, even though it is a good weapon and is satisfactory for training, it is unlikely that this weapon will ever be used in combat again. How long do the Reserve Components have to wait before they get the equipment for training with which they would be expected to go to war?

The 8-inch towed howitzer is used by Battery D, 1st Battalion, 175th Field Artillery, 47th Infantry Division, Minnesota Army National Guard, for training.

Field Artillery units	
ARNG	**USAR**
Corps artillery headquarters (2) Division artillery headquarters (8) Field artillery brigade headquarters (20) Field artillery cannon battalions (103)* Target acquisition batteries (8) Howitzer batteries (cavalry squadrons) (12)	Field artillery brigade headquarters (3) Field artillery cannon battalions (18)**
*32 battalions are organic to the 8 division artilleries, 21 are direct support battalions to separate maneuver brigades, 41 fall under the peacetime control of the field artillery brigades, 3 are under one of the corps artilleries, and the remaining 6 are separate field artillery battalions. **3 battalions are direct support to separate maneuver brigades, 6 are under the control of the field artillery brigades, and the remaining 9 are separate field artillery battalions.	

Figure 1. Reserve Component Field Artillery.

The bottom line is that, given the resources with trained officers and noncommissioned officers, Reserve Component units can reach the required level of readiness. While some units are presently low in strength and have only three or four howitzers, many are at or near their authorized strength. The question of "How good?" is as different as there are number of units. The fact is that, regardless of how good they are today, they are all we have to back up the "Regulars" and a battery with only four guns is far better than a battery with no guns.

D. J. Marholz
LTC, FA
Chief, RC Division
DCRDT, USAFAS
Fort Sill, OK

Realism in nuclear weapons training, operations, and inspection

A tactical unit identified to assemble, transport, fire, or secure nuclear weapons must be trained, evaluated, and qualified specifically for those missions. Until March 1978, however, the training and evaluation of nuclear capable units was unrealistic and distorted. To correct this, the Army Chief of Staff changed the Army's Training and Evaluation Program (ARTEP) to develop realistic standards and procedures and also changed the inspection system for noncustodial, nuclear-capable units.

The ARTEP stresses the importance of the Army's current doctrine to "train as you will fight" by requiring tactical units to conduct concurrent conventional and nuclear tasks in their training and evaluation programs. For example, a unit must train to provide simultaneous transportation of its entire nuclear load and all of its conventional ammunition.

To accomplish realism, both the training and evaluation (internal and external) programs must be driven by a scenario which develops a tactical situation requiring the unit to perform its tactical mission under simulated combat conditions. The key to effective training and evaluation is competent trainers and evaluators who can determine training proficiency by—

- Comparing results achieved with prescribed standards.
- Applying common sense.
- Weighing mission accomplishment against courses of action taken.
- Keeping in mind other constraints placed on the unit.

Along with this modification in training and evaluating, the "qualification" requirements (certification is no longer used) for noncustodial units has also been changed (Chapter 8 to AR 50-5). The Army recognized that the old nuclear surety inspection and certification system was cumbersome, unrealistic and unfair to units.

Now a unit is qualified by first demonstrating its ability to accomplish its total nuclear and conventional mission during external evaluations based upon ARTEP. This is done at least once every 18 months. The evaluated unit can neither pass nor fail the evaluation since it is designed to be a diagnostic tool rather than a test. This allows units to discover weaknesses early in their training cycle, develop a corrective training program, and subsequently emphasize training in weak areas. A unit that does not satisfactorily perform the nuclear tasks during external evaluation, will retrain and be reevaluated until the standards for all nuclear tasks are achieved. Division or comparable commanders, assisted by unit trainers, are responsible for the total evaluation.

Within the same 18 month period, the MACOM or Department of Army Inspector General (DNA conducts a similar DNSI) will conduct a technical validation inspection (TVI) of a unit. TVI will be within 180 days after a unit has shown it can satisfactorily perform all nuclear tasks during evaluation. (The need for retraining/reevaluation may require re-scheduling of the associated TVI). TVI is limited to technical operations (without tactical play), the personnel reliability program (PRP), systemic problems, and where applicable, war reserve storage and accountability.

The IG does not give overall ratings on TVIs as in the past. Only individual functional areas are rated. MACOM will review the TVI report in detail and use it as only *one* of the indicators for "qualification". Other readiness factors count heavily, such as unit readiness reports, personnel turbulence, performance on FTX-CPX, training proficiency determined by evaluations using ARTEP. There are others. MACOM will then rate the unit by giving any one of three ratings—nuclear qualified, nuclear qualified with limitation, or not nuclear qualified.

As the training program and inspection system for nuclear capable units were changing, so was the doctrine for nuclear operations. Newly revised FM 100-50 (unclassified) prescribes procedures, techniques, and standards for units with a nuclear mission under combat conditions and also provides guidance to commanders and staffs for functions peculiar to nuclear missions and capabilities. Tactical units no longer must establish elaborate security or operational procedures for nuclear weapons in field storage locations that do not increase technical proficiency or add to overall security. Additionally, and perhaps more important, units are not required to train unrealistically during tactical operations with nuclear weapons.

Since March 1978, the Army has made great progress in developing realistic standards and procedures for tactical nuclear operations. The revised policy for nuclear operations, training, and inspections has contributed to a more successful training program, increased the readiness capability of nuclear capable units, and provided a means in which to realistically evaluate total mission capabilities.

Charles L. Hellier
MAJ, FA
US Army Nuclear and
Chemical Agency
Springfield, VA

Redleg units

Infantry magazine began a series of articles in its January-February 1978 issue profiling an active infantry division of the US Army. The articles covered such areas as unit history, training readiness, field operations, joint training, and new concepts.

I would like to see the *Field Artillery Journal* feature a similar series of articles on active cannon, missile, and target acquisition units of the US Army and Marine Corps. Not only would the articles be interesting reading for individuals in their specific specialties, but they would also assist in promoting a better understanding of the different elements of the Field Artillery.

James R. Clark
1LT, FA
3d Armored
Division Artillery
APO NY

*The material you describe was solicited by **Infantry** magazine from respective division public affairs officers. Through their support, **Infantry** was able to publish the interesting series. As stated in previous **Journals,** as well as personal letters to our FA unit commanders, we here would be more than pleased to run a similar series of articles **if our** magazine could obtain the copy and photographs.—Ed.*

Let's do it anyway, artillerymen

The "maxi-package" associated with upcoming maneuver battalion ARTEPs is a challenge of the first order. The "maxi-package" has appeared to many of us in the past years by other names. As often as it appeared (mostly under the banner of "Combined Arms ARTEP"), it was cast aside or let die a natural death of benign neglect. Any S3 worth his horse blanket can name you five reasons why a combined arms or "maxi-package" ARTEP won't work. Given the constraints of most maneuver areas (safety, ecology, budgets, etc.) he will probably be right all five times. Concessions have to be made. Only the hardest of the hard core will fail to understand the decided drop in morale of the Aggressor detail which is taken under fire by live artillery and mortars.

Those realities notwithstanding, the "maxi-pack" offers the Redleg a unique opportunity to remind his maneuver associates of the artillery's capabilities. Because of the heightened interest resulting from an impending ARTEP, your maneuver associate is likely to be most receptive to your professional advice and assistance. Here are some simple guidelines which may help you insure that good fire support is provided to the maneuver unit you support.

• Fire support officers (FSOs) must be a *part of the planning*. I have been told by well-meaning folks "We have a great relationship with our FSO; every time we plan an exercise, he gets one of the first copies." That is roughly the equivalent of a quarterback taking the snap and then yelling to his linemen what the play is. They *may* be able to support him, but something is clearly lost. If this happens to you as an FSO, it's your fault—make that maneuver commander consider what you have to say. He may not have considered your ability to provide obscuration with smoke, thus allowing him to bypass what would have been an intermediate objective. In this and many other ways, fire greatly *influences* maneuver, not just *supports* maneuver.

• Don't confuse "opportunities" with "capabilities." The famous "real world" list of restrictions will, doubtless, modify your *opportunities* to provide fire support; however, during the planning phase, it is your job to insure that the maneuver commander is properly considering fire support *capabilities*. If the operations order (OPORD) allocates an "arc light" B52 strike on ROY, you must insure that the maneuver plan has taken this "capability" into account even though you will not have the "opportunity" to execute.

• Wherever possible, try to influence the maneuver planning so as to allow every possible opportunity for realistic use of live supporting fires. Artillery, mortars, and air strikes where they could logically be needed in combat—to the unit's front or at least flank—where they can be seen or at least heard adds to the realism of the training and the credibility of the FSO/FIST. This is not a question of support driving maneuver; it is a matter of making the maneuver planner aware of the additional training value available by moving his axis of attack two kilometers to the north.

• Finally, let's not betray sound doctrine in order to appear to be eager and accommodating. Artillery doctrine is both tested and sound. It has been developed by senior officers of all branches. Don't rewrite it by yourself. Don't do the maneuver commander the disservice of allowing him to think he will get a quantity or type of support that he will not get in combat.

With the right attitude and proper planning, the "maxi-pack" is going to allow for some excellent training. A significant portion of that training will occur before the first Frag Order is published. It will occur when the fire support officer and maneuver commanders sit down and declare "We need to *plan* some ARTEP scenarios." In fact, there is so much potential in such planning sessions that if I knew for a fact that the "maxi-pack" ARTEP would *only be planned,* I'd say, "Let's do it anyway!"

Mark Hamilton
MAJ, FA
HHB, 9th Inf Div Arty
Fort Lewis, WA

Passive defense

During a recent annual training session with my National Guard unit, I found our perimeter defense lacking in basic principles taught to me as an infantryman. For example:

• No observation or listening posts were used.

• Primary or alternate positions were not designated.

• No fire plans or positions were designated for machineguns.

• No workable reactionary force movement.

• No use of suppressive fire plans for likely avenues of approach.

When I addressed this problem with my commander, he explained that, under the current concept of "Shoot and Move," a passive defense posture was applied.

Hearing this, I could not help but wonder if this tactic should be applied to a rear trains element. I could understand the procedure used by a firing battery, but how about in the rear trains which do not have the requirement for numerous moves?

A second problem I observed was that there seemed to be a lack of awareness throughout the brigade of the 8 to 10 airmobile/airborne elements currently within the Russian Army. These divisions have specific primary missions in combat and among them is destruction of nuclear capable units. Therefore, attack by units from these elements is not only feasible but probable.

I do not understand this passive defense posture principle where there is no established perimeter, no method of early detection, lack of control of fires, and a general lack of survivability. Even with the advent of personnel shortages, a weak defense posture is not the answer.

Passive defense was once described to me as "a snake that when hit, strikes back, and then crawls away." If this concept applies, then I would, as a combat soldier, either attempt to maintain contact with the snake until final destruction is achieved, or move to another unit.

I personally feel that training shortcuts used in the evaluation of units due to personnel or equipment shortages are death dealing. If a unit is expected to perform its combat mission, then it should do so with whatever shortcomings may exist at the time. Units should understand that, without effective defense measures, mission accomplishment is almost impossible.

Every soldier should be trained to fight, fight to survive, and survive to fight again.

Timmy W. Reid
SFC, KSARNG
HHB (-Det 1)
1st Bn, 161st FA
Dodge City, KS

The battery defense should be organized in accordance with the nine basic considerations of defense (FM 6-50, chapter 7, page 1). One of these fundamentals is to ***"analyze and use terrain properly"*** *which stresses the use of passive defense measures. This concept requires the battery commander to select a position that is not easily detectable and is easily defendable, while still facilitating the accomplishment of the mission. The passive defense calls for the battery to melt into the terrain it occupies or, in other words, to naturally conceal itself to avoid enemy detection.*

Passive defense measures must be complemented with the other fundamentals of defense ***(plan to defend in depth, establish and maintain security, plan to defend in all directions, plan mutual support, practice dispersion, establish control, establish priorities, and be flexible)*** *in order to insure a sound battery defense plan. These fundamentals urge the battery to actively prepare its defense by establishing listening posts (LPs) and/or observations posts (OPs), patrols, reaction forces, and defensive positions with interlocking direct fires. By adequately employing these nine considerations, a battery can greatly improve defensive posture. To only employ passive defense measures without considering the active ones would lead to confusion and poor coordination within the battery during an enemy attack. This will stand to greatly increase the possible casualties sustained in this type of operation as well as hamper the main mission as artillerymen to provide support to the maneuver element.*

It appears then that a unit review of FM 6-50 may be required. Additionally, as artillerymen, the purpose of our defense is to avoid detection and early warning or, if detected, be able to repel the attack. We do not attempt to maintain contact.—Ed.

Attention Coast Artillerymen!

I am engaged in a research project on Coast Artillery Harbor Defense units and would appreciate hearing from anyone who served in a Coast Defense unit, particularly those individuals who served with a unit whose primary mission was defense against an enemy ship attack and those who served outside the continental United States.

Charles H. Bogart
201 Pin Oak Place
Frankfort, KY 40601

The Direct Support Field Artillery Battalion—Is It Time For A Change?

In reviewing MAJ Kenneth Owen's article "The Direct Support Field Artillery Battalion—Is It Time For A Change?" (*Field Artillery Journal*, July-August 1980), I find that much of his tenet is correct and unchallengeable. Field artillerymen who have been associated with the direct support field artillery battalion since the reorganizations that eliminated the headquarters and service battery and subsequently established the fire support team (FIST), suffer along with the author.

The need for a full-time S4 at battalion staff level is absolute. There is no question with Major Owen's assessment. Individuals who possess the abilities to perform both jobs (S4/service battery commander) are rare; the average Field Artillery officer assigned to that position cannot effectively manage his time and priorities for both positions. Thus, battalion commanders take steps to fill the void, most commonly by assigning the service battery commander as the full-time S4, and utilizing another officer as the commander of service battery. This solution, although it works at best, creates problems in career management and most importantly in property accountability.

I do take exception to the fire support battery (FSB) concept. In particular, those problems associated with the management of the FSB. Creation of the FSB, during a training environment (peacetime) is viable to a point, but do we create units for a peacetime mission or for deployment/employment during hostilities? What happens to the proposed unit when it goes to the field for extended exercises or for that matter during committal for hostilities? Some examples of problems created are:

- **Mess.** How does this section of the battery support its assigned FIST, when the FIST are attached to maneuver companies spread over the brigade zone? Does the FSB occupy positions in the brigade trains area or forward in the brigade tactical operations center (TOC) area with the brigade fire support officer (FSO)? The same questions have to be asked about administration, maintenance, and supply.
- **Command of the battery.** If the battery commander is as proposed (i.e., the brigade FSO), then the first sergeant should be the brigade senior fire support sergeant. Who is the executive officer; an FSO or a FIST chief? Unless there is an assigned XO with no other duties, the XO must also move out with the unit to which he is assigned to support. How does the commander under the concept above manage the battery if he is to perform his duties at the brigade TOC?

The areas stated above are only some of the concerns raised in the creation of an FSB. Major Owen's attempt to solve the problem is commendable, but appears to compound an already sizeable headache.

Logistical support, training activities, and command and control relationships of fire support sections must be addressed in the near future, or the concept will fail. Units in the field have identified problems and (to use the old cliché) "applied quick fixes." In our situation, they work for a specific training exercise or an annual training period, but because of personnel changes, personality quirks, etc., they don't last from one year to the next. What we need is a common solution, applicable to all FISTs.

I would suggest that the authors of FIST May have encountered or addressed some of these concerns in the early stages of formulating the doctrine, but decided to allow units and commanders in the field to define the problems and seek their own solutions. They create an asset of tremendous import to the Field Artillery but, in doing so, created logistical and command nightmares which are causing the system to suffer internally and give the impression externally that we in the Field Artillery Community are indecisive and can't get our act together.

I recommend that units which are experiencing problems with FIST, regardless of how small or trivial, make them known to the Close Support Study Group. Only by putting the problems on the table and thrashing them over will they ever be resolved. It could be that somebody has already experienced the problem and solved it, but others don't know about it.

Frederick A. Camacho
MAJ, FA, WIARNG
S3, 1-120th FA
Wisconsin Rapids, WI

From the Editor

Following distribution of the September-October issue, Ms. Ann Reese left the *Journal* for reassignment in another career field. In addition to wishing Ann well, we here offer our sincere thanks and appreciation for her invaluable contributions as the *Journal's* Circulation Manager and Editorial Assistant.

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As this year comes to a close, the *Journal* staff thanks all of you who, whether a reader or contributor, provided the interest and support necessary to the magazine's existence.

Have a safe and happy holiday season.

1980 Redleg Reference

The following is a list of *Journal* articles and "View From The Blockhouse items for calendar year 1980 and the issue in which the material was published. The letters (VB) indicate "View From The Blockhouse" items.

Air Operations/Support

Aerial Displacement of Tube Artillery, Nov-Dec.

Ammunition/Fuzes

Artillery Fired Atomic Projectiles—A Field Artilleryman's Viewpoint, Mar-Apr.
Development and Use of Field Artillery Fuzes in World War II, Mar-Apr.
Liquid Propellant For Cannon Artillery?, Nov-Dec.

Communications/Electronics

Communication readiness, Jul-Aug (VB).
Countering the Soviet EW Threat to Field Artillery Communications, Mar-Apr.
Electronic counter countermeasures training device, Mar-Apr (VB).

Counterfire

Ballistic met dollar crunch, Sep-Oct (VB).
Field Artillery Target Acquisition Conference, Jan-Feb (VB).
Forward Area Limited Observation Program, Nov-Dec (VB).
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Met expendables for sound/flash platoons, Sep-Oct (VB).
Meteorological equipment repair tapes, May-Jun (VB).
Revised forms for survey computer set, Nov-Dec (VB).
Sound ranging—essential to counterfire, Mar-Apr (VB).
Standard survey party, Mar-Apr (VB).
Status of sound ranging equipment under procurement, Jul-Aug (VB).
Target acquisition battery DA TOE changes, May-Jun (VB).
Target Acquisition Commanders Conference, Jul-Aug (VB).
The 63 CMF revision, Jul-Aug (VB).

Doctrine

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Requisition authority for PHHC, Mar-Apr (VB).

Equipment
(continued)

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The New Artillery, Nov-Dec.
TI-59 hand-held calculator, Nov-Dec (VB).

Foreign

Soviet 122-mm Self-Propelled Howitzer, Jan-Feb.
The Israeli Field Artillery System: An Overview, Jan-Feb.

Gunnery

How GFTs get to the FDC, May-Jun (VB).
Wanted: Battalion FDO! Jan-Feb.

History

Pelham—The Gallant Artilleryman, Mar-Apr.
Tadeusz Kosciuszko: Father of American Artillery Tactics, Jul-Aug.
The American "Schneider," Nov-Dec.
The "Long Tom," Nov-Dec.
The Roar of the 8-Incher, Mar-Apr.

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Your Artillery Mechanic . . . The Invisible Soldier, May-Jun.

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USAFAS Archives Program needs input, May-Jun (VB).

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Direct Support Field Artillery Beyond 1990, Jul-Aug.
Division '86 Update, Mar-Apr.
The Direct Support Field Artillery Battalion—Is It Time for a Change? Jul-Aug.

Personnel

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Branch is Never Immaterial!, Jan-Feb.
First female FA warrant officer, Sep-Oct (VB).
Survey of FA company grades, Jan-Feb (VB).

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Rockets and Missiles: An Obituary for Cannon? Jul-Aug.
The Comeback Trail: Challenges in Equipping the New Army, Sep-Oct.

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Attachment or operational control? May-Jun (VB).
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Battery Security in the Active Defense: A Proposal, Mar-Apr.
Battlefield Interdiction: Old Term, New Problem, Jan-Feb.
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Field Artillery Officers Advanced Course Profile, May-Jun (VB).
Field Artillery Reference Data Update, Jan-Feb (VB).
Firefinder Operator Trainer, Jan-Feb (VB).
Firefinder Simulator—A New Era In Training, Nov-Dec.
Firefinder training, Nov-Dec (VB)
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Hipshoot!, Jul-Aug (VB).
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MILES: Realistic Training for Direct Support Artillery, Sep-Oct.
NET course for AN/TPQ-37, Mar-Apr (VB).
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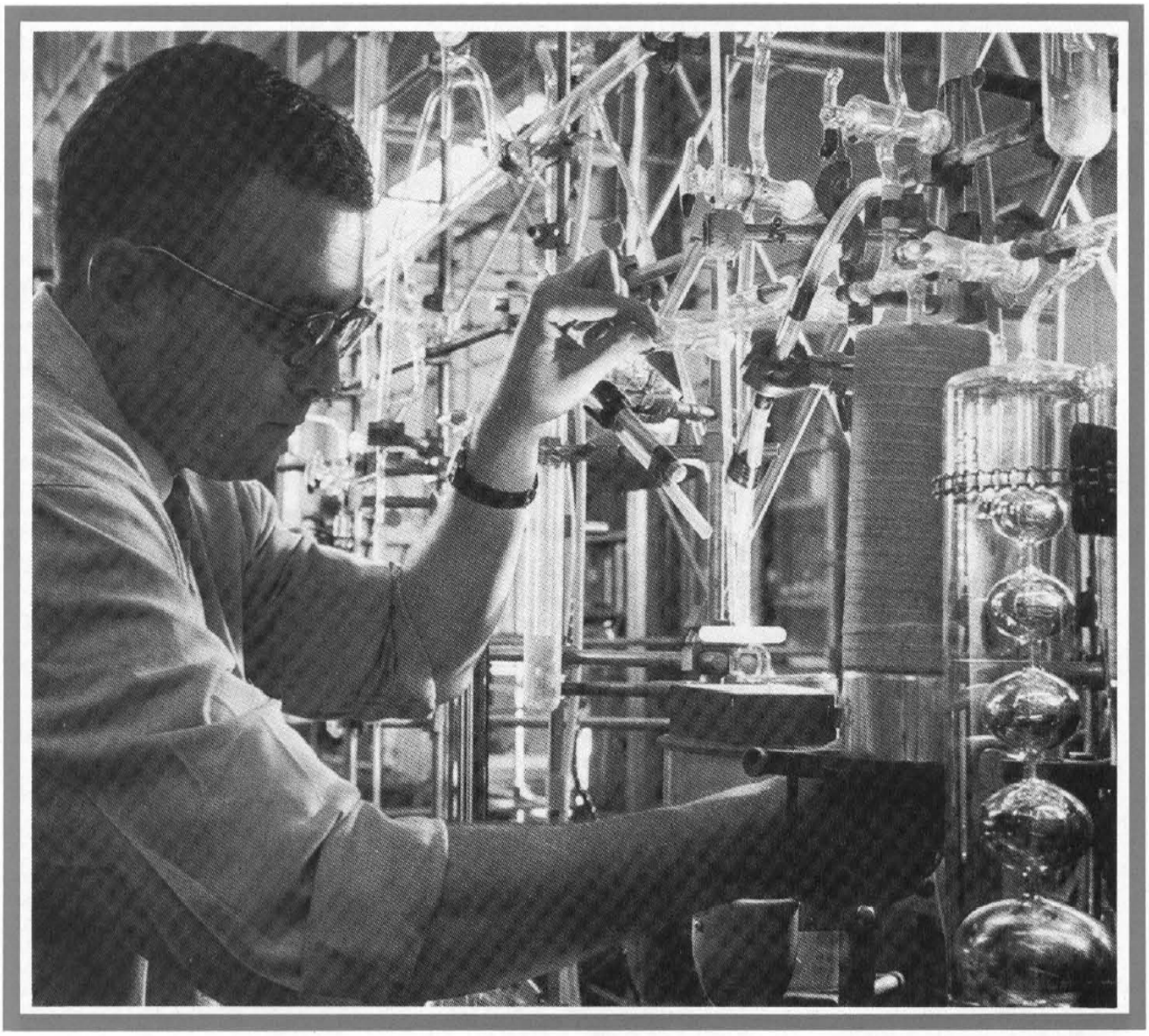
Training literature update, May-Jun (VB).
Update on FMs 6-30 and 6-40, Jan-Feb (VB).
Upgrade of Tactical Communication Chief Course (MOS 31V30), Sep-Oct (VB).
USAFAS accredited, Jul-Aug (VB).
User test conducted for A17E-12 training device, May-Jun (VB).



Liquid Propellant for Cannon Artillery?

by CPT Joseph W. Silbaugh Jr.

Not only was Leonardo da Vinci a painter, sculptor, architect, and engineer, but he was also a designer of military hardware with many ideas that were hundreds of years ahead of the times. He was keenly interested in the art of artillery and designed a self-propelled cannon, a fin-stabilized rocket, a machinegun, and a covered armored car. Yet, if he returned today, he would probably be awed at the dramatic developments since the 15th century.

In his article, "Field Artillery of the 1980s" (*National Defense*, May-June 1978), MG Jack N. Merritt (former Commandant of the US Army Field Artillery School) draws us a picture of a highly sophisticated battlefield where TACFIRE (Tactical Fire Direction System and its microprocessor computer technology allow us to break the habit of standard firing unit formations. In addition, Firefinder, BSTAR (Battlefield Surveillance Target Acquisition Radar), and the RPV (Remotely Piloted Vehicle) will provide accurate target acquisition to TACFIRE which interfaces with FAMAS (Field Artillery Meteorological Acquisition System) and PADS (Position and Azimuth Determining System) to provide precise firing data to individual cannons. Throughout his articles, General Merritt highlights major developments in weapon systems and ammunition, including precision guided projectiles, rockets, and missiles.

Although it is obvious we have improved our vehicles and weapons and refined our target acquisition and fire control methods, we are still using the same basic chemical propulsion technology introduced centuries ago. For that reason, the concept of using a liquid instead of a solid propellant in artillery cannon is currently under study. As with any new system, there may be some innate resistance to change as well as unforeseen difficulties, but the potential advantages to the Army, other services, and the country as a whole make the project worthwhile. Even though the move from solid to liquid propellant (LP) is a radical shift in cannon propulsion technology, the concept in itself has "been around" for some time.

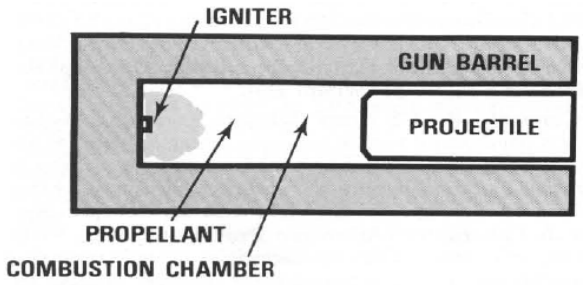


Figure 1. Bulk loaded liquid propellant gun.

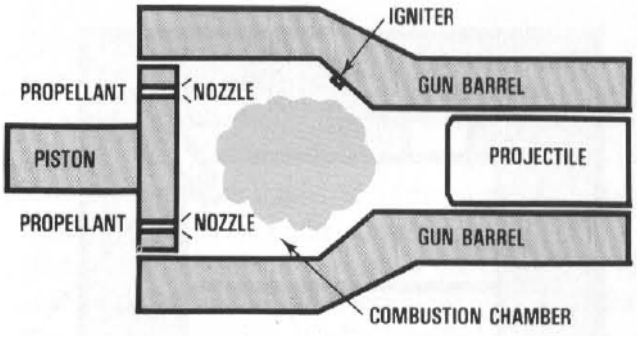


Figure 2. Direct injected regeneratively pumped liquid propellant gun.

What is a liquid propellant gun?

Basically, there are two types of liquid propellant guns (LPGs): the bulk loaded (figure 1) and the direct injected regeneratively pumped (figure 2).

Until about four years ago, the bulk loaded liquid propellant gun (BLPG) was the kind most extensively researched. In this type weapon the chamber behind the projectile is filled completely with liquid propellant, and the propelling charge is usually ignited at the rear. The present BLPGs, however, suffer from erratic combustion and do not produce the same ballistics with each firing.

In the direct injected regeneratively pumped gun (RLPG), the propellant is pumped through orifices in a differential area piston during the combustion cycle so that the rate at which the propellant is injected into the combustion chamber is controlled. As the piston moves back, liquid is injected into the combustion chamber; thus, the faster the piston moves back, the faster the liquid propellant is sprayed into the combustion chamber where ignition and combustion are continuously taking place until the fuel is burned. The rate at which the liquid propellant is metered into the combustion chamber controls the rate of combustion and thus the pressure. Muzzle velocity and range are controlled by the stroke of the piston, chamber pressure, and in-tube projectile travel.

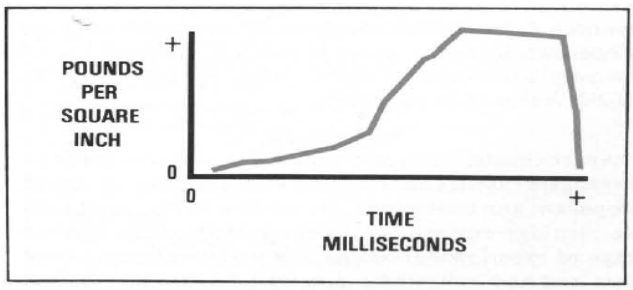


Figure 3. Propellant pressure time curve.

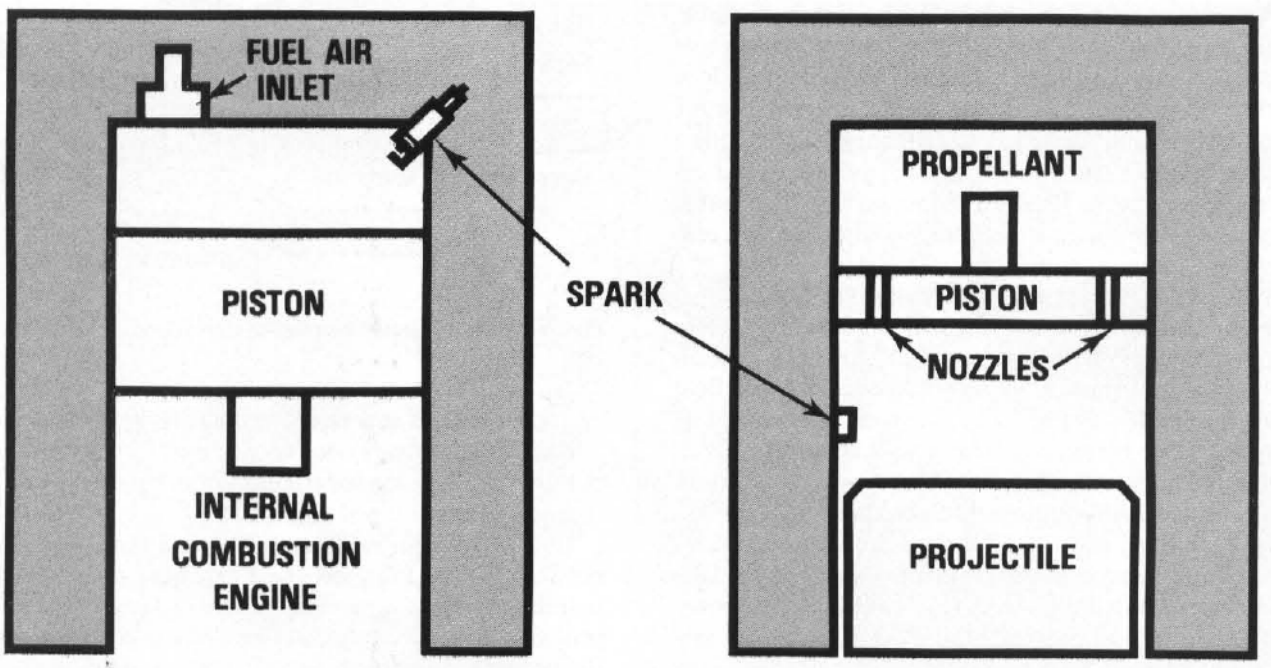


Figure 4. Internal combustion engine operation.

For example, the more liquid propellant used, the higher the muzzle velocity and the longer the range (shown by the pressure time curve in figure 3); conversely, the less liquid propellant used, the lower the muzzle velocity and the shorter the range. The pressure time curve also shows that, for a short time, there is almost a steady state of combustion, which generally provides more efficient use of energy from the propelling charge. To illustrate the operation more simply, consider an internal combustion engine in which the carburetor injects the combined fuel-air (oxygen) mixture into the cylinder; the spark ignites the mixture and the piston is driven down by the force of the explosion (figure 4). Instead of a carburetor, in the regeneratively injected liquid propellant gun, the holes in the piston meter the liquid propellant into the combustion chamber where a spark ignites the liquid propellant and forces the projectile from the tube.

Note: *Only the direct injected regeneratively pumped method is considered here because General Electric Corporation (who is conducting a study on the use of liquid propellants under an Army sponsored contract) has reportedly demonstrated much better control using the RLPG rather than the BLPG.*

Background

Approximately 20 years ago, a decision was made to investigate caseless ammunition rather than study liquid propellant gun technology. By the late 1950s, combustible cartridge exploratory development had reached the stage of experimental testing in a variety of heavy tank guns and had indicated a potential for use in armored weapon systems. History and the Congressional Record indicate that this program was plagued with failures and that caseless ammunition proved to be unsatisfactory.

In the early 1970s, both the United States Navy and the Defense Advanced Research Project Agency (DARPA) had intensive programs directed toward the immediate application of liquid propellant guns. The Gruman Aerospace Corporation study for the Navy indicated that a liquid propellant gun would be efficient and effective for use in an air-to-air role and would have a 300 percent increase in kill probability over the current 20-mm Vulcan M61A1 cannon. However, in late 1976, the prime contractor for DARPA experienced two catastrophic failures in a bulk loaded liquid monopropellant gun system, and Congress demanded that DARPA terminate its demonstration program. Also, in late 1976, Congress denied funds for further work on a Navy BLPG and, in the spring of 1977, removed monies from the Air Force budget for a BLPG demonstration program. The Air Force subsequently awarded two contracts (one to Ford Aerospace and one to General Electric) to develop a more conventional cannon rather than conduct additional research on a liquid propellant gun.

Currently, the US Army Ballistics Research Laboratory is conducting a small in-house research program on monopropellants, basically aimed toward supporting a General Electric Corporation contract sponsored by the Advanced Concept Team (ACT) with the Ballistics Research Laboratory (Alberdeen Proving Ground, MD) acting as monitor. General Electric is investigating the applicability of the regeneratively injected process to high pressure, liquid propellant guns. This study will establish

the technical data base needed for eventual application to artillery cannon.

Success in developing a liquid propellant gun would have considerable impact on the Army's medium and large caliber weapons systems. A liquid propellant tank gun system is, however, out of the question at this time since ammunition design decisions for the XM1 (the tank of the 1980s) are almost totally fixed. Once the capabilities of the RLPG are demonstrated, extension to the higher operating pressures required for a tank gun may be more seriously pursued. At the present time, however, the ballistic characteristics of the RLPG are more suited for larger caliber weapons with lower operating pressures and extremely well-controlled muzzle velocities. Since artillery calibers (105-mm, 155-mm, and 8-inch) have remained essentially the same since World War II, one of these calibers would seem a likely candidate for the application of the RLPG technology. Although there is currently a great emphasis on self-propelled artillery, recent improvements in self-propelled artillery basically have centered on adaptations and modifications of existing weapons systems to achieve higher mobility (by reducing weight) and longer ranges (by using different solid propellant charges and longer tubes).

New concepts in artillery

As General Merritt stated in his article ("Field Artillery in the 1980s"), "The Field Artillery System will furnish the combined arms teams the versatile, destructive firepower it needs" (i.e., if the combat industrial developers can field the various pieces of equipment).

What is being considered is a totally different type of technology which would have far-reaching advantages in the total Field Artillery System as well as multiservice applications. First, let us compare liquid and solid propellants.

It is fairly common knowledge that our solid propellants are produced in government owned and contractor operated (GOCO) plants and that the environmental impact of their production is significant. Also, since several critical materials and high amounts of energy are required in the production of solid propellants, they are extremely sensitive and must be handled with great care.

In contrast, the liquid propellants under study are of hydroxyl ammonium nitrate (HAN), fuel-nitrate, and water solutions which we will refer to as LPX. The elements required to produce LPX are not costly, and the production process is basically a non-polluting electrolysis (unlike our current ammunition plants). Since a low amount of energy is required to produce LPX, the cost should be considerably less than that of current ammunition.

How safe is LPX?

LPX is relatively safe (almost too safe) since the normal flammability hazards associated with ammunition production, storage, and shipment are not present. Unlike most liquid and solid propellants, LPX will not support a flame at atmospheric pressure (this does not mean it cannot be ignited). HAN-based liquid propellant will react at atmospheric pressure, but only with slow, low-level energy release similar to a fizz burn. On the other hand, LPX must be under considerable pressure to be ignited to flame combustion and is therefore quite suitable for use in cannon. Another unique quality of LPX is that it is water soluble. If LPX is spilled or becomes decomposed, water can be used to flush the contaminated area which makes this propellant simpler to handle and ideal for naval applications.

In case of demilitarization, solid propellants are costly to destroy. Chemically, LPX can be diluted easily and inexpensively and might even be sold as a high grade nitrate fertilizer, thereby diminishing the cost of demilitarization significantly.

Advantages

As previously mentioned, the systems probably most affected at first would be self-propelled artillery. Possible advantages associated with a liquid propellant direct injected regeneratively pumped gun system are as follows (figure 5):

ACCEPTED ADVANTAGES

- Safety
- Reduced vulnerability
- Increased volumetric impetus
- Continuous zoning
- Simplified logistics
- Increased on-board storage
- Simplified loading
- Elimination of cartridge case
- Reduced muzzle flash
- Improved weight distribution (important in aircraft)
- Increased ammunition carrying capacity

POTENTIAL ADVANTAGES

- Reduced wear and erosion
- Increased rate of fire
- Adaptability to existing projectiles and barrels
- Production ease
- Lower cost to produce
- Lower energy requirement in production
- No critical materials required in production
- Demilitarization (low cost)
- Use after demilitarization as high nitrate fertilizer
- Reduced storage cost
- Reduced transportation and handling cost
- Reduced packaging and preservation cost
- System design (external storage)

DISADVANTAGES

- New field
- Not as much technical data available
- No direct correlation to rocketry

Figure 5. Advantages and disadvantages of liquid propellant.

• Battlefield survivability may be increased because liquid propellants appear to be less sensitive to outside ignition than presently fielded solid propellants. (Liquid propellants could be externally pumped and stored.)

• An increased ammunition carrying capability might result because of additional storage volume since, on a volume basis, there is much more energy available in liquid propellant than in the same volume of perforated solid propellant. This is extremely important for system design and also illustrates the increased volumetric impetus of LPX.

• This leads to a key advantage: That of continuous zoning instead of fixed zones. The amount of liquid propellant injected into the chamber can be metered precisely; e.g., you could call in zone 4.5576 and get more accuracy from the weapon system. With some redesign and reprogramming, TACFIRE and other battlefield computers might provide a means for easy implementation of continuous zoning.

• Similarly, the rate of fire may be enhanced because only the projectile has to be handled manually. Therefore, system design and automatic loading could be simplified. For example, suppose the gun had to return to zero elevation for the automatic loader to function; perhaps only the projectile would have to be loaded in zero elevation and the gun could be elevated as the programming is set for the liquid propellant charge.

• The brass or spiral wrap cases (105-mm and other tank guns) could be eliminated.

• Another advantage lies in reduced muzzle flash. Because solid propellants are very fuel rich, there is some loss of energy when a charge is fired. In fact, less than half the propellant energy is normally imparted to the projectile as it leaves the tube. The hot fuel rich gases speeding out of the tube burn vigorously when mixed with outside air, causing a large secondary flash. With liquid propellant, there should be no secondary flash because the fuel-to-oxidizer ratio is basically one; therefore, no fuel rich gases will burn off at the end of the tube.

• Because the gases of a solid propellant are so hot, a thin layer of the tube is actually melted each time a weapon is fired. LPX gases are lower in temperature; thus there should be reduced tube wear and erosion. More study is necessary, however, to determine the exact effects of liquid propellant on tube life.

• General Electric Ordnance System engineers indicated that existing tubes could be adapted to the new liquid propellant system, thus reducing the cost compared with developing a new system.

• With quick disconnect couplings and our experience in handling liquids, resupply should be expedited.

Disadvantages

The biggest advantage lies in a lack of sufficient data available to the field. There is no correlation to the low pressure data obtained with rockets using liquid propellants.

Adequate understanding of the high pressure combustion process and potential explosive hazards must be achieved prior to moving on to the larger scale testing. Operational requirements such as performance, size, weight, safety, and reliability must be taken into account in developing configurations that have potential for ultimate operational feasibility. Propellant loading methods and ignition techniques are also factors which require further consideration and investigation.

Conclusions

Thus far, the possibilities of a liquid propellant gun look especially attractive, considering performance, cost, projected ease of implementation, and potential benefit (not only for the military, but also for our environment and economy). The energy savings alone in production of liquid compared to solid propellants appear to be significant and worthy of further investigation.

In the final analysis, liquid propellant gun technology is just scratching the surface but, with continued interest and research, could open a whole new flexibility in system design. As we've seen pointed out in other *Journal* articles, "Let's find out."

CPT Joseph W. Silbaugh, a Quartermaster Corps US Army Reserve Officer, lives in Shrewsbury, PA.

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

Please do not use this system to order publications. Consult your FA Catalog of Instructional Material for this purpose.

Firefinder Simulator– A new era in training

by WO Thomas Curran and
Dr. Raymond O. Waldkoetter

Simulation has naturally been accepted as a symbolic operation which looks like or produces results comparable to that of another system that is too expensive, difficult, or complex to use for routine training purposes. An exercise that imitates the specific activity and movement desired, even if only on a small scale, can surprisingly motivate and improve a student's learning. For example, experiments show that carefully visualizing one's golf swing and practicing the desired movement will actually have a positive influence on how well the entire game is played. However, simulation or controlled practice must have well-designed application even in a manual or imagined training mode to allow full opportunity to exploit its utility.

The Firefidner radar systems (AN/TPQ-36/37) are sophisticated mortar/artillery locating radars that provide automatic first round location of multiple weapons firing from different locations. Therefore, early in the development cycle, it was apparent that a simulator might effect a significant cost savings in the training base system. By emulating the actual system, the Firefinder Operator Trainer A17E11 offers a more economical and rapid way to train students. Additionally, its automated instructor control allows higher student-to-instructor ratios.

Beginning in November this year, the first resident Firefinder Operator Course (13R10) will be offered at the Field Artillery School, and nearly half of the training will be accomplished on Firefinder Operator Trainers. The device consists of three major components:

- *Computer,* which serves as the storage unit for the *Trainer. Fixed* and variable discs permit all training exercises to be filed and recalled as student assignments.
- *Instructor Station,* where the exercises are requested from the computer and sent to the Student Station. The Instructor Station consists of two computer terminals

A17E11 Trainer

which interface with the main computer, line printers which provide a permanent copy of student progress, and an intercom system which is used to communicate directly with the students.

• *Student Station*, which is an exact replica of the interior of the S-250 Common Shelter (control center for the Firefinder radar system) where the student performs each exercise the same way as it would be performed on the "real" system. For example, when the actual radar system is emplaced, an initialization program is run by the computer to set up parameters required for operation. This situation is simulated on the trainer, and the student is given questions by the computer to set these operating parameters into the radar. These questions, in sequence, deal with site location (coordinates, direction, and altitude), map data (the size of the map), TACFIRE codes, and other artillery information. The students must answer these questions in the sequence required for the actual equipment.

Thus, the operator trainer offers a positive instructional opportunity in the application of the following cost-effective simulation techniques:

• Trainer scenario exercises based on Firefinder radar systems' functions and operations.

• Instructor control/student interaction which allows individual pace in exercises and evaluations.

• Efficient student transition to the actual radar.

The Firefinder operator trainer is an excellent example of an automated trainer since it realistically simulates the man/equipment interface experienced by an operator on the actual radar systems. The results obtained by this operation are multidimensional.

• Training effectiveness is verifiable on the A17E11 trainer.

• Research, trainer, and system costs are completely recoverable in Firefinder Life Cycle Management.

• Instructor training management is more efficient.

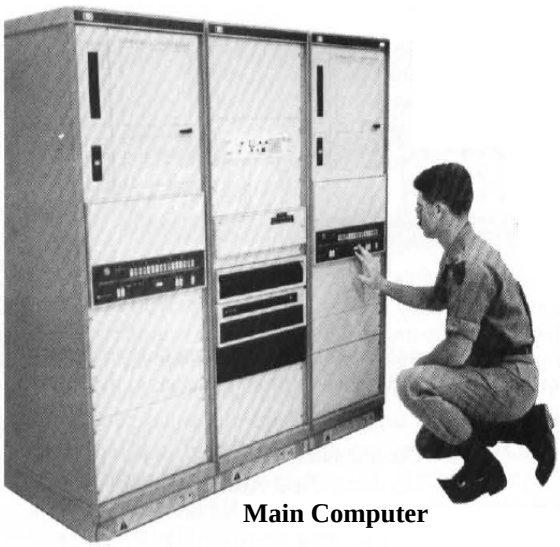
• Positive training motivation is applied to attain proficiency and operational continuity.

The interconnectivity of the instructor and the student is most important since, when dealing with computer-controlled training devices, a common misconception is that the device determines the rate of learning and that control is a sole function of the trainer. This is not the case, since the role of the instructor is one of *direct control* over both the rate at which the student will learn and the rate at which the trainer will teach. This requires direct instructor experience in managing and evaluating the progress and quality of all aspects of the training curriculum.

The instructor assigns the student an exercise, and the device initiates the training sequence; however, the instructor uses the intercom to guide the student and, with the aid of the computer terminal, monitors student progress. The trainer alerts the instructor to each student switch, and only the instructor can correct errors or redirect student learning efforts. The device then stores and grades responses and notifies the instructor of student progress who then sorts out the stored information, evaluates the grading, and guides the student through the course.

A single instructor at the trainer console can control and monitor up to six students. The trainer system simulates all actual radar system human factors, tolerances, instrumentation, and other physical characteristics which allow students to learn selected tasks and skills at their own individual pace. As each exercise progresses, overall monitoring capabilities include detailed display or printout of student actions, historical student data, and continuous display and recording of student progress. Such system attributes lessen the instructor's administrative stress, allowing more time for positive reinforcement of operator performance skills. An instructor has the interactive option to stop any student exercise, redirect those having learning difficulty, and then continue the exercise from that point or from any other point in the exercise. For a given task, each error is displayed at the instructor's console along with the automatic updating of each student's percent of accuracy, completeness, and time standards for each task completed.

Both the instructor and student receive positive learning feedback through the accurate trainer emulation of the operational characteristics



Main Computer

of the actual Firefinder system. In the design of this simulator training device, enhancement for training purposes was accomplished largely through the use of computer-assisted and computer-managed instruction (CAI/CMI). In the Firefinder trainer scenarios, this CAI gives the student simulated messages from a supervisor or user unit and task directions at designated points in the exercise. For example, when the student has correctly initialized the radar system, an alert buzzer cue sounds with the message prompting: "Supervisor commands you begin radiating." By allowing the scenario to prompt the student, an instructor is released from the stress of cueing which, in turn, lends credibility to real system operations. Application of CMI is evident in numerous messages displayed at the instructor's console to note student errors. When student difficulties are noted, the instructor facilitates the student's learning progress by holding, reversing sequence, restarting, or cancelling the exercise. To assess a student's speed in completing a training task, scenario controlled clocks are instrumented to determine the time interval between switch actions. Should a student's time in task performance go longer than required by the training objective, the time criteria score is reduced and notice is made to the instructor at the console display.

As a case study, the Firefinder Operator Trainer represents the awakening of a new era of computer-assisted training which effectively simulates actual experience on Field Artillery equipment systems. While some may question the concept of simulated training, actual exposure to computer-managed and computer-assisted instruction should convince them of its worth as a training asset. The problems of classroom space, larger instructional staffs, and excessive expenditures of repair parts and fuel are important reasons to look toward a future of simulated devices. The lesson learned with Firefinder is that, as systems become more complex, in contrast, training for operation of the sophisticated equipment must become easier. Any attempt to gain experience or training using only actual hardware proves to be difficult and extremely expensive. One can see then that this new era is slowly justifying simulation as a means to adapt to the advanced world of automated weapon systems which demand a highly structured student learning process.

The question might be asked, "Is Firefinder simulation mandatory?" The response to this should be "Yes!" We must take the most cost-effective way that accomplishes our training goals. Built into the trainer is the capability to train more students in less time, which requires fewer actual systems at the training base.

Another question which arises is: "Would having more of the actual equipment available assure more proficient training?" The only answer to this question is "No!" Effective training, with learning transfer of critical skills and tasks, is most likely when simulated behavior is programmed, trained, and evaluated.

One of the prime considerations in developing Firefinder training devices was cost-effective training. Originally, a total of 26 radars (10 AN/TPQ-36 and 16 AN/TPQ-37) were to be procured for the Field Artillery School training base. At a cost of approximately $3 million each, it was felt that alternatives to support training were needed. The total cost of the development, production, and installation of the Firefinder training devices was $16 million, and the requirement for actual radar equipment was reduced to eight (a savings of approximately $38 million during the procurement phase). In addition to the immediate savings, the total savings in life cycle training costs are estimated at $173 million.

Beyond cost savings, there is an increase in training effectives that is difficult to put into monetary terms. For example, with the actual equipment, only one student could operate (hands on) the system, whereas, as previously mentioned, with the trainer six students can be trained simultaneously under the control of one instructor.

The Firefinder Operator Trainer A17E11 is a benchmark for a good beginning in superior artillery equipment simulation training. As the skill performance aids program becomes widely implemented, simulated training devices comparable to the Firefinder trainer will grow to support force development, deployment of new materiel, and conversion of human resources.

WO Thomas Curran is assigned to the Firefinder Branch, Radar Division, Counterfire Department, USAFAS. Dr. Raymond O. Waldkoetter is employed by the US Army Research Institute for the Behavioral and Social Sciences Fort Sill Field Unit, Fort Sill, OK.

View From The Blockhouse

notes from the school

TI-59 hand-held calculator

Video tape TEC Lessons will be available for the Computer Set, Field Artillery, General, Cannon Gunnery Applications by January 1981. The lesson numbers and titles are listed below:

Lesson number	Title
-2E/250-061-0864B	Description of the Computer Set, Field Artillery, General and Program Kits.
-2E/250-061-0865B	Computational Principles and Limitations of the Cannon Gunnery Application of the Computer Set, FA, General.
-2E/250-061-0866B	Computation of Firing Data Using the HHC for Grid, Polar, and Shift Missions (All Cannon Weapon Systems to Include 14.5MM Trainer).
-2E/250-061-0867B	Cannon Gunnery Program for the HHC, Error Codes, and Operator Warnings.
-2E/250-061-0868B	Precision Registration and the Determination and Application of Residuals Using the HHC.
-2E/250-061-0869B	Computation of a Concurrent Met Using the HHC.
-2E/250-061-0880B	Computation of a Subsequent Met Using the HHC.
-2E/250-061-0881B	Hasty Survey and TGPC Computations Using the HHC.
-2E/250-061-0882B	HB/MPI Computations Using the HHC.
-2E/250-061-0883B	Special Missions with the HHC (WP, Smoke, ICM, ILLUM).

TCAD becomes TCADD

The Tactics and Combined Arms Department (TCAD) has been officially redesignated the Tactics, Combined Arms and Doctrine Department (TCADD). The new name is indicative of TCADD's added responsibility for management and development of fire support doctrine.

As the designated proponent for fire support doctrine within the Field Artillery School, TCADD will serve as a single source for coordination of doctrinal development matters to include answering all questions concerning fire support doctrine.

The new task will also involve management of the Doctrinal Literature Program which is designed to move doctrine from the conceptual stage to a published field manual.

Individuals and organizations are encouraged to contact TCADD with their doctrinal questions at the following address:

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

Or, by calling AUTOVON 639-5609.

Parts for M109A1

The Field Artillery School has recently received several inquiries from the field concerning wartime parts requirements and appropriate peacetime stockage levels for the M109A1 howitzer.

The Field Artillery Controlled Sample Data Collection (SDC) Program has yielded valuable insight regarding the contribution of Non-Operational Ready Supply (NORS) time to the Operational Readiness (OR) rate. The following parts for the M109A1 caused combat abort and logistical delay over 30 hours:

NSN	Nomenclature	Average NORS time (hours)
1025-186-5078	Replacement kit, seal	123.1
1015-928-6192	Kit, repair	48.0
1015-570-6971	Valve assembly	168.0
1025-019-5267	Crank, operator assembly	307.5
1025-439-6541	Lever cam	137.0
5330-633-4935	Packing, preform	53.0
1025-757-4787	Carrier assembly	288.0
1025-860-9169	Pin, firing	60.1
1025-861-1467	Ring	41.5
1025-861-1460	Ring	47.8
1025-919-7277	Cylinder, recuperator	36.0
1025-919-0408	Plunger, detent	81.4
1025-937-0616	Shaft, follower assembly	54.3
1025-937-2027	Buffer assembly	624.0
1090-937-2034	Seal replacement kit	97.4
1090-937-2818	Seal	71.9
1025-999-7931	Housing assembly	66.0

It is recommended that M109A1 units adjust individual Prescribed Load Lists (PLLs) in anticipation of excessive NORS delays for these parts. Additionally, this data should be provided to appropriate support units for Authorized Stock Level (ASL) considerations.

Local judgment (part-by-part review) rather than blanket increases in PLL/ASL is extremely important. (Mr. Abrams, DCD)

New CPX available

The Field Artillery School has recently completed the "Battle of Eiterfeld," a special Fire Support Element/Fire Support Team Command Post exercise (CPX). The Battle of Eiterfeld is designed to train FIST and battalion fire support personnel in ARTEP tasks which require an interface between fire support and maneuver elements. This CPX can be conducted with or without participation of the direct support field artillery battalion and maneuver personnel in a garrison or field environment. Additionally, it exercises current doctrine and tactics in a European scenario and can train one, two, or three FISTs and one battalion fire support element.

The Battle of Eiterfeld is not a war game and, as such, can be tailored to individual units and missions, using the unit's own terrain models, scenario, and message play. The potential is limited only by one's resources and imagination.

The Battle of Eiterfeld can be requested by writing to:

Commandant, USAFAS
ATTN: ATSF-CT-RC-FSB
Fort Sill, OK 73503
(AUTOVON 639-1406)
(SSG Sprung, DCD)

M110A2 prefire checks

The Commanding General, US Army Field Artillery Center and Fort Sill (USAFACFS), recently received a letter from USAREUR concerning proper prefire procedures for the M110A2. Specifically, the letter questioned the sequential procedures identified in the March-April 1979 *Field Artillery Journal* and a letter from USAFACFS to all 8-inch units (dated on or about 9 February 1979) which addressed damaged M201 cannon tubes. The purpose of this follow-on information is to clarify any misunderstanding or misconceptions that units may have received from the article or letter.

Three critical checks were identified that must be performed each time an 8-inch weapon occupies a new position. The article and letter addressed these checks as they appear in TM 9-2300-216-10 (not in the sequence of performance) which has presented some problems in the field. The correct sequence for performing the checks is as follows:

- Fluid level check.
- Establish the oil reserve.
- Equilibrator adjustment check.

Currently, the fluid level check cannot be performed with the weapon emplaced (spade down, lockout cylinders engaged). Therefore, to allow units time to perform this check prior to emplacing the howitzer, the ARTEP standard in ARTEP 6-165 was changed to allow 8½ minutes rather than 2½ minutes for emplacement. Additionally, a modification to the dipstick has been developed to allow units to check the fluid level once the weapon is emplaced. (USAFACFS is attempting to get an early release of the dipstick modification.)

Neither the old (TM 9-2300-216-10) nor the new (TM 9-2350-304-10) M110A2 manuals point out that units should check to determine whether the equilibrators and/or loader-rammer are *out of adjustment* before making any adjustments. (Changes to these manuals will be submitted by the School.) Although not clearly stated in the manual, if the equilibrator is out of adjustment and/or the loader-rammer is out of time, corrective steps as outlined in the manual must be taken. (Obviously, there is no need to perform adjustment or timing if not required.)

Until units receive the modification to the dipstick, the following procedures and sequences should be followed for emplacement:

- Howitzer pulls into position and receives initial deflection.
- Move cannon to in-battery position.
  1) Check recoil mechanism for leaks.
  2) Check valve operation.
- Perform fluid level checks.
- Establish the oil reserve (cannon must be retracted and returned).
  1) Check recuperator cylinder head oil index.
  2) Check movement of replinisher piston.
- Emplace spades.
- Lay howitzer.
- Emplace aiming points.
- Measure site to crest.
- Boresight.
- Emplace azimuth marker, if appropriate.
- Complete prefire checks (all of those not already performed); e.g., equilibrator adjustment, loader-rammer timing, telescope mount, and telescopes.
- Position improvement.

Even though the number of M201 cannon tubes damaged from fallback has been significantly reduced since the initial article and letter were published, occasionally a tube is still damaged. It is therefore important that training continue and that all units remain aware of the potential problems of failing to follow required procedures. (LTC Landrum, WD)

COUNTERFIRE SYSTEMS REVIEW

Forward Area Limited Observation Program

The Counterfire Department, USAFAS, has completed a Forward Area Limited Observation Program (FALOP) handout which contains complete instructions for taking and recording surface observations.

In the future, the artillery ballistic meteorology crewman will be required to observe, record, and disseminate surface observations, using the NATO Supplementary Surface Weather Report (SUPREP) code. The code is simple and easy to use by soldiers with little or no observing experience.

Students graduating from the Artillery Ballistic Meteorology after 15 August will be given the handout, and each meteorology section will be receiving all necessary information via the next Met Newsletter. For further information contact:

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-R (Mr. Charles Taylor)
Fort Sill, OK 73503
AUTOVON: 639-1108/2408

Meteorology Data System AN/TMQ-31

The state of the atmosphere (weather) affects the employment of rockets, missiles, and extended range cannon munitions, as well as the necessary dispersion of ground forces, rapid displacement of both men and materiel on the battlefield, and efficient use of nuclear weapons; therefore, meteorology (met) effects constitute the largest set of errors in the employment of artillery. Timely measurement and rapid application of met corrections to the solution of the gunnery problem will increase the accuracy of our artillery fires approximately 5 to 10 percent. A percentage spread is used because the percent of met effect is directly related to the varying degree of the meteorological parameters (wind, temperature, and density) encountered at the time of firing.

There is an urgent military requirement for more accurate and timely met information within the field army, and good met data must be obtained in more detail over increasing areas of the modern battlefield. Real-time data from the surface to altitudes of up to 30 kilometers for use by the field artillery and other units is an urgent requirement. The met section, therefore, must be capable of operating in close proximity to the forward edge of the battle area (FEBA) and possess a mobility comparable to that of the supported unit.

The Meteorological Data System (MDS) AN/TMQ-31 is designed to fulfill these needs and will replace the existing 30-year old Rawinsonde (AN/GMD-1) system. The development of the MDS is responsive to the required operational capability (ROC) approved by Department of the Army and a subsequent contract awarded to Bendix Corporation for engineering development on 14 March 1979. The MDS will be capable of rapid displacement and will produce real-time atmospheric sounding to desired altitutes. It will be deployed in the vicinity of direct support field artillery battalions (three to seven kilometers behind the FEBA). The system will operate in climatic extremes over most types of terrain and can be used continually over extended periods of time to sound the atmosphere every hour or every two hours, depending on the mission requirements and the stability of the atmosphere.

The system will determine the exact position of the radiosonde during the flight by one of two passive methods: navigational aids (NAVAID) or radio direction finding (RDF). In the NAVAID mode, the system will receive Loran, Omega, or VLF data transmitted from the radiosonde, computing positions based on time differences of signal arrival. The MDS can operate in the NAVAID mode while in transit, once a radiosonde has been launched. During normal operations upon arrival at the desired launch point, the section can be set up and operational within 10 minutes in the NAVAID mode and within 20 minutes in the RDF mode. In the RDF mode, position will be computed using the measured parameters of azimuth and elevation angles. Geometric altitude will be calculated from the transmitted pressure data. The output of this position data will be wind speed and direction. Temperature, humidity, and pressure will be measured and transmitted in the same manner as they are with the current rawinsonde system, except that additional data will be examined faster and more accurately as the meteorological probe ascends through any given artillery zone.

Meteorological data collected will be automatically provided by radio to the artillery Tactical Fire Direction System (TACFIRE) and the Battery Computer System (BCS), as required by the tactical situation. A teletype link can furnish met data to detachments of the Air Weather Service (AWS) of the US Air Force.

One MDS unit consists of three 2½-ton trucks with trailer. One truck mounts an S-280 shelter which houses the electronic equipment for the MDS, while a second

carries a seven-day supply of met expendable items and inflation and launching equipment. The third truck will be used to transport miscellaneous met and personal equipment. The RDF antenna/pedestal assembly is trailer-mounted for both transport and operation. Two 10-kilowatt, 60-hertz generators are mounted on another trailer, and the third trailer is used to transport the water necessary for generation of hydrogen to inflate the met balloons. The trucks and trailers may be rapidly and easily transported into the theater of operations either by water or rail or inside C-130 cargo or rotary-wing aircraft.

Operational testing (OTII) for the system is scheduled for October 1981. Institutional training will begin at Fort Sill in October 1983, while initial operation capability (IOC) will occur in December 1983. The first 10 systems are scheduled to be deployed in USAREUR in FY84.

Firefinder training

Fielding of the AN/TPQ-36 and AN/TPQ-37 Firefinder weapons locating radar systems began 1 October and, as a result, new job positions are available to support the deployment of the new systems. The Field Artillery School has developed three new resident programs of instruction to train personnel who will man and maintain the Firefinder systems.

Beginning 27 October 1980, a 23-week, 2-day direct support maintenance course is available to Active Army, USMC, and Reserve Component soldiers with MOS 26B20 and 19 months remaining on active duty. Graduates will be awarded the additional skill identifier K1, signifying they have the knowledge required to inspect, test, and perform direct support maintenance on the AN/TPQ-36 and -37 radar systems.

Beginning 4 November 1980, the 6-week, 2-day Firefinder Operator's Course will be taught to Active Army, USMC, and Reserve Component soldiers. Operator's training includes site selection and evaluation, emplacement and march order, performance of preventive maintenance, hostile weapons location, and friendly fire radar gunnery application. Graduates will be awarded MOS 13R10 and must have at least nine months remaining on active duty at course completion.

A follow-on Organizational Maintenance Course of 14 weeks and 4 days will be offered to selected soldiers with MOS 13R10 who have at least 13 months remaining on current enlistment. Graduates will possess the knowledge required to inspect, test, and perform organizational maintenance on the Firefinder radar systems and will be awarded the additional skill identifier X5.

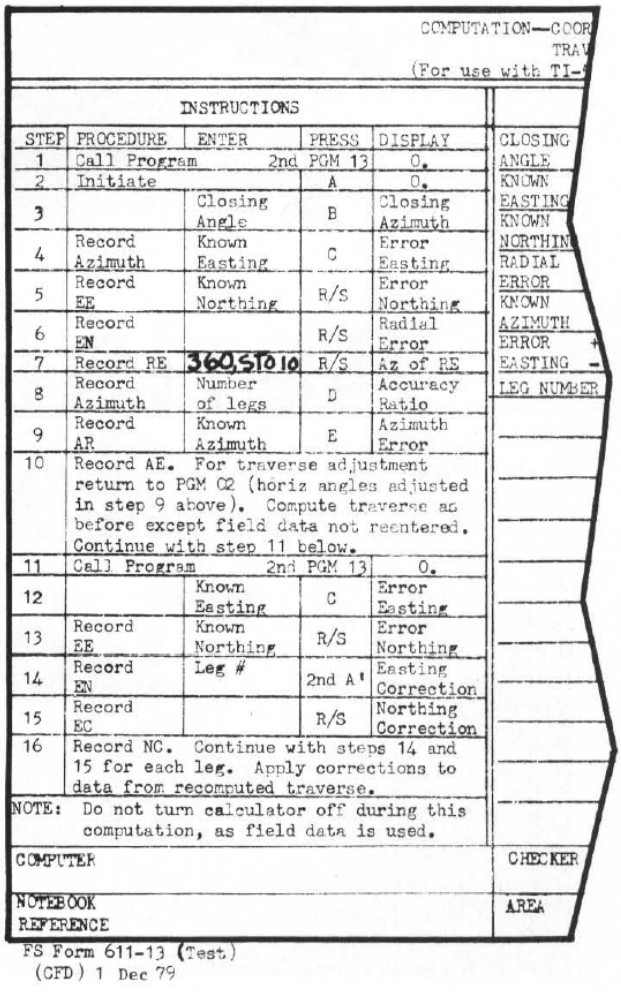
To receive training in the two new maintenance courses (additional skill identifiers K1 and X5), soldiers must have a standard score of 100 or higher in aptitude area "EL." An entry score of 105 in area "SC" is required for the 13R10 operator's course.

Revised forms for survey computer set

The Survey Computer Set (TI-59), fielded in January this year, was issued with test survey computation forms. Proposed forms to be submitted to Department of the Army for approval and printing are in the final stages of preparation and validation. The major revisions from the test form include simplification of instructions and numbering the data entry and answer blocks to correspond to the instructional steps.

An omission exists in the test form (FS Form 611-13 (Test), Coordinates and Azimuth Closure: Traverse Adjustment) which permits an erroneous azimuth of radial error (Az of RE) recorded in block 8 when the azimuth falls in the fourth quadrant (4800-6400 mils). The test form should be modified to correct this error by inserting "360, STO 10" at step 7 in the "enter" column under instructions.

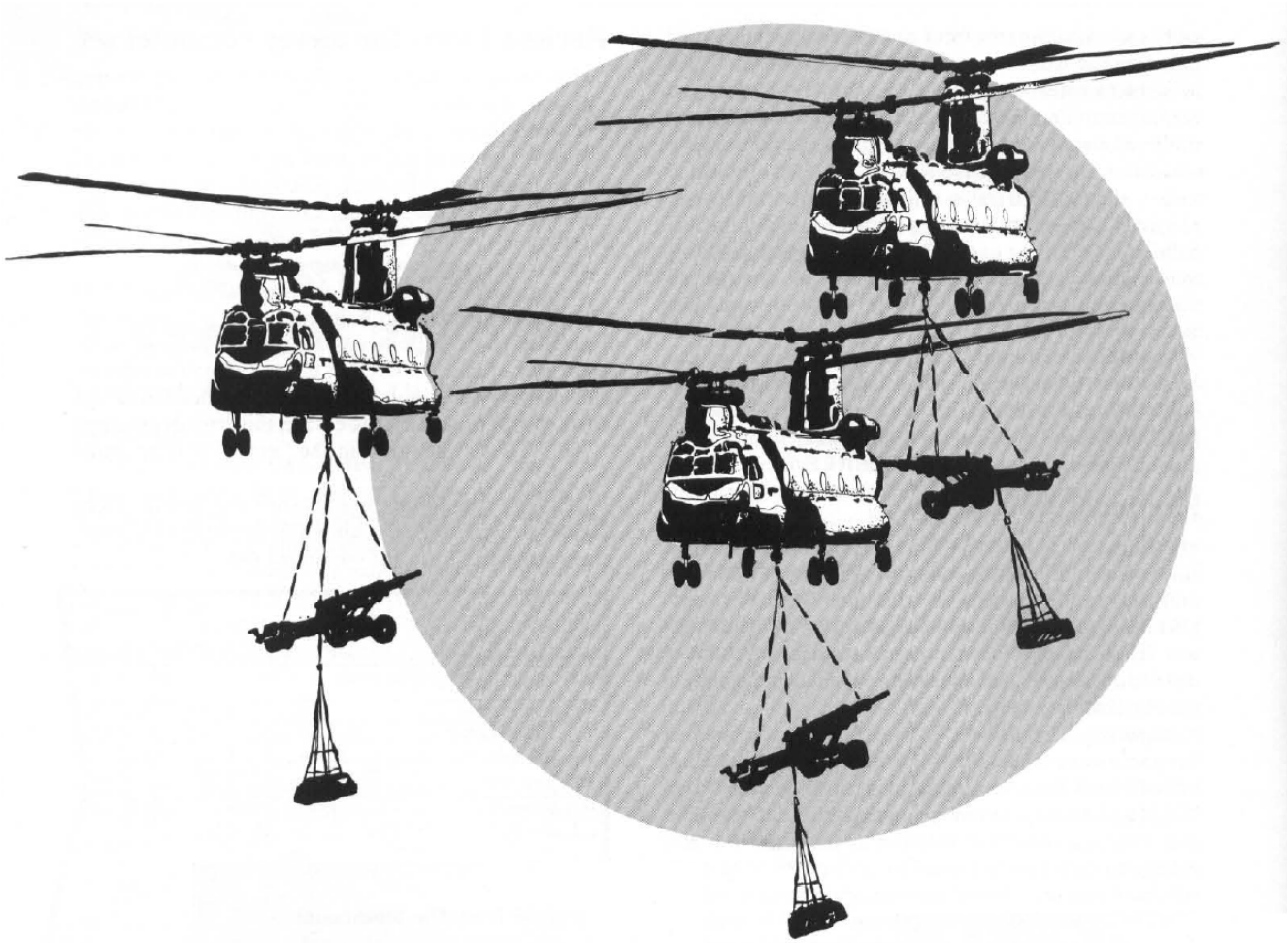
Until the new forms are published and distributed by Department of the Army, units are responsible for reproducing the test form for continued use.



COMPUTATION—COOR
TRAV
(For use with TI-

INSTRUCTIONS					
STEP	PROCEDURE	ENTER	PRESS	DISPLAY	
1	Call Program	2nd PGM 13		0.	CLOSING ANGLE
2	Initiate		A	0.	KNOWN EASTING
3		Closing Angle	B	Closing Azimuth	KNOWN NORTHIN
4	Record Azimuth	Known Easting	C	Error Easting	RADIAL ERROR
5	Record EE	Known Northing	R/S	Error Northing	KNOWN AZIMUTH
6	Record EN		R/S	Radial Error	ERROR +
7	Record RE	360, STO 10	R/S	Az of RE	EASTING −
8	Record Azimuth	Number of legs	D	Accuracy Ratio	LEG NUMBER
9	Record AR	Known Azimuth	E	Azimuth Error	
10	Record AE. For traverse adjustment return to PGM C2 (horiz angles adjusted in step 9 above). Compute traverse as before except field data not reentered. Continue with step 11 below.				
11	Call Program	2nd PGM 13		0.	
12		Known Easting	C	Error Easting	
13	Record EE	Known Northing	R/S	Error Northing	
14	Record EN	Leg #	2nd A'	Easting Correction	
15	Record EC		R/S	Northing Correction	
16	Record NC. Continue with steps 14 and 15 for each leg. Apply corrections to data from recomputed traverse.				
NOTE: Do not turn calculator off during this computation, as field data is used.					
COMPUTER					CHECKER
NOTEBOOK REFERENCE					AREA

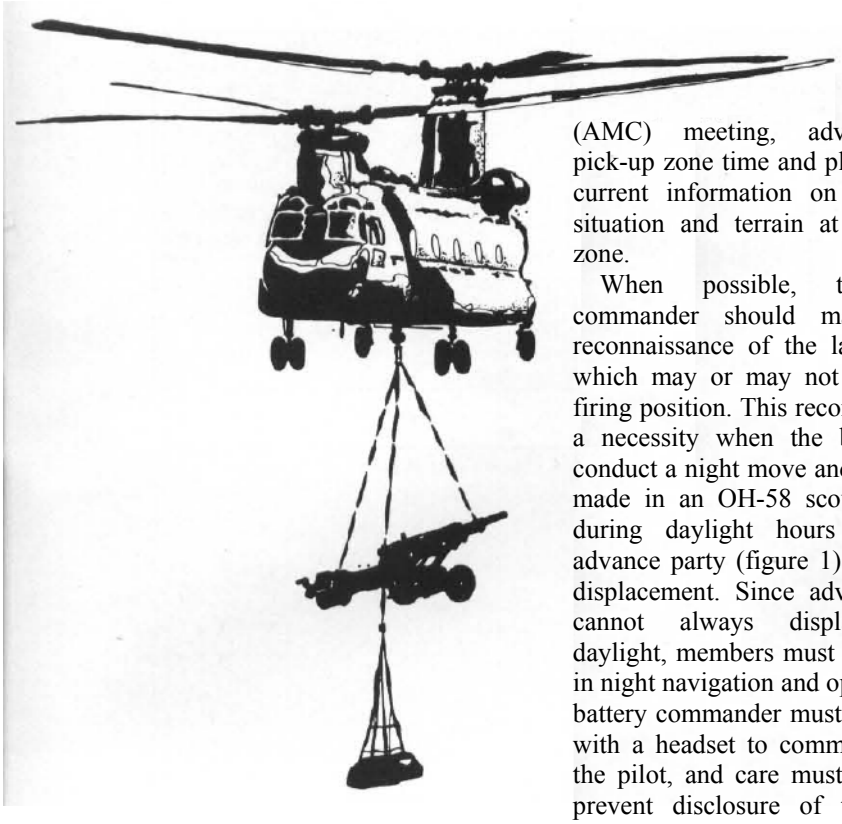
FS Form 611-13 (Test)
(CFD) 1 Dec 79



Aerial Displacement of Tube Artillery

by 1LT Terry G. Stewart

The term "flying battery" originated during the Mexican War to describe the mobile nature of light horse drawn artillery (July-August 1979 *FA Journal*). At the Battles of Buena Vista and Palo Alto, these versatile units were cited for providing necessary firepower to defeat the enemy at the decisive time and place. This "flying" tradition is still carried on today by the 101st Airborne Division Artillery and all towed artillery units capable of displacing by air.



The movement of tube artillery and its supporting elements by air involves several considerations, the more important of which will be discussed in this article.

The 48 CH-47 Chinook helicopters of the 101st Airborne Division's 159th Aviation Battalion give the 101st Div Arty the tactical mobility necessary to provide supporting or reinforcing fires from positions displaced up to 150 miles. Prior to displacement, the battery commander (BC) is normally given an aerial displacement mission by the battalion operations officer (S3) whose warning order should include the following information:

- Landing zone (LZ) location.
- Pick-up zone (PZ) location.
- PZ time (indicating the arrival of the first CH-47).
- Number of sorties (indicating the number of loads to be lifted).
- Special instructions pertaining to the move.

The S3's special instructions may include specifics as to load configuration and pick-up order, the time and place of the air mission coordination (AMC) meeting, advance party pick-up zone time and place, and any current information on the tactical situation and terrain at the landing zone.

When possible, the battery commander should make an air reconnaissance of the landing zone, which may or may not be the next firing position. This reconnaissance is a necessity when the battery must conduct a night move and is normally made in an OH-58 scout helicopter during daylight hours before the advance party (figure 1) conducts its displacement. Since advance parties cannot always displace during daylight, members must be proficient in night navigation and operation. The battery commander must be equipped with a headset to communicate with the pilot, and care must be taken to prevent disclosure of the battery's intention to occupy a position.

Given the warning order, the battery commander and the battery executive officer (XO), who will control the PZ, must decide upon march order times to move to the PZ.

An AMC meeting between a representative of the lifting aviation unit and the battery is highly recommended to coordinate the interface between units. Depending on the situation and the combined skill levels of the battery and aviation unit, standardization may minimize necessary coordination. Generally, however, the following considerations must be jointly understood by both air and ground elements:

- Load configuration (internal or external sling loads).
- Load pick-up order.
- PZ/LZ layout and location.
- Marking techniques to be used.
- Mission frequencies.

Several areas facilitate standardization. Among these is load configuration. Internal loads, while disguising the contents of the aircraft to observers, require significant amounts of time to load and unload (10 minutes is needed to winch an M102 howitzer into a CH-47). External loads are preferred because of the minimal loading time (an M102 howitzer and crew can be picked up in three to five minutes) as well as the opportunity to use A-22 bags to move up to 40 rounds of 105-mm ammunition (15 rounds of 155-mm ammunition) or 2,000 pounds of equipment.

The tactical situation will dictate the load pick-up order. If a firing capability must be rapidly established at the new location, it is advisable to lift the howitzers first, followed by

Legend:
ACL–allowable cargo load
BC–battery commander
GS–gunnery sergeant
GG–gun guides
FDC–FDC representative
Comm–communication representative

	ACL = 7				ACL = 11	
	Two UH-1H				UH-60	
One UH-1H		No. 1		No. 2	(Blackhawk)	
BC	1	BC	1	1SG	1	BC 1
GS	1	GS	1	Comm	1	1SG 1
GG	3	GG	3	GG	3	GS 1
FDC	1	GDC	1	FDC	1	Comm 1
Comm	1					FDC 1
						GG 6
Totals:	7		6		6	11

Figure 1. Aerial advance party configurations.

the prime movers and other support vehicles. It is quite possible to have rounds down range as the move is being conducted by laying the pieces as they are set down. Naturally, coordination with the lift representative as to the desired positioning of the howitzers to facilitate laying, the correct azimuth of fire, and routing of air traffic behind the gun-target line will enhance a more rapid operation.

However, should the battery be required to move from the landing zone to another firing position, it is recommended that one complete howitzer section be moved at a time. This is accomplished by picking up the howitzer with crew and the prime mover (M561 gama goat) in successive lifts. Once the section arrives at the LZ, it may either move into a temporary position to await the entire battery's move as a convoy or conduct a move by infiltration to the next position.

Marking techniques are used during both day and night operations, and coordination is needed to specify the type of marking to be used. Strobe lights, for example, are excellent navigational aids at night, whereas VS-17 panels with coded letters provide sufficient terminal guidance during daylight. Figure 2 lists commonly used navigational aids which all members of the battery, particularly those in the advance party, should be familiar with.

An adequate AMC briefing before the move is necessary and will facilitate radio silence. Should radio coordination become necessary, the battalion command or administrative/logistic net should be the standardized mission frequency. An aircraft advisory may have to be transmitted with the information shown in figure 3. While battery participation in an AMC briefing generally insures smooth execution, an efficient move can be accomplished by adequately marking the PZ and using trained ground guides to direct aircraft to the correct loads.

Day	Night
Terminal guidance: VS-17 panels Smoke	Terminal guidance: Strobe lights
Ground guidance: Air-to-ground vests Hand/arm signals	Ground guidance: Bean bag lights Flashlight wands

Note: Standardized bean bag light colors may be used to indicate the load configuration (i.e., internal, external, or external with passengers). FM 57-38 (Pathfinder Operations) provides details on LZ/PZ marking and ground guidance.

Figure 2. Marking techniques.

1) Directions to PZ from communication check point (CCP).
2) Desired landing direction.
3) Wind velocity and direction.
4) Desired landing formation.
5) Friendly situation.
6) Enemy situation
7) PZ elevation (obstacles and terrain features).
8) Visual signals at PZ (smoke, lights, panels, etc.)
9) Air traffic conditions.

Note: In the absence of an AMC briefing, it may be necessary to transmit this information to the aircraft.

Figure 3. Aircraft advisory information.

During the planning phase, the XO, as the PZ control officer, should make a reconnaissance of the PZ to investigate the suitability in terms of soil firmness, space limitations, entry routes, and obstacles to both vehicles and aircraft. Should the PZ prove unsatisfactory, an alternate one must be rapidly located and coordinated through the S3.

The XO should envision how he will lay out the various loads and prepare a sketch to brief section chiefs as to traffic routes and load placement in the PZ. The PZ layout should be organized into rough columns or ranks as shown in figure 4. This configuration facilitates the occupation of the PZ and supervision of ground operations by the XO.

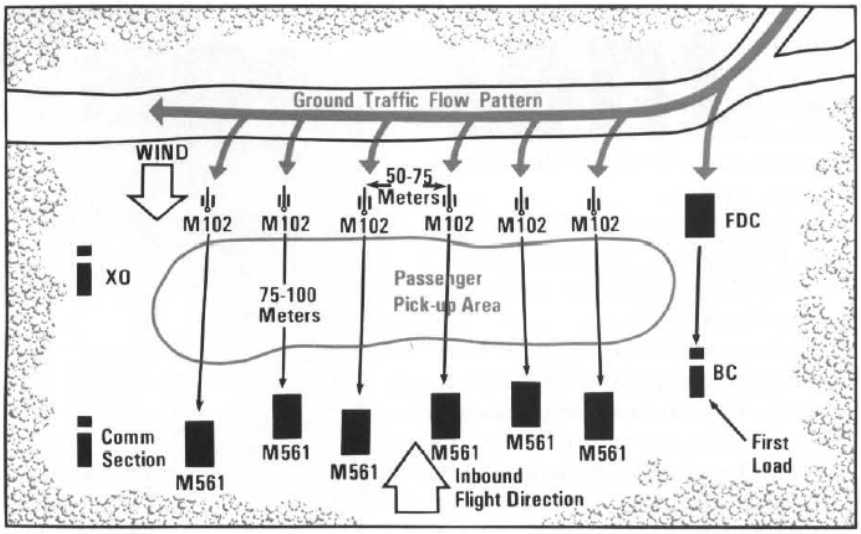


Figure 4. Pick-up zone layout sketch.

Figure 5. The simultaneous movement of battery loads requires sufficient spacing in the pick-up zone.

The most important considerations in PZ layout include the distance between loads and obstacles, ground traffic flow, perimeter defense, and organization. The distance between loads should allow maneuver space for several CH-47s to pick up loads simultaneously. An interval of 50 to 75 meters in daylight and 75 to 100 meters during darkness is satisfactory. Insufficient space delays the move and wastes valuable time when aircraft have to wait to pick up loads. The CH-47s not only present lucrative targets, but their numerous tactical and logistical missions require their expeditious use. (Figures 5 and 6 depict normal intervals required by the CH-47.)

Figure 6. An M102 howitzer with A-22 bag rigged for external sling loading. (Note spacing between loads.)

Depending on time available, number of aircraft assigned to the mission, and size of the PZ, the battery may position only a few loads to be lifted at a time. The remainder of the unit would be positioned in a concealed holding area nearby.

Section chiefs and vehicle operators must be thoroughly briefed on the occupation of the PZ to reduce the supervisory burden on the PZ control officer. A simple ground traffic pattern must be established to reduce confusion and wasted time.

Perimeter considerations include proper sighting of organic air defense and crew-served weapons as the time and situation permit. Personnel should be directed to lie down and form mini-perimeters around their section's loads while they wait for pick-up. This facilitates the control of section members, especially at night. It also provides for their protection from flying objects kicked up by the rotor wash of hovering aircraft (winds as high as 90 knots can be expected). The XO must coordinate with any non-organic elements assigned to provide PZ security, such

as an air defense artillery platoon or a maneuver element.

Having established his movement plan, the battery commander may now initiate preparation for moving to the PZ. Time available, of course, is a major factor in the decision to march order. Preliminary rigging of the howitzers and prime movers may be accomplished in the firing position, while A-22 bags for the ammunition are best constructed at the PZ. Gama goat truss kits are also put on once the load is positioned at the PZ. While the battery can be laid in the PZ, the BC must keep time in PZ posture to a minimum. Yet he must allow sufficient time for such problems as mechanical breakdown and early arrival of the aircraft. Time must also be provided to rig A-22 bags, emplace truss kits, and inspect loads for proper rigging and tie-downs.

The advance party must be ready for immediate assembly to depart from the PZ, and the XO should designate an area in his layout plan for the advance party aircraft to land. Should the mission be flown at night, the advance party pilot will require proper terminal marking to minimize his searching for the battery.

As the battery march orders, the XO should go forward to the PZ to begin directing the various loads into position. The chief of firing battery (CFB) should remain behind to supervise the march order and release sections for an infiltration move into the PZ. By spacing the release of loads, generally five minutes apart, the XO is given adequate time to direct loads into position. This also prevents a traffic pile-up at the PZ entry point. The tactical situation, however, may not permit a move by infiltration, forcing the battery to displace in an open or closed convoy.

As the loads are positioned, final preparations are made by the section chiefs, CFB, and XO.

Considerable loss or damage of section equipment can result from the slightest flaw in rigging techniques; therefore, inspection of the various loads, including tie-downs, must be accomplished by the XO and the CFB. Temporary tie-downs are used to insure that the various slings are not caught on such items as panoramic telescope mounts, operator's handles, and steering columns when lifted by aircraft. One-fourth inch cotton webbing is recommended for temporary tie-downs, but masking tape will suffice. Permanent tie-downs are used on such items as sight boxes, battery boxes, gama goat windshields, and any equipment that may come loose during flight. Type III nylon cord is recommended for permanent tie-downs.

To prevent unnecessary strain on the gama goat articulation joint, inspectors must insure that truss kits are properly emplaced. (TM 55-450-11 provides detailed instructions on rigging loads for external movement and the Gama Goat Operator's Manual, TM 9-2320-242-10, March 1977, includes instructions on placement of truss kits.)

Units conducting air moves may be assigned three to four trained pathfinders from the aviation unit to assist in the preparation and conduct of the move. These soldiers can be utilized by the battery to mark obstacles, inspect loads, and assist as ground guides to direct aircraft to particular loads. However, to facilitate the simultaneous pick-up of various loads, each section should have trained ground guides and hook-up men.

For each sortie with passengers, the XO should prepare a 3 by 5 information card (figure 7) for the section

B/3-319 FA
LZ: 456745
Msn freq: 3138
PZ callsign: X3L10
LZ callsign: X3L15
Az of fire: 190 degrees
This is last load. PZ is clear.

Figure 7. Pilot information card.

chief to give the pilot to further insure that the load will be delivered to the right location.

As the first aircraft arrives, ground guides and hook-up men must be in position. The XO and CFB should position themselves so as to supervise the order of pick-up and provide assistance where needed. Since the XO's vehicle (M151 truck) will be the last vehicle lifted, it can be used to control PZ operations at the decisive place.

In a typical air move, the first CH-47 should be landed where the BC's vehicle can be driven directly into the aircraft. (All ¼-ton vehicle drivers must be skilled in driving forward and backward into CH-47 aircraft.) Some fire direction center (FDC) personnel also board this first aircraft. The aircraft crew chief and his personnel will then secure the vehicle using their own tie-down material. The second load is normally the FDC vehicle (M561 gama goat) which is an external sling load without a passenger pick-up, as are all subsequent gama goat loads. The third load consists of the first gun section to be lifted and those members of the FDC used to ground guide and hook-up their vehicle. Thus FDC personnel are spread over several aircraft loads should any one aircraft not make it to the LZ.

As the third aircraft approaches the first howitzer, it should be landed preferably to the rear of the piece to pick up section members and then as the pilot hovers the aircraft he has eye contact with the load as it is hooked up. A ground guide should assist in this meneuver, but the pilot will be taking his instructions primarily from a crew member positioned at the cargo hatch located in the floor of the aircraft. As the hookup is completed, ground personnel should immediately clear the area to avoid being hit by the A-22 bag. Hurricane type winds will confront ground guides and hook-up men; therefore, eye goggles are highly recommended. As crop fields are often

used as PZs/LZs, plant stalks and small branches can become dangerous projectiles.

The noise generated by the aircraft will hamper any attempt to use voice commands to control the PZ. The need for air assault trained personnel at all levels is thus amplified.

The advance party, having landed at the LZ, conducts their normal preparation of the new firing position, with the additional responsibility of receiving the incoming loads (figure 8). Smooth execution at the LZ is directly influenced by the terminal guidance used to direct the aircraft and rapid recovery of prime movers by vehicle operators. Vehicular ground guides are vital to assist in orienting operators and key personnel who have just landed.

The tactical situation may require an immediate ability to receive calls for fire, in which case the howitzers are brought in first and laid in place. In this case, the aiming circle must be tightly secured to prevent the high winds from knocking the circle down, and wire communications for laying purposes is considered a must. In this scenario, the assistant executive officer (the fire direction officer) may be left behind to control the PZ while the XO goes forward to direct the firing battery.

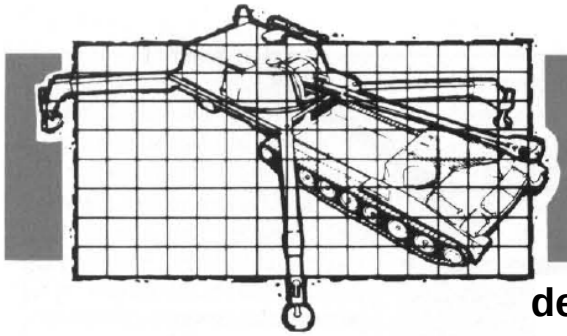
Section chiefs must control their sections and prepare their equipment for the move. Every soldier must know what aircraft to board and when to board it. Time may not permit a complete rigging inspection by the XO and CFB, making section chiefs totally responsible for proper rigging.

As the displacement nears completion, continuous checks must be made to be sure no equipment is left behind (e.g., bean bag lights at night). As the XO loads his vehicle as the last load, he must insure that all personnel have been moved and indicate on a 3 by 5 card to the pilot that the aircraft contains the last load. The S3 may require that a "PZ clear" message be transmitted to him over radio. Upon landing, the XO must immediately attempt to orient himself and obtain a status report from the BC.

Figure 8. Ground guides are essential to the success of an aerial displacement mission.

With proper planning and aggressive execution, the aerial displacement of artillery can provide the maneuver commander the firepower advantage at the decisive time and place in battle. Detailed supervision, principally by section chiefs, will prove the difference between a smooth, efficient operation and one characterized by confusion.

1LT Terry G. Stewart is Commander of C Battery, 3d Battalion, 319th Field Artillery, 101st Airborne Division (Air Assault), Fort Campbell, KY.



FA Test and Development

design • development • testing • evaluation

The Field Artillery Crew Test

Computer models, scenarios, and war games—simulations for assessing and predicting battle as we believe it will be—are essential and valid (although limited) substitutes for actual combat. In varying degrees of detail, these models and scenarios describe friendly capabilities and tactics vis-a-vis threat capabilities and tactics in both dynamic and static environments. A great deal of credence has been placed on the myriad of simulations, and consequently the results of several of these models and scenarios have led to the reshaping of fire support doctrine and organizations and to the establishment of materiel requirements.

Simply stated, simulations have told us what we need to do to win, and we in return have worked to equip, organize, and train ourselves to do just that. But, one very crucial underlying question surfaces: "Can the Field Artillery really do the things our scenarios say must be done if we are to win?" More specifically, can the Field Artillery actually fire the high volume of ammunition, make the large number of tactical moves, and do all the other things required of field artillerymen in extended combat? From these basic questions has emerged the Field Artillery Crew Test (FACT)—a significant undertaking which will attempt to gain insight into a small segment of a very expansive question.

Specifically, the FACT will assess 155-mm self-propelled firing battery's ability to accomplish its mission during a portion of the Scenario Oriented Recurring Evaluation System (SCORES) Scenario, Europe I, Sequence IIA. It is not intended that the FACT be conducted in a worst case situation, but rather that an artillery battery be exposed to typical requirements and conditions generated by SCORES.

In the truest sense, the FACT is not a test. It is not an exercise to evaluate satisfactory or unsatisfactory (go or no-go) performance of a firing battery. It is not merely a massive ARTEP: it is, more appropriately, an aggressive experiment during which data will be gathered on a typical unit's ability to perform its mission under as realistic conditions as possible. Thus, it is essential that the FACT output be as objective and quantifiable as possible to maximize the effect of the FACT on future changes to materiel, force structure, doctrine, and training requirements. The specific stated objectives of the FACT are:

- To assess the capability of 155-mm SP howitzer crews to operate effectively in a sustained, intense environment.
- To assess the capability of the battery ammunition distribution system to provide requisite support in a sustained, intense environment.
- To assess the capability of a FADAC/manual battery fire direction center (FDC) to provide timely, accurate fire control in a sustained, intense environment.
- To assess the capability of battery command and control, communications, maintenance, supply, and mess elements to operate effectively and provide requisite support in a sustained, intense environment.
- Inherent in each of the above objective is the requirement to assess physical/fatigue and psychological factors that affect unit personnel under sustained, intense conditions.

The broad scenario, within which the FACT will be conducted, calls for continuous battery operations for eight days, an average ammunition expenditure of 300 rounds per day, and an average of six tactical moves per day. FACT issues encompass all elements of the firing battery, as well as a battalion ammunition support slice and terminal effects. All other aspects of the fire support system external to the firing battery will be administratively controlled or simulated.

It is clearly recognized at the outset that the FACT is not a panacea. It will not answer all questions for all people. It is also clearly recognized that the FACT will be quite complex and resource-intense to execute. It will require a heavy expenditure of manpower, funds, and time. Additionally, it is recognized that not all aspects of the exercise will be quantifiable, such as mental/physical factors and test performance versus combat performance. Therefore, subjective findings will require judgmental evaluation and assessment as to the significance and potential application of the results. It is believed, however, that the outputs of the FACT will provide invaluable information to all areas of the Field Artillery Community.

The FACT is a Force Development Test and Experimentation (FDTE) user test being developed and planned

under the purview of US Army Training and Doctrine Command (TRADOC) Regulation 71-9. Once the Independent Evaluation Plan (IEP) has been approved and the Test Support Package (TSP) has been completed, the detailed scenario to conduct the FACT will be prepared jointly by the Field Artillery School, the TRADOC Combined Arms Test Activity (TCATA), and the US Army Research Institute of Environmental Medicine (USARIEM). Additionally, another key participant in planning and executing the FACT is the US Army Human Engineering Laboratory.

Clearly, there is a great deal of planning and preparation yet to be accomplished such as test dates, test site, and unit to participate.

Since the IEP for the FACT is a dynamic document and is not yet complete, timely reader suggestions can influence the FACT and are therefore encouraged.

Suggestions may be made telephonically by calling MAJ Bill Yerkes at AUTOVON 639-3669 or by writing:

Commandant
US Army Field Artillery School
ATTN: ATSF-CD (MAJ Bill Yerkes)
Fort Sill, OK 73503

Tie-down straps for Nuclear Weapon Technical Inspections

Tie-down straps marked "Training Only" may be used during Nuclear Weapons Technical Inspections (NWTIs) for movement of training weapons simulated to be "War Reserve" (WR). The straps must be serviceable; however, they may exceed normal shelf life.

Use of "Training Only" type straps will eliminate the requirement for units to use "WR" straps for inspections.

Preproduction testing of BCS

Preproduction testing of the Battery Computer System (BCS) is underway at Fort Sill to assess Norden Company's modifications to shortcomings found in the system during developmental and operational tests. Fielding of BCS remains set for October 1982 and, when developed, will replace the FADAC system now used by Active Army and Reserve Component Field Artillery units.

TACFIRE update

On 25 September this year, the TRADOC System Manager for TACFIRE was notified by Department of the Army that approval had been granted to reprogram $81 million of FY80 "Army" money for procurement of 43 more TACFIRE sets.

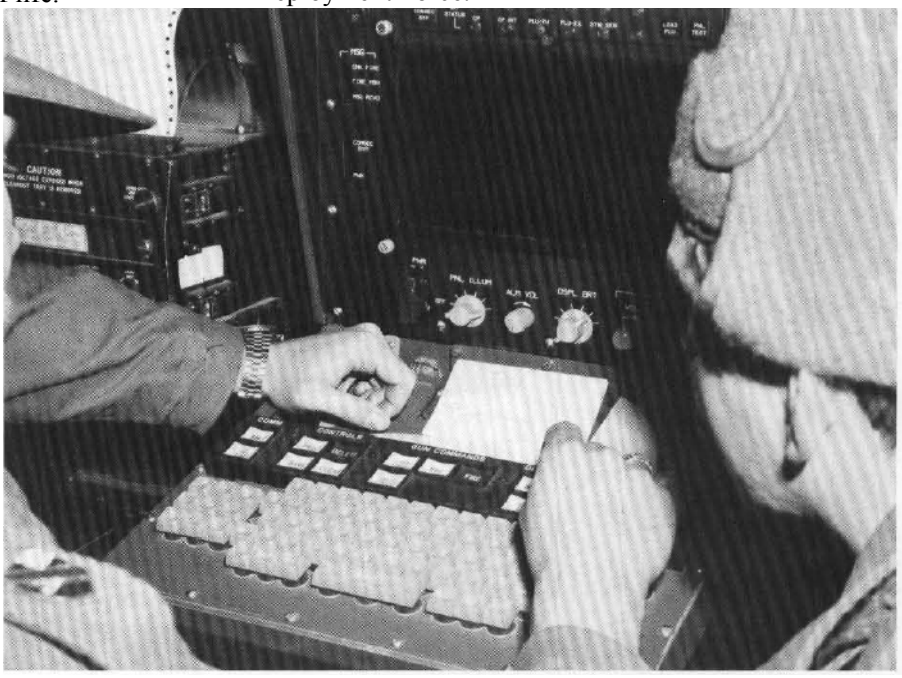
Currently equipped with TACFIRE are the 1st Cavalry Division Artillery, Fort Hood, TX, and the 212th Field Artillery Brigade and 1st Battalion, 17th Field Artillery, at Fort Sill, OK. The next organizations scheduled for TACFIRE deployment are the 1st Infantry Division (Mechanized), Fort Riley, KS, in January 1981 and the 8th Infantry Division (Mechanized), USAREUR, in June 1981.

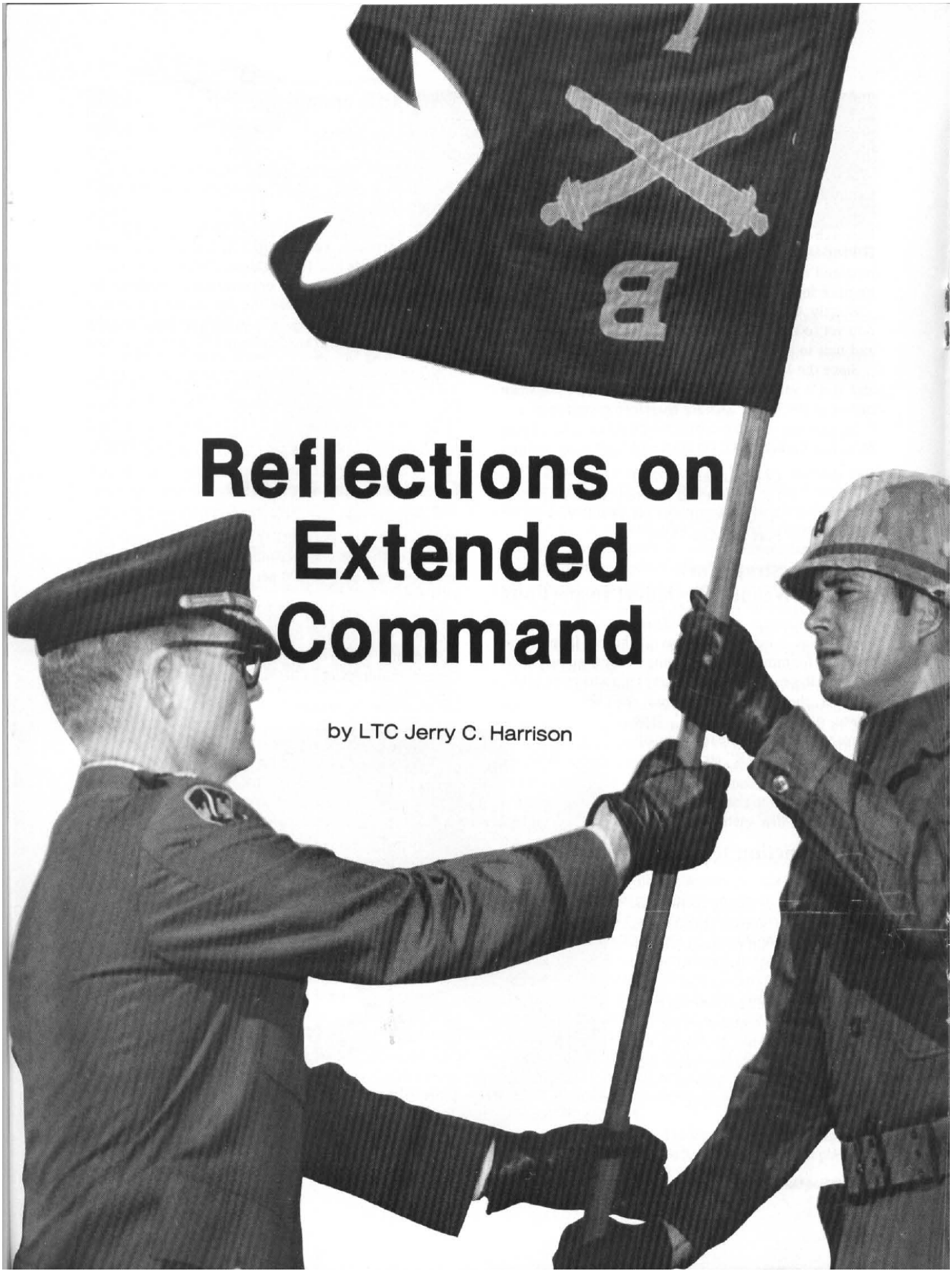
Procurement and fielding of the 43 TACFIRE sets will bring the total for the Active Army to 116. An additional $73 million will be sought for FY81 to fund the remaining 23 sets required for complete Active Army deployment.

Cost increases for M198

If you're in the market for a new M198 155-mm towed howitzer, you'd better check the current cost figures. According to the General Accounting Office the originally estimated cost of $184,000 per weapon has increased to $421,000.

Because of this price increase, the approved fielding program was reduced to 478 weapons; however, this number may be increased because of The Department of Defense requirement to field and equip a Rapid Deployment Force.



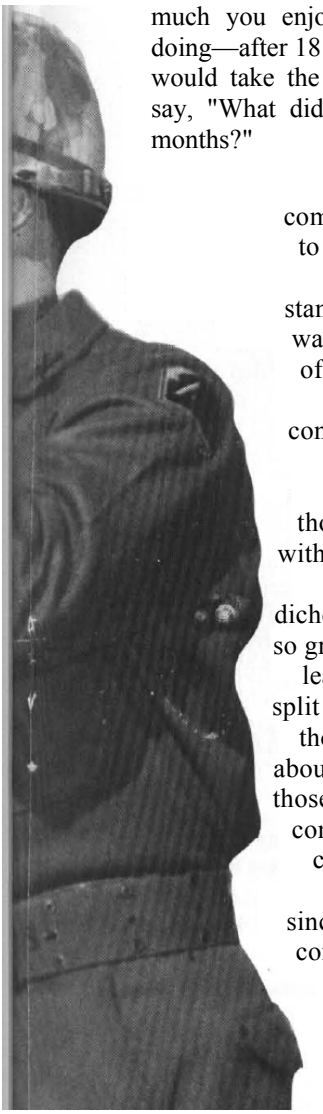


Reflections on Extended Command

by LTC Jerry C. Harrison

"Congratulations. You've just been extended in command of your battalion." While these words are welcome to many, to others they produce a weak smile, the expected response, and rising fear that they will never make it.

Twenty-seven months ago I began the "normal" CONUS 18-month command tour—the month of my "change of command" was forecast by MILPERCEN and my replacement just happened to visit the post three months after I'd taken command. This all fit into the normal course of events to which command-selected lieutenant colonels and colonels had become accustomed: Hit them hard, do your best, and hope everything would work out! Above all—no matter how much you enjoyed what you were doing—after 18 months someone else would take the helm and invariably say, "What did that guy do for 18 months?"



Prior to assuming command, I would listen to the old timers talk of "their" tours with a standard comment that it was the best assignment of their career. Still, all too often, as the conversation lengthened one would say, "I couldn't wait to pass those colors and escape with my life." I never did understand that dichotomy. If the job was so great, why the hurry to leave? I suppose it was split about 50-50 between those who were sincere about wanting to stay and those that couldn't wait to complete their "normal" command tour. It is to those that are really sincere about wanting to command that I want to address.

Due to the recent change in command tour lengths, I feel it timely to comment about the effect of longer tours on the commander and his unit. I was fortunate to have been extended, first for three months and then for six more as a battalion commander in the 4th Infantry Division at Fort Carson. The second extension brought about a genuine inward look at myself, my unit, and my whole approach to command. For those of you planning the 30-month tour, I urge you to do the same and consider a few of the following points.

Plan for the long term

The longer tour allows time for you to adequately plan and develop long range programs. Look for continual progress and not the sudden burst that quickly fades. If you need a new maintenance SOP, spend the time to develop a good one because you will most likely live with it for a year or more. You know that you will have numerous inspections, evaluations, and continued inquiries in areas peculiar to your unit. You will still give each one your best shot, and you will benefit from your past success or failure. Good, workable SOPs are possible, and with each revision those problems "no one thought of" will occur less frequently.

Utilizing the staff

You and your staff will benefit from experience and you will be surprised how much is remembered about particular situations. Here, good after-action reports are essential. Guidance to the members of your staff, however, must be tempered with patience to avoid telling them how to do the job. This will get harder the longer you are in command because you will want to fall back on what worked well in the past. You can, however, teach them proper staff work and above all how to plan—not just react.

I urge you to use your staff well. Many commanders pride themselves on being their own S3, X0, or their own staff entirely. Not only does this violate good leadership and management concepts, but it will also wear you down after a while. You need to develop your subordinates so that you can delegate and decentralize. Again, this is nothing new, but it takes on added meaning in longer command tours.

Training

In the area of training, you are in for a number of warm feelings. As you spend more time in command, you can better plan activities because you know what your unit can do and how long it takes to do it right or do it over again. Critical tasks are defined and battery/company/troop commanders are pointed in the right direction. That innovative program to prepare for skill qualification tests (SQTs) that didn't go so well last year is refined, and those proud soldiers start showing results. Planning calendars are developed from experience, and major events are spaced out to allow for proper recovery. Multi-echelon and concurrent training become a reality, and overall you are able to lead the unit more systematically.

Personnel

You can expect some unusual personnel experiences. For example, a first lieutenant who had been in the battalion for approximately five months went to Korea, then to the Advanced Course, and is now back as a captain. I have other soldiers who have gone on short tours of one year plus and have either returned to my unit or to another on post. You find yourself losing track of which year old First Sergeant Ironhorse retired—was it last summer or the summer before? Rather than attributing that to old age, I attribute it to the plain, simple comforting fact that I've been in the job longer than any other I've had in the Army.

Over the months you become involved in the soldiers' promotions, pay, and perhaps directly in their discipline as well. Above all you know

the soldier—his capabilities and limitations. The soldiers know you've been with them through it all and while they never come out and say it, you can sense the stability they feel in their on-and-off-duty lives. They talk to you about how we did it last year and how much snow we got last winter (or was it the year before?). They joke about their ETS/PCS and remind you that you'll be in the good old 1-29th FA until you're old enough to draw Social Security. You get to know the soldiers' families much better. Instead of only one child you might see two born to a family and you watch them—soldiers and families—grow.

Turbulence will continue to be a problem (my battalion turned over an average of 18 percent per quarter). You see more individuals come and go, and *you* are the continuity at the top. New personnel are briefed on standing operating procedures and requirements.

I often paralleled my job with that of a football coach who develops his team, wins a few games, and then loses his quarterback to injury, two linemen to retirement, and his chief assistant to a head coaching job. This all happens in mid-season. That coach may lose a few games, but only until his team is back in order. He accomplishes this by using a play book (the team's SOP), by having a good knowledge of the game itself, by knowing his players, and by enforcing basic proven standards.

Improve yourself

Extended command gives you a better opportunity to really learn. You have time to go further into those field and technical manuals and, more importantly, to pass your knowledge on to junior officers and enlisted men. Our business is a complex one, and it seems there's never enough time to really get into supply procedures, Army regulations, weapons manuals, or SQTs. In an extended command tour the time is there, so take advantage of it. (By the way, all those books you receive at the Pre-Command Course are useful for that purpose.) Don't overlook the hands-on training we all need. This complements the book work and is probably more important in the eyes of the soldier. You should be able to set head space and timing on the M2 .50 caliber machinegun, put on a mask in nine seconds, and perform other hands-on tasks related to your basic branch. So many of our commanders can't and their officers normally can't either. As before, this is nothing new—but the extended command tour provides more time for self-improvement.

Relationship with the chain of command

Now it is necessary to look at how our superiors fit into the extended command tours. Of course your major subordinate unit (MSU) commander is there for the same length of time as you are, so there will be some good overlap. It would be ideal if the tours of all the command group of the division were lengthened. If this were done, the entire team could settle in with a common purpose and philosophy and would be concerned with how a unit does over the long term and whether steady improvement is made.

Additionally, many of the comments about a battalion are also true for the MSU and the division. Superiors get to know you well, including your capabilities and limitations and one hopes there is considerable exchange of information and guidance. It is in the best interest of the soldier for commanders all the way up the line to teach and offer constructive criticism to their subordinate commanders. After all, you will be together a long time.

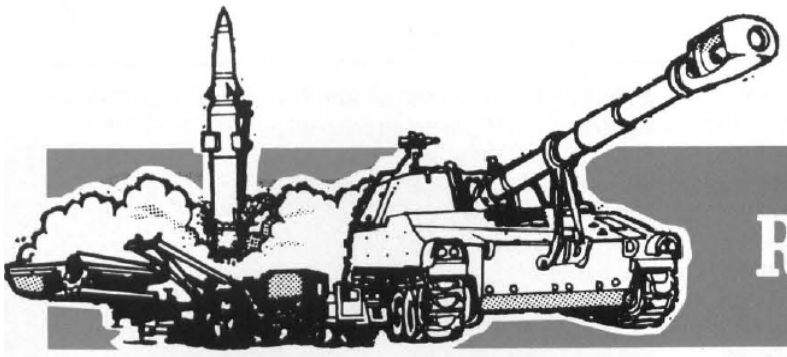
Incoming rounds

I would like to offer a few suggestions to those of you who see yourselves as Army Chief of Staff material and have had bright careers so far. When you put on those green tabs, you had better be prepared for some direct hits when things don't go well. There will be many chances to excel, but in 30 months you will occasionally drop one of those balls. We have seen others or felt ourselves destroyed by some incident that appeared to tarnish a perfect image; however, you must expect and be able to cope with mistakes. There is a lot of truth in the saying that, "It isn't what happens to you that's important; rather what you do with what happens to you." You will take your unit through several ups and downs—you'll have it together, and then for some reason, your unit can't do anything right. That is the time to put together some good sound programs that address the problem and put your soldiers back on top. You now have the time to see it through, and that gives you one of those warm feelings mentioned earlier.

The soldier

Thus far I have focused primarily on experiences you can expect as a commander. It is central to the concept of extended command, however, to understand that the fundamental ingredient of our profession—the soldier—is the one who benefits from your experience, your concern, and your professional knowledge. The extended tour will allow you to be with each soldier longer and you will get to know him or her better. Each will give you considerable satisfaction and a few headaches, but always remember that it is the soldier's actions—not your own—that bring about any praise you might receive as a commander. So I urge you to settle back and give them the leadership they deserve. Enjoy the opportunity you have to learn your job, to do it well, and to work with the greatest bunch of soldiers in the world.

LTC Jerry C. Harrison, former Commander of the 1st Battalion, 29th Field Artillery, is attending the Industrial College of the Armed Forces.



Right by Piece

Jump refresher

FORT BRAGG, NC—Practice, practice, practice. No matter how many times you leap from that "big iron bird," there's some part of the jump—some skill—that could be improved. Some paratroopers need to practice exiting from the aircraft, while others need to perfect their parachute landing fall so that it includes points of contact below their shoulders.

Recently, the 1st Battalion (Airborne), 319th Field Artillery, checked in at the 34-foot tower for their semiannual airborne refresher. For most of the artillerymen, it was a case of *deja vu* to those happy times of training beneath clear Georgian skies surrounded by the happy, smiling faces of the cadre at the Airborne School. In the finest tradition of that School, this day's activities were run strictly by the book. Despite the oppressive midsummer heat, each soldier was required to make two satisfactory jumps—one from each door of the tower.

The refresher provides each paratrooper an opportunity to work on his aircraft-exiting technique under controlled and relatively safe conditions. Experienced paratroopers agree that a strong exit from the tower in a tight body position is reasonable assurance that a jumper will perform correctly when it's time for the real thing.

To satisfactorily complete the tower portion of the refresher, the cannoneers had to demonstrate that they could make strong exists from the tower doors in the proper body position—feet and knees together, the body bent slightly from the waist, and the chin tucked to the chest. Additionally, the left hand had to cover the carrying handle of the reserve chute, and the right hand had to be on the rip cord grip with the fingers spread. Jumpers who forgot to count in a loud and thunderous airborne voice for the required four seconds were given a "no go" by the evaluator.

As a final point of performance in the tower exercise, jumpers spread the risers and visually checked a make-believe parachute canopy for holes and other defects. Occasionally a jumper found a red flag attached to one of the risers which required simulated activation of the reserve parachute.

The cannoneers also got a chance to "refresh" themselves in the suspended harness apparatus where they reviewed, among other things, how to pull a riser slip to steer the older T-10 model parachute. (Dave Matthews)

Near the end of the line—a paratrooper from the 1st Battalion (Airborne), 319th Field Artillery, grips his risers and prepares to "land."

"On The Minute"

FORT WAINWRIGHT, AK—"We, the members of the 1st Battalion, 37th Field Artillery, dedicate ourselves to the high principles that motivated those before us. We take pride in being part of this unit's history and even greater pride in the men whose heroic actions and honorable service have made this history possible. These men have given us the incentive to strive for perfection."

This statement appears in the battalion's preamble as a reminder to soldiers—old and new—that they are part of a proud and continuing heritage.

But these aren't just empty words. Many of these individuals weren't around when the battalion took part in such battles as "Heartbreak Ridge," "Old Baldy," "T-Bone," or "Pork Chop Hill." In fact, several members hadn't even been born when Charlie Battery of the 1st Battalion, 37th Field Artillery, fired the first mission by the battalion in France on 11 June 1944. That's when they officially became involved in World War II, during the battle for Fort DeCerisy.

Yet today, esprit de corps is still evident among the members of the battery, as it was when the 1-37th was first organized on 17 August 1918 at Camp Lewis, WA.

SGT Gary Warren, Charlie Battery's oldest member with almost five years at Fort Wainwright, explains it this way: "There's esprit de corps, but I think it's more respect for 'Top' than anything. Soldiers know he won't let anything happen to them—that he looks out for them." 1SG Walter E. Spriggs is "Top," and he credits all achievements to the chain of command although it's customary to pass the buck when the time comes to fess up for achievements. It's the modest thing to do.

Everyone in Charlie Battery does their part when the unit carries out its responsibility to provide artillery support to the 4th Battalion, 9th Infantry, in their arctic mission.

Although successful mission accomplishment is the "norm" for this artillery unit, it isn't always easy. Says one battery officer, "The nature of the area of operations that we train in is such that the road networks, in many cases, preclude ground movements. We've therefore developed a proficiency in airmobile operations. Snow conditions and the effects of temperatures on weapons bring up many problems. Basically, everything takes a little longer in the arctic."

Prevailing snow and ice conditions throughout much of the year present special concerns. For example, loose, powdery snow tends to come "unglued" when stirred by a helicopter's rotor wash, which results in whiteout conditions. Here frostbite is easily sustained even in relatively mild temperatures.

All problems aside, however, Charlie Battery (together with their counterparts at Fort Richardson) has a track record of which to be proud.

The 37th was decorated with five streamers, a Belgian Fourragere, and many individual awards during World War II. Their awards during the Korean conflict include 10 battle streamers, 3 Distinguished Unit Citations, and 2 Republic of Korea Presidential Unit Citations.

With credentials such as these, it's small wonder that the battalion's motto is "On The Minute."

Members of Charlie Battery, 1st Bn, 37th FA, await pickup and transportation to their winter ARTEP. (Photo by Joseph Spencer)

Low temperatures and rotor winds from a CH-47 turn even the most regular training exercises into endurance tests for members of the 1st Bn, 37th FA, at Fort Wainwright, AK. Charlie Battery trains hard during the winter months to maintain efficiency on the Alaskan frontier. (Photo by Joseph Spencer)

FORT RILEY, KS—Redlegs are on time—members of the 1st Battalion, 7th Field Artillery, move into position to provide artillery support during a combined arms exercise for ROTC cadets attending the 1980 ROTC advanced camp.

FIST training

FRANKFURT, WEST GERMANY—While "beating the bushes" during training in the hills surrounding Butzbach, West Germany, a group of 3d Armored Division soldiers decided "They could do it!" The soldiers, all newly-arrived to HHB, 2d Battalion, 3d Field Artillery's fire support team (FIST), took to the hills for four days of land navigation training but, according to those involved, they received much more.

"When we first started planning this training, it was only going to be an orienteering-type exercise," said 1LT Serphin Alorra, "but we decided to make it more challenging and stressful."

Additional stress and skill qualification test (SQT) type training was added. Classes were taught in map reading, patrolling, prisoner-of-war processing, terrain sketches, visibility diagrams, and tactical movements.

CPT David Webb, officer in charge of the training, explained that the factor of stress was introduced by requiring the soldier to march long distances (10 to 20 miles per day) and feeding them only two cold C-ration meals per day.

The FIST members were separated into four patrols, each with the hypothetical mission of capturing classified documents. Each patrol member was outfitted with load-bearing equipment, protective mask, weapon, and sleeping roll of a blanket and poncho.

Using patrol techniques, the Redlegs walked to a series of checkpoints where SQT classes were given by patrol leaders. The average distance between checkpoints was 10 miles.

PVT Gregrey Huffman enjoyed the training. "I loved it! It was really good training, and you never know when you're going to war."

Patrol leader SGT Ricky Williams felt that the stress portion was an important addition. "The stress training is to make the soldier realize that he can go that extra step when he needs to make it," Williams said. "It's important to let these guys know that kicking back in the barracks and going to the motor pool every day is not the Army," he continued. (SP5 Scott Flaherty)

PV2 Randy Smith keeps a keen eye out for an "escaped spy" as he leads a patrol to the next checkpoint.

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The New Artillery

by Patrick F. Rogers

Of all the tactical problems facing today's US Army, one is preeminent: in any land conflict with the Soviet Union in the key areas of Europe and Asia, we will be faced with massive armored attacks by forces whose numbers, organization, equipment, and training are designed to rapidly overwhelm and destroy our forces.

The Soviet Union obviously has the capability to mount such attacks. The vast majority of Russian divisions are armored or mechanized. In recent years they have been strengthened by significantly increasing the numbers of men and weapons assigned to each division. The quality edge we once possessed has been eroded by the introduction on a massive scale of such advanced weapons as the T72 tank and the BMP armored personnel carrier. Supporting tactical airpower has been similarly upgraded with the introduction of the MiG-27 and the SU-19.

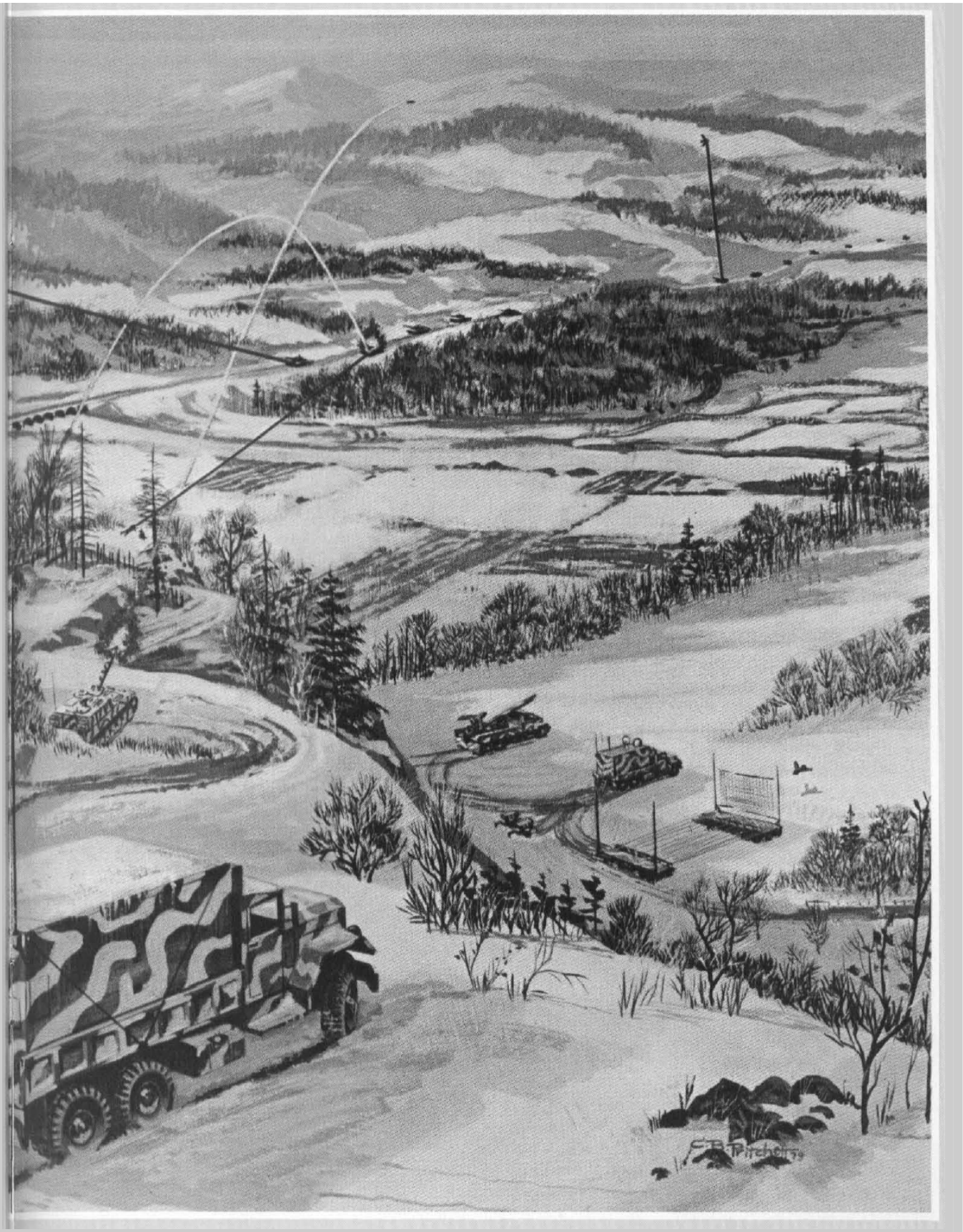
In past wars the US Army has relied on concentrated firepower to defeat massed attacks. Our field artillery has been the principal source of battlefield firepower in World War II, Korea, and Vietnam. On call 24 hours a day, unaffected by weather, and leading the world in the techniques of massing and shifting concentrated fire, US field artillery has provided a devastating response to massed attacks against our forces.

Despite this, the effectiveness of our artillery in a war with the Soviet Union has been in doubt for the last 10 years. This has not been due to any loss of efficiency but results from the major change in the threat. Artillery has never been very effective against armor. The probability of scoring direct hits on moving targets at long range is so low that tanks can advance through conventional artillery fire almost with impunity.

Artillery kills primarily by blast and fragmentation; shell fragments are its principal lethal agent against advancing infantry, but relatively light armor plating shields effectively against fragments. This has led the modern armies of the world to invest heavily in armored personnel carriers (APCs).

Nowhere in the world is this trend more pronounced than in the Soviet Army. Today's Russian infantrymen do not attack as did the waves of men running forward on foot familiar to us from World War II. They ride into combat in BMP and BTR armored personnel carriers, protected from anything but a direct hit. All infantry formations in Soviet tank and motorized rifle divisions are provided with APCs.

These units, protected by armor, have the capability to move directly from within their vehicles. Against this type of attack, the effectiveness of field artillery, no matter how skillfully used, is drastically reduced. Without radically new weapons, our artillery cannot provide our infantry and armor the support they must have to fight and win against heavy odds.



Fortunately for us, we have such weapons under development and moving towards deployment. A number of small, independent Army research programs have been successfully completed which promise revolutionary improvements in artillery effectiveness. The new artillery capabilities do not require a new, radically advanced family of artillery pieces. Existing weapons, modified by product improvement programs, will be able to fire all of the new projectiles.

The existing M109 155-mm and M110 8-inch, self-propelled howitzers presently form the backbone of our mechanized and armored divisions' artillery. They are being modified to the new M109A1 and A3 and M110A1 and A2 versions, with lengthened barrels and modified mechanisms to obtain major increases in range. The M109 howitzers in Europe have already been converted and both the modified and unmodified versions will be capable of firing the new projectiles in their caliber.

The new projectiles—improved conventional munitions (ICM)—do not demand new capabilities or advanced training for the cannon crews. The advantage of this is obvious. We can gain new capabilities as rapidly as the new types of ammunition can be produced and deployed without waiting for the development of new weapons or the retraining of gun crews. Additional demands will be placed on our fire direction centers as new capabilities and extended-range weapons are phased in. This can be compensated for by the new small and rugged multipurpose computers available for fire-direction computation.

One of the most significant of the new weapons is the 155-mm cannon-launched guided projectile (CLGP) which can maneuver in flight to strike moving targets with pinpoint accuracy. The 155-mm M712 Copperhead CLGP is a cannon-fired, semi-active, laser-guided artillery shell. The M712, now going into production, can be fired by standard, unmodified field artillery pieces. All 155-mm howitzers in the inventory become CLGP-capable once the ammunition is deployed.

Copperhead makes no special demands on the gun crew. It is handled and fired like any other 155-mm howitzer round. The round is inert before firing. No special checkout is required. The fuze is set, the round is loaded, and the howitzer is fired. The shell cannot be allowed to spin at the high rate of a normal shell; if it did, the effectiveness of the hollow-charge warhead would be greatly reduced.

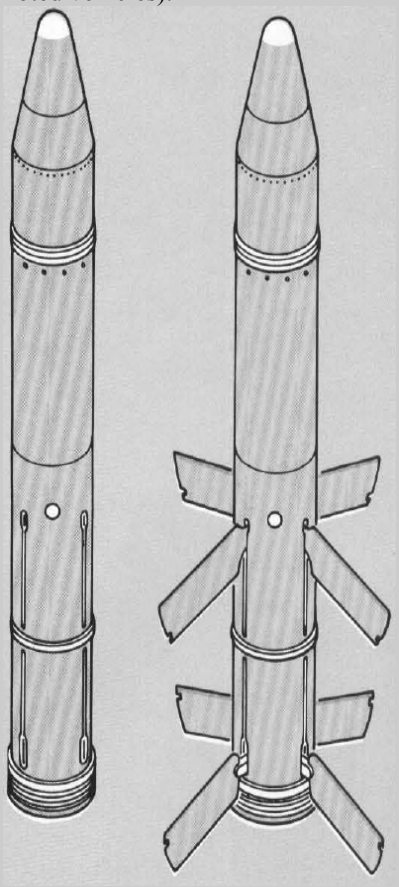
To avoid the normal spin-up by the howitzer barrel's rifling, the M712 uses a special rotating band/obturating band. The band takes the rifling of the barrel but is designed to slip rapidly over the shell body. The slipping action decouples the body of the shell from the band and the effects of the rifling.

When the Copperhead is fired, acceleration actuates the battery which supplies power to the semiactive laser seeker and the control fins. As the shell clears the howitzer muzzle, the stabilizing and guiding fins pop out automatically. The shell follows a normal ballistic trajectory toward the target area. As the projectile reaches the peak of its trajectory and starts downward, the target area comes into view.

The preset timer activates the laser seeker which scans the target area, searching for the particular laser frequency and pulse repetition rate that identifies its assigned laser designator. The forward observer team keeps the invisible laser designator spot on the target to be destroyed, using the telescopic sight and tracking unit built into the designator.

The Copperhead seeker unit locks onto the designated target. The guidance unit computes the maneuver required for a direct hit and steers the shell directly into the target. The M712 has the capability to maneuver to a designated target at any point within a 3,000-meter-diameter circle centered on the ballistic aiming point under normal weather conditions. As long as the guidance and maneuvering unit functions properly and the laser designator spot is on the target, the probability of a direct hit is extremely high.

A direct hit by a 155-mm or 8-inch HEAT (high-explosive antitank) projectile will destroy any armored fighting vehicle in the world. Many designators can be used simultaneously in a single area as long as each is set for a particular pulse code. Designators can be operated by ground-based artillery forward observer teams, helicoptors, Army aircraft or RPVs (remotely piloted vehicles).



Copperhead projectile in loading configuration (left) and flight configuration (right).

This seems almost too good to be true. But publicly announced tests of the experimental 155-mm XM712 CLGP demonstrate the system's capability. The 138-pound CLGP has a maximum range of 16,000 meters. Successful tests have been conducted at ranges of 4, 8, 12, and 16 thousand meters, hitting both moving and stationary tanks. Firings have been conducted in daylight and darkness. Successful test firings with the laser designation performed by an Army mini-RPV and a Cobra helicopter have been conducted.

The Copperhead laser designator system offers many tactical advantages. The designation beam and the laser spot on the target cannot be seen by the human eye. There is no flash, smoke, or noise to reveal the location of the designating sites. The cannon which fire the Copperheads are several thousand meters to the rear, firing indirectly. They cannot be detected or counterattacked by the targets.

This contrasts favorably with an antitank guided missile such as TOW, where the launcher and crew must be within line of sight of the enemy to engage and are visible to the intended target. When the missile is fired, the flash and blast of the rocket motor provide an easily detected signature. If the tank is within 2,000 meters of the missile launcher, it can immediately open fire with its main cannon. A TOW requires 8.6 seconds to fly 2,000 meters. A Soviet 100-mm tank gun shell can cover the same distance in less than three seconds—and there will probably be more tanks attacking than TOW's defending. At ranges below 1,500 meters, the odds definitely favor the tanks.

In a similar situation, the laser-designating teams are difficult to detect. The laser beacon must be on only during the last few seconds of the projectile's flight. The launching cannon cannot be detected by the targets and tank cannon are ineffective against the remote artillery pieces. Only hostile artillery counter-battery fire or supporting airstrikes are likely to be effective, and the enemy armored forces under attack have no way of rapidly locating the US artillery units firing laser-guided shells at them.

CLGPs obviously have great value in the attack. Key enemy strong points can be designated by forward observers and hit with the same precision—ask any veteran of the Korean War about the value of a one-shot, direct-hit kill on any enemy bunker in sight.

Copperhead is not cheap. The cost of the 155-mm M712 has been estimated at $8,796 per round in 1976 dollars. But the capability to rapidly destroy tanks and other key hostile targets is well worth the price. And consider this: conventional artillery may require 20 or more rounds to score a direct hit on a nonmoving point target. The savings in time, tube wear, and conventional ammunition may make Copperhead the cheaper solution.

Another significant advance is the adaptation of cluster munitions techniques to artillery projectiles. In this method a shell acts as a carrier for a number of submunitions, each with its own warhead and fuzing system. The guns are aimed, loaded, and fired with normal techniques. As the shells approach the target area, the main fuze fires, and a low-powered charge opens the shell and the submunitions are dispersed.

Each submunition follows an individual trajectory to the target area, impacts and detonates, providing a "shotgun" pattern surrounding the original aimpoint. Submunition ammunition can saturate a far wider area than conventional rounds. For example, the ICM 155-mm M483A1 projectile carries 88 antipersonnel fragmentation submunitions, each more effective than a hand grenade. A small number of artillery pieces firing cluster munition shells can rapidly saturate a wide area.

Once perfected, the technique can be adapted to use a wide variety of submunitions. Hollow-charge bomblets can be used to attack the thin upper armor of tanks and APCs and a wide variety of chemical projectiles can be employed. But perhaps the most important use of artillery cluster-munition shells may be to create barriers to enemy movement and fight delaying actions by remote control.

Cluster munitions techniques allow the artillery to deploy antipersonnel and antitank mines inside enemy territory. The tactical implications of this capability are striking. Artillery-delivered mines allow us to lay minefields deep behind enemy lines, to deliver a minefield within minutes of deciding to do so, and to maintain the minefields against enemy attempts to clear them.

The effective range of division and corps artillery allows the emplacement of minefields up to 20,000 meters behind the frontlines. There is no distinctive signature to alert the enemy that mines have been laid. The enemy is thus forced to operate on the assumption that any key area behind his lines within range of our artillery may be mined. Mines may be laid down in front of an enemy attack, on key road junctions to screen a vulnerable flank, or to isolate and cut off advanced enemy units from supplies and reinforcements.

Delivery of artillery-laid minefields is extremely rapid. A decision to deploy mines in a given area can be made and implemented in minutes. The mines are delivered by artillery shells which cannot be intercepted and the minefields can be laid down with great precision, day or night, and in adverse weather. Once laid, the minefield can be maintained.

Mines can be delivered on an advancing column. If the enemy clears paths through a field, the field can be relaid in minutes. Harassing fire with fragmentation shells or antipersonnel, cluster-munition shells can make

attempts to clear a field slow and costly.

Picture an advancing mechanized column running into an artillery-delivered minefield. Reconnaissance units have preceded the column and reported a clear advance route for several thousand meters. As the column moves forward, its advanced tanks and APCs move into an antitank/antipersonnel minefield delivered by US artillery minutes ago. A few vehicles are knocked out, treads blown off or hulls pierced.

Few things are more unpleasant than driving in a minefield. The *Blitzkrieg* grinds to a halt. The enemy commander must dismount infantry or call for combat engineers with specialized equipment to clear paths through the field. Harassing artillery fire inflicts heavy casualties and delivers new mines to maintain the field. Special equipment coming up from the enemy rear runs into new minefields laid behind the column.

The advance is slowed to a crawl. Masses of immobilized armored vehicles provide a tempting target. Attack helicopters armed with TOWs swarm to the scene; helicopters equipped with laser designators arrive; and cannon-launched, laser-guided projectiles begin to strike tanks with deadly precision. The enemy attack is shattered without even engaging American infantry or armored units.

The only effective defense would be intense counterbattery fire directed at all artillery units within range, but even this does nothing to clear the minefield already in place.

Employment of artillery-deployed mines will give US artillery a blocking and delaying capability. Until now, artillery could delay a hostile attack only by continuously firing on it. While effective, this defense is vulnerable to saturation. If the enemy has the resources, he can attack simultaneously in a number of selected spots and break through. Artillery-delivered mines provide artillery with a major increase in capability to block enemy penetrations and to harass and delay hostile units which break through.

Effective use of the new artillery capabilities will require improved capability to detect, identify, and acquire targets. It is worth noting that the problem may be quite different from Vietnam. There, the problem was to detect concealed and camouflaged targets dispersed over wide areas. Frequently, the enemy objective was to avoid contact with US Army forces. The problem was to find the needle in the haystack. We may fight a war like that again, but we may not. In a NATO-Warsaw Pact clash in Central Europe, our problem will not be to find isolated, hidden targets but to deal with vast quantities of targets coming straight at us.

The Army is developing new target-location capabilities. Least glamorous, but essential, are new artillery- and mortar-locating radars. These radars can detect hostile shells, rockets and mortar bombs in flight and track them to establish their trajectories. Trajectory data fed instantaneously to the associated computers allows the firing point to be computed instantly while the enemy projectile is still in flight, and rapid counterbattery fire can be delivered with great accuracy.

Past experience with counterbattery radars in the field has not always been happy. However, the new radars taking advantage of advances in microelectronics and digital computers should solve the problems of earlier designs. Two new radars, the artillery-locating radar AN/TPQ-37 and the mortar-locating radar AN/TPQ-36, are now in early production. When deployed, these radars will significantly increase our target-acquisition and counterbattery capability and offset potential enemy numerical superiority in artillery and mortars.

A second radar development promises to give the Army early warning of massive enemy movements through its own resources. The standoff target acquisition system (SOTAS) consists of a large radar system carried by two helicopters. The SOTAS can detect moving targets with great accuracy deep within enemy territory.

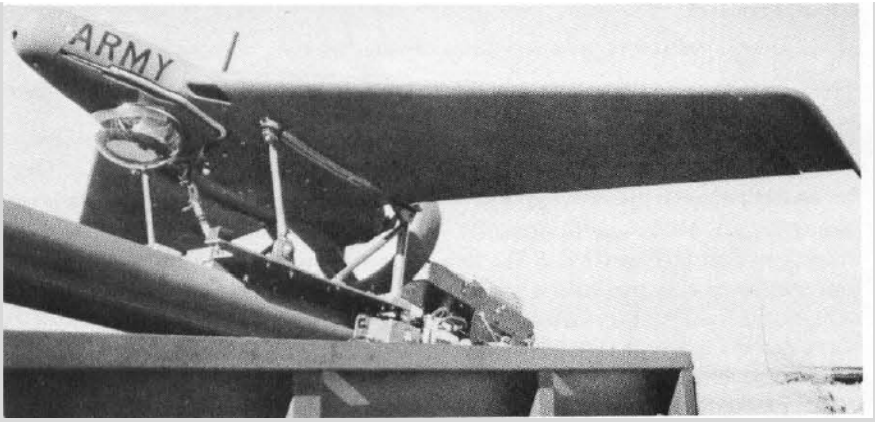
The radar data is relayed to a ground control station in digital form. The ground station converts this data to map coordinates, allowing the attack on the enemy formation with artillery or airstrikes. The system can operate day or night, through smoke or fog, and in all but the most severe weather. The helicopters can operate well back out of enemy AA guns or SAM range.

A single SOTAS unit can monitor vast areas of hostile territory and actual tests of prototype SOTAS along the Korean and German borders have demonstrated that SOTAS can perform as designed. When deployed, the system promises to increase significantly our artillery target acquisition capability as well as providing a major source of tactical intelligence.

A third potential advance in target acquisition is the development by the Army of mini-RPVs. Army RPVs are small, unmanned, remotely piloted aircraft or helicopters operated from a ground station. Equipped with a television system, the RPV can relay instant television images to the ground station's screens, enabling the operators to instantly "fly" the vehicle and make tactical decisions concerning the data appearing on their screens.

If a laser designator is added to the RPV's sensor package, it can designate a target shown on the screen for attack by laser-guided shell. These capabilities have already been demonstrated in prototype form by successful tests of CLGPs against tanks which have been laser-designated by RPVs.

Operational RPVs could be equipped with low-light level TV or FLIR (forward-looking imaging infrared)



The US Army Aquila remotely piloted vehicle ready for launch from its truck-mounted pneumatic rail. The plastic dome beneath the word "ARMY" on the fuselage houses the various TV cameras that make up the payload of the unmanned craft.

sensors which would enable them to detect targets day or night. The RPVs will be small, maneuverable, and difficult to detect. They can range in weight from 25 to several hundred pounds, depending on the range and capabilities required. A single type of ground station could be designed to operate several different types of RPVs, allowing efficient use of resources and multimission capability.

Army RPVs will have to be rugged and reliable, capable of moving with combat units in the field. Airstrips are out of the question. RPVs must be launched and recovered in many types of terrain without extensive preparations. Current Army prototypes have demonstrated the capability of being launched from a truck-mounted launcher and recovered in a portable net system.

While further development will be necessary, the basic principles of operation have been demonstrated. Army tactical RPVs with improved sensors, data links, and propulsion systems offer a major increase in our capability to acquire, identify, and designate targets for artillery attack.

Another potential source of tactical intelligence and target acquisition is the remote sensor or intrusion detector. These devices detect the presence or passage of personnel or vehicles through their area of detection and relay the data to remote control and monitoring stations. Sensors of various types have been developed which include seismic (earth vibration), magnetic, passive infrared, electronic, and unintentional radiation detectors.

A mixed network of sensors can detect, monitor, and classify intrusions into the area of detection. Target location is sufficiently precise to allow artillery attack against area targets with conventional HE and WP shells, cluster-munitions shells, and artillery-delivered mines. These sensors were developed during the 1960s for use in Vietnam.

Progress in microminiaturizing and making electronic components more rugged will allow delivery of intrusion detector sensors by artillery shells using cluster-munition techniques. Other sensors which cannot be made rugged enough to withstand artillery delivery can be delivered by Army RPVs.

The ability to emplace intrusion detector systems rapidly by artillery adds a new meaning to reconnaissance by fire. In addition to providing a new means for artillery target acquisition, valuable tactical intelligence can be provided to prevent surprise attacks, screen flanks, or time the delivery of artillery and airstrikes at key communications centers and vulnerable points.

The revolutionary new capabilities of the field artillery will have one adverse effect: it will attract a great deal of unwelcome attention. If an enemy commander hopes to achieve major breakthroughs and rapid advances, he must neutralize the US division and corps artillery. Our firing units will undoubtedly be subjected to heavy counterbattery fire and intense airstrikes.

At present we are outnumbered in Europe three to one by the Soviet artillery. The Soviet tactical air units are rapidly increasing in quality and quantity. To offset these threats, we must rely on rapid displacement of our firing units and an intensified antiaircraft defense against low-firing aircraft.

All of our divisional artillery units in Europe are self-propelled. This allows rapid shifting from one firing position to another; firing positions can be surveyed and prepared prior to hostilities. The M109A1 self-propelled howitzers are lightly armored. The crew and the cannon are protected against fragments and aircraft strafing, but the 8-inch howitzers are not. The driver is under cover, but the crew and cannon are completely exposed.

This is a significant defect in an otherwise outstanding piece. Light armored shelters are now being developed for the M110A1s to provide fragmentation and strafing protection for the cannon and crew. Our existing units are thus mobile, and will have a degree of protection. This will tend to reduce the effectiveness of hostile counterbattery fire, while our own new projectiles and advanced target-locating techniques can increase the effectiveness of our own counterbattery fire. What will be the effects of the new projectile and target acquisition capability on artillery organization and tactics? The ICM projectiles do not require new guns. They have been carefully designed to be compatible with our existing cannon. The principal effect of the new capabilities may be to saturate the system.

Today, a 155-mm howitzer battalion can fire high explosives, phosphorus, smoke, illuminating, and chemical projectiles. Add to this the capability to destroy tanks with laser-guided projectiles, fire cluster munitions, deliver sensors, lay minefields, and deliver enhanced-radiation

nuclear artillery shells with pinpoint precision, and the artillery system is likely to be saturated with requests for fire missions.

While an artillery battery can carry out any one of these tasks, it cannot do all of them simultaneously. The increased capabilities require more artillery for maximum effectiveness.

Today, most of our armored and mechanized divisions have three self-propelled 155-mm howitzer battalions and one 175-mm gun/8-inch howitzer heavy battalion. Improved 8-inch howitzers are replacing the 175-mm guns. The 155-mm howitzer battalions have normally had three firing batteries with six guns each. The heavy battalion has had three firing batteries with four guns each.

Additional artillery is being provided by adding more guns and batteries to existing battalions. Studies conducted by the Army's Training and Doctrine Command (TRADOC) showed that this was a cheaper and quicker way to obtain more artillery than organizing new battalions.

The existing 155-mm howitzer firing battery can be increased from six guns to eight and the number of batteries in a battalion from three to four without a major change in the division artillery structure.

Additional supporting vehicles and personnel will be required to support the added guns, but the increase from 18 to 32 guns per battalion can be obtained at a relatively low cost.

A similar addition of two guns per battery and a fourth firing battery per battalion will be used to strengthen the 8-inch howitzer battalion.

The eight-gun battery appears to offer a number of advantages on a European battlefield. Guns can be dispersed in half batteries of four pieces, each of which constitutes an effective firing unit. Greater dispersion will provide improved protection against enemy counterbattery fire. If some guns are lost, the eight-gun battery will still remain an effective unit.

Another new artillery weapon system in development is the multiple-launch rocket system (MLRS). The United States has not had a significant battlefield artillery rocket system since World War II. The Soviets, on the other hand, made extensive use of artillery rockets during World War II and have retained and improved their capability. The MLRS, when deployed in the early 1980s, will fill the current artillery rocket gap and, if combined with other new developments, may give our Army decisive superiority in the artillery rocket field.

Artillery rockets are of great value because they give our artillery a surge capability. A single, multiple-tube, heavy-caliber rocket launcher can deliver the firepower of an artillery battalion for half a minute. Used in numbers, they can deliver a tremendous concentration of fire in an extremely short time.

The MLRS is such a system. A final development contract was recently awarded to Vought Corporation, following a competition with Boeing Aerospace Company. The specifications call for a mobile, rugged system that can move with other combat units. Vought describes its proposed system as "a low-cost, rugged, reliable, free-flight rocket system which can be rapidly deployed and deliver a high volume of fire."

It will consist of a tracked, armored launcher which will carry 12 rockets ready for firing. The rockets can be fired singly or rippled in rapid fire if required.

The armor and mobility of the tracked launchers will enable them to move as an integral part of tank-mechanized infantry combat teams.

The intended maximum range of the system is 30,000 meters. The striking power of a single 230-mm MLRS rocket will be greater than that of an 8-inch howitzer shell. The initial warhead planned for the MLRS is an antipersonnel-anti-materiel cluster-munition design. It is clear that many of the other new artillery projectiles can be adapted to the MLRS. Laser homing projectiles and scatterable mines are two obvious examples.

The potential firepower of a MLRS-equipped battalion is immense. The extremely short time in which that firepower can be delivered makes it an almost ideal crisis weapon. When developed and deployed, the MLRS will provide a significant addition to the Army's firepower.

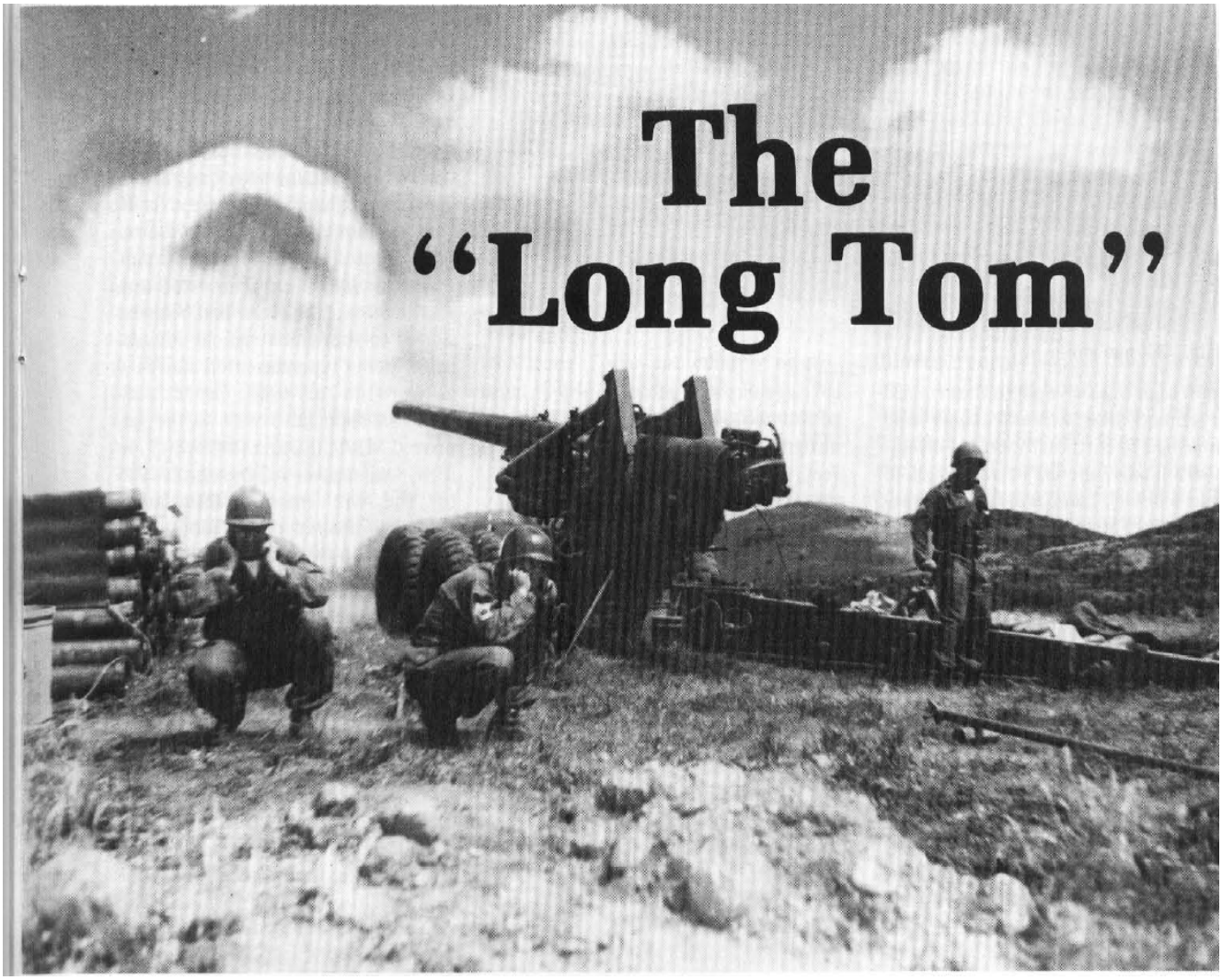
Collectively, the new artillery projectiles and targeting systems offer a revolutionary advance in US artillery capability. They are not paper concepts—all have been demonstrated repeatedly in developmental testing. They face, however, one final obstacle: viewed individually, they are not glamorous in this age of ICBMs and cruise missiles.

The individual projectiles are more expensive than conventional rounds and the Bureau of the Budget has been known to turn a deaf ear to "improved effectiveness" arguments. If the new artillery systems are procured and deployed in quantity, the impact on ground warfare may be as great as anything since the development of the tank.

Let us hope so. In the uncertain 1980s, the Army will need the new artillery.

*(Reprinted with permission from July 1980 **ARMY** magazine.)*

Patrick F. Rogers, a development engineer with Lockheed Missiles and Space Company, is currently involved in projects to develop and target antiship and land-attack cruise missiles.



The "Long Tom"

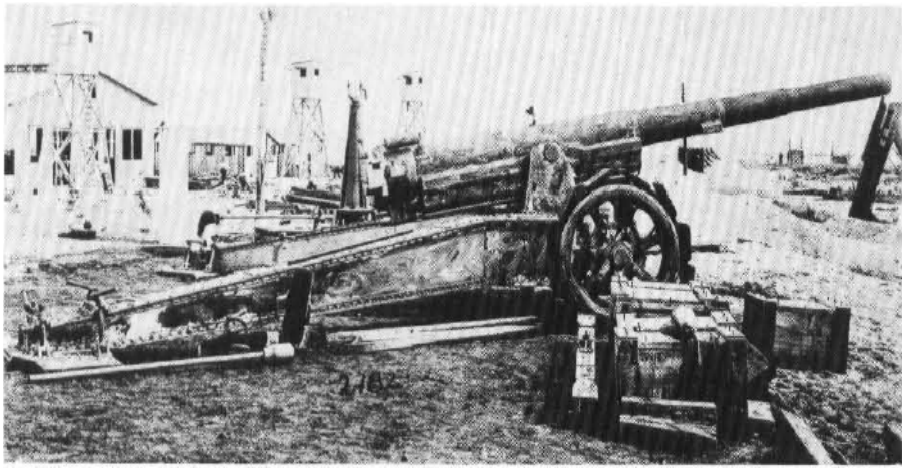
by Mr. Truman R. Strobridge

By the time the Americans entered the grim trench warfare of World War I, the mood of joyous certainty with which our allies went to war in 1914 had been transformed into a more realistic attitude by the hideous losses of the battlefield. Thus, the French, who had lost 377,000 at Verdun alone, were more than willing to share their artillery with the exuberant doughboys whose eyes were still unscarred by the wanton slaughter of modern warfare and whose biggest field piece was the 3-inch howitzer.

The static warfare of no-man's-land demanded cannons of sufficient destructive force to smash heavily fortified positions. In fact, over 50 percent of the 37,500,000 casualties on all fronts in World War I resulted from artillery, making it the number one battlefield killer.

One of the ordnance pieces lent by the French was the 155-mm gun, called the *Grande Puissance Filloux* (GPF)—literally "Filloux's gun of great power." Weighing 25,500 pounds underway and 20,100 pounds in firing position, it could hurl a 95-pound explosive shell over 17,000 yards.

Its official adoption by the American Expeditionary Force (AEF) came, when the US Army labelled it the M1917 155-mm gun. The subsequent M1918 was merely an American-manufactured version of the French gun. All one had to do to transform a GPF into the M1917A1 was to fit an American breechblock to the French gun. Expertly handled by doughboy crews, this gun—sometimes referred to as the 155-mm rifle—pounded the German lines



M1918 155-mm gun.

with high explosive shells that roared overhead like express trains and smashed to earth with violent effect.

Ironically, the GPF, according to one account, had been designed specifically to provide long-range covering fire for troops in retreat. The doughboys, nevertheless, considered it as "the best type of heavy field artillery developed and used during the war," because of its simplicity, wide traverse, efficient recoil system, long range durability, and "very pleasing appearance."

Development between wars

The memory of the 155-mm gun's uncanny accuracy, long range, and destructive prowess was still fresh in the minds of cannoneers when they were queried by the Westervelt Board just months after the Armistice. This group of ordnance and artillery officers had been convened to canvas its own and foreign artillerymen as to the relative merits of different cannon, as well as what they envisioned would be most desirable on any future battlefield. One of the Board's recommendations, submitted on 23 May 1919, called for a new improved 155-mm gun, with the extra proviso that a self-propelled version also be developed.

Since the Board's specifications for both the 155-mm gun and the 8-inch howitzer were nearly identical, the ordnance planners—faced by the inevitable shortage of research and development funds once the fighting stopped—decided to design a single carriage capable of mounting either of the two new weapons. The newly designed 155-mm gun measured 22 feet, 10.7 inches long (not including the breech), weighed 9,200 pounds, and could fire a 95-pound projectile over 26,000 yards. The resultant dual-purpose carriage, along with the new 155-mm gun and 8-inch howitzer, was designed as the M1920E. Spring suspended, the carriage alone weighed 18,800 pounds. The maximum elevation was 65 degrees and total traverse was 60 degrees for the 155-mm gun, while the Filloux type variable recoil mechanism permitted a maximum recoil of 60 inches and a minimum recoil of 24 inches. The carriage's hard rubber tired wheels, while adequate for the slow moving tractors then used to move field artillery, made it obsolete for any fast-moving mechanized army. The carriage proved unstable when the gun was fired at maximum power, and, as an additional handicap, the M1920E model had been specifically designed to be divided into two separate loads for transportation, particularly when crossing bridges.

The Ordnance Department tinkered with several other experimental carriages during the 1920s, but without success. Then, in the summer of 1930, Rock Island Arsenal developed the radical split-trail T2 carriage which contained at least two "firsts" for heavy field artillery carriages: an all-welded construction and a unique 8-wheel (four dual tires) roll-bearing bogie that permitted the gun to be carried on truck wheels cross-country at high speeds. For stability in the firing position, special built-in jacks (which eliminated the need for a crane) dropped the bottom carriage to the ground. This T2 carriage survived for over 30 years without any major modification.

Meanwhile, both a new 155-mm gun and 8-inch howitzer had been designed to share this radical T2 carriage, being type-classified standard as the M1 in July 1940. The M1 155-mm gun soon gave way to the improved M1A1 in June 1941 which, in turn, was superseded in March 1945 by the M2 (model designation changes reflected the different type construction of the tube and breech ring). On 9 August 1945, the unconverted M1 and M1A1 were declared obsolete.

The M1 155-mm gun, affectionately known as the "Long Tom," weighed 9,595 pounds and fired a 95-pound high explosive shell to a distance of 26,000 yards at the rate of one round per minute. Its hydropneumatic variable recoil mechanism weighed 3,890 pounds and allowed a maximum recoil of 70½ inches, although the normal recoil was 65 inches at 0 degrees and 32 inches at 65 degrees. Total weight of the gun, recoil mechanism, and carriage was 30,600 pounds.

The United States, still reeling from the catastrophic effects of the Great Depression, however, did not feel it could afford the luxury of big expensive guns; therefore, only 65 Long Toms were built before 1941. Left over from World War I, however, and still carried on the army inventory were 908 GPFs, some of which had been modified for high speed towing.

North African Campaign

The Long Toms quickly earned the respect and admiration of all that came without sound or striking range of its mighty blast. In the war

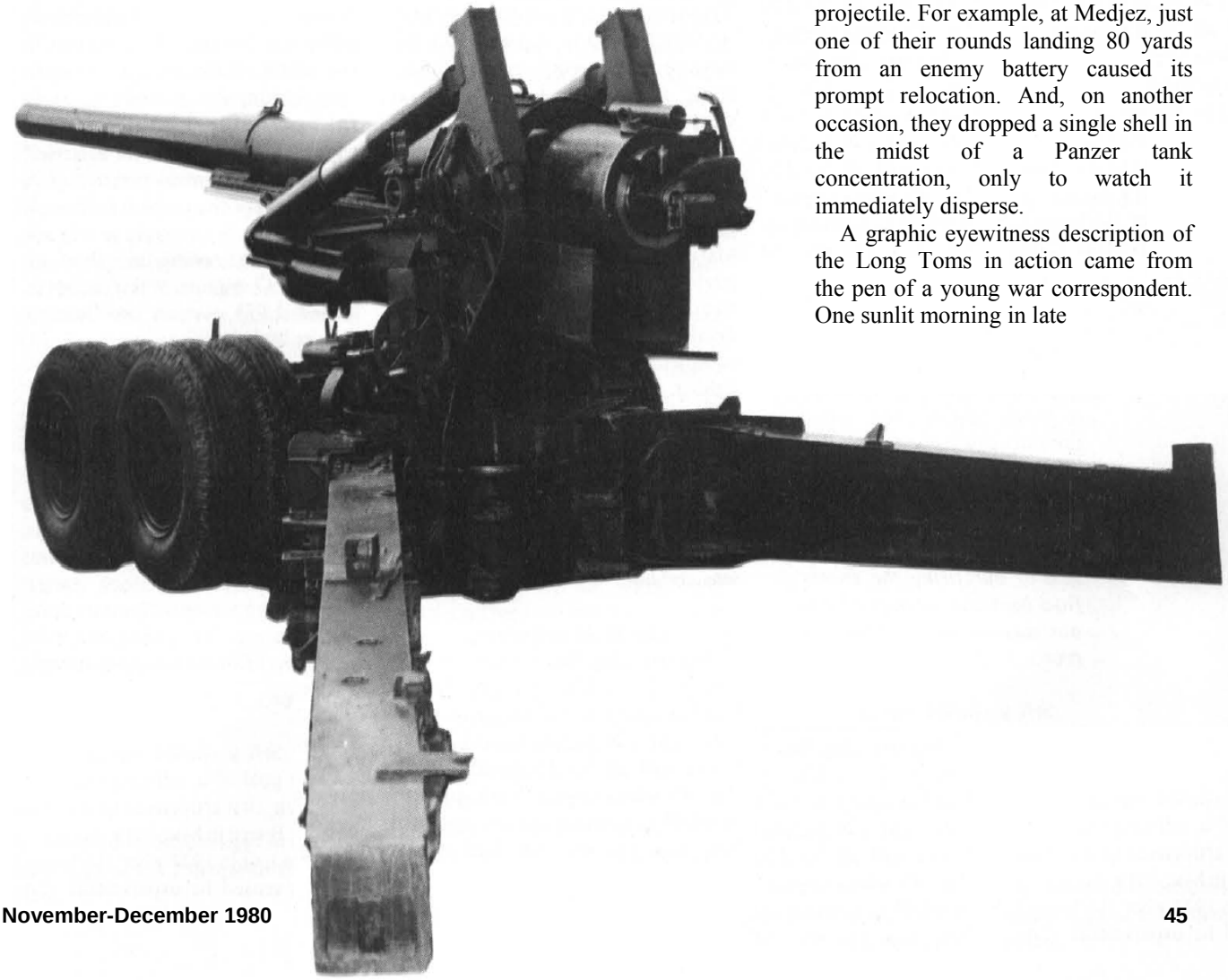
years to come, both the European and Pacific theaters were to witness its accuracy and deathly punch. But, it was in the brown-hued landscape of North Africa that the Long Toms first revealed their awesome, accurate firepower in combat. Ironically, because of the tight security surrounding the preparations for Operation TORCH, the ammunition requisitioned from the States was for the old World War I GPF rather than the new M1 155-mm gun, with which the US II Corps was equipped; thus, the M1s were left behind in England and missed the initial phases of the North African Campaign.

American-crewed Long Toms not only fought alongside the GIs of every American division that saw combat in North Africa, but also served for two months with the British Army. While serving with the Royal Artillery, US cannoneers and their Long Toms were utilized as reconnaissance-in-force units. On numerous occasions in December 1942 and January 1943, the Long Toms and their US handlers found themselves on Hill 609 with only a mere company of British paratroopers for local protection. An armored car, meanwhile, would probe some 10 to 15 miles out front into enemy territory and, when it drew hostile fire, the Long Toms immediately retaliated. On 18 January 1943, for example, a battery of four Long Toms expended 368 rounds in this fashion in a matter of just a few hours.

The accurate and long-reaching heavy punch of the Long Toms was in great demand during the hectic fighting in North Africa that transformed the "green" GIs into seasoned veterans. They were rushed to the Kasserine Pass to support an armored counterattack, following the American's disasterous defeat. Later, a battery of 155-mm rifles, after getting the worse of a counterbattery duel, withdrew across the Medjerda River and occupied an Arab cemetery. Here, the Long Toms fired for 18 straight days without being detected by the enemy, although both their old positions, as well as a dummy position just 800 yards away, underwent heavy shelling and bombing. Then, on 23 March 1943, a forward platoon of 155-mm guns shelled a German airfield near Maknassy, destroying five planes—probably the first every to be hit by a Long Tom.

As for the crews of the 155-mm guns, they soon came to appreciate the strength and effect of their heavy projectile. For example, at Medjez, just one of their rounds landing 80 yards from an enemy battery caused its prompt relocation. And, on another occasion, they dropped a single shell in the midst of a Panzer tank concentration, only to watch it immediately disperse.

A graphic eyewitness description of the Long Toms in action came from the pen of a young war correspondent. One sunlit morning in late



March 1943, Alan Moorehead "found an artillery spotting-post right in the center of the E1 Guettar valley, commanding the most perfect view of a battlefield that he ever had, before or since." Here, he watched a major American armored thrust down the Gafsa-Gabes road, launched in hopes of cracking the Axis defenses and linking up with the British Eighth Army on the coast:

> *I crouched in a dugout with one of the artillery commanders while he gave his orders into the telephone to the American Long Toms a mile or two behind us. It all seemed so easy; just a few figures spoken into the telephone. Then the air above us was full of tearing express trains, and we grabbed our glasses to watch the hits. They fell among the high brown rocks, first with a snowwhite column of smoke that streamed steadily upward until it was caught by the cross wind on the mountain crest and billowed out into grey and formless clouds. Sometimes when the smoke cleared you could see the little figures of Germans or Italians running to better cover. They were only a mile or two away, but this was killing by remote control, without the maddening stimulus of hand-to-hand fighting. One could carefully assess the targets and take aim with the same unemotional calmness of a sportsman shooting grouse on the moors. Almost, not quite. In the intervals of our firing the enemy fired back and we ducked into our dugout and hugged the rock.*

Self-propelled version

The goal of a self-propelled 155-mm gun, first articulated by the Westervelt Board in May 1919, came to a sudden halt in 1922 when the United States ceased its experiments. The objection that the entire weapon system would become immobilized once the engine in the carriage failed seemed to demonstrate at that point in time that tractor-drawn artillery was more dependable in combat. As a result, the very promising beginnings were destined to remain dormant for nearly two decades.

But the dream did not die, at least for ordnance experts. As early as June 1941, the Chief of Ordnance recommended the development of a 155-mm gun mounted on a modified M3 tank chassis. The skilled craftsmen of Rock Island Arsenal, once given the go-ahead, promptly fabricated a pilot model, which was tested at Aberdeen Proving Ground in February 1942. Designated the T6 GMC, it consisted of an M1918 155-mm gun (an aging veteran of World War I) emplaced on a mobile tank chassis. The Army Ground Forces, however, initially refused to consider this innovation, primarily because they could not see a need for such a weapon.

The Ordnance Department, however, still firmly convinced of the value of the self-propelled 155-mm gun, ordered 50 to be produced in March 1942. Despite additional objections, the new weapon system was standardized as the M12 and, production of an additional 100 was completed in March 1943. Once fielded, these pieces were used for artillery training in the United States. By December 1943, however, when the plans for the invasion of "Festung Europa" were being finalized, the decision was made to overhaul 74 of the M12s for possible use in overseas combat.

The M12s in Europe

One of the first units to be furnished the M12 was the 991st Field Artillery Battalion, a former New York National Guard unit. Crews trained for 15 months with this new weapon—a 155-mm gun of World War I vintage mounted on the M4 tank chassis that had been stripped of armor and a spade added to absorb the force of recoil. As could be expected, crews encountered the normal difficulties of adjusting to a new artillery piece. Typical American improvision and persistence however resolved their problems. By the time the 991st FA Battalion landed on Omaha Beach at Normandy on 11 July 1944, its crews and M12s were performing at peak efficiency. Since the M12 was capable of churning across terrain at 35 miles per hour, road marches of 200 miles per day were considered the norm, not the exception.

During the battle of Normandy, the M12s of the 991st FA Battalion were attached to the corps of the US First Army and were utilized primarily to deliver supporting fire. Following its attachment to the 3d Armored ("Spearhead") Division on 12 August, the 991st abandoned its static role for one of movement in the Battle of the Falaise-Argentan Gap. During this period, the M12s fired most of their missions against enemy flak batteries, field batteries, and deep interdiction targets, all in accordance with accepted field artillery doctrine for medium and heavy artillery. The heaviest day's shooting came on 17 August, when the M12s hurled 1,073 rounds on German Panzer tanks.

After the closing of the gap at Putanges, the M12 unit joined in pursuit of the retreating Wehrmacht. As the only artillery heavier than the ubiquitous 105-mm howitzers attached to the fast-moving 3d Armored Division, the 991st FA Battalion was the only unit available for deep counterbattery, long range targets of opportunity, interdiction, and covering fire during the emplacement of light artillery batteries.

Despite the speed of the advance across France, coupled with frequent displacements, the GPF tubes of the M12s "again proved, as in the last war, that they could speak with authority on French soil." The rapid pursuit, however, permitted enemy

units to infiltrate between the 3d Armored Division spearhead and the 991st FA Battalion and, for one 24-hour period, these fast-moving artillery units became virtually isolated from the rest of the corps and army.

As a result, the M12 battalion had to fight several infantry actions. The sharpest one came between 2 and 4 September 1944, when the 991st FA Battalion, aided only by headquarters troops of the armored division, fought off the remnants of the German 348th Infantry Division in the vicinity of Quevy-le-Grand. Its fire proved very effective on tanks, half-tracks, trucks, and personnel. In all, the M12 battalion took 500 prisoners. When the infantry arrived to take over, the 3d Armored Division roared off again, this time straight eastward toward Germany, with the self-propelled Long Toms following close behind.

To the M12 battalion went the honor of being the first Allied artillery unit, from the West, to unleash its deadly barrages on German soil. The target was a key road junction near Bildchen, a small town southwest of Aachen, at a range of 19,800 yards. The Long Toms of the 991st FA Battalion spoke authoritatively at precisely 1721 hours on 10 September 1944. This fire, according to the air observer overhead, proved "effective."

As the VII Corps assaulted the Siegfried Line south and southeast of Aachen, the batteries of the 991st FA Battalion assisted the combined tank/infantry effort to penetrate this strongly fortified line by destroying concrete pillboxes by direct laying. Battery A remained attached to the 3d Armored Division, while Battery B worked with the 9th Infantry Division in and around the Huertgen Forest. Battery C aided the 1st Infantry Division to first isolate Aachen and then speed the city's reduction by providing direct fire support to the infantry which was fighting street by street.

When the last great death gasp of the Third Reich on the western front erupted into the Battle of the Bulge, the fast-moving M12s fought first in defensive actions and then took the offensive with the First Army. Next, in January 1945, the 991st provided necessary fire support to assist the 1st Infantry Division to smash through the Siegfried Line southeast of Monschau and, after shifting to the north, supported the crossing of the Roer River, the drive to the Rhine River, and the capture of Cologne.

M40—A later version of the self propelled Long Tom.

Next, the batteries of the M12 battalion, now attached to the Seventh Army's divisions, lent the weight of their awesome Long Toms to drive again through the Siegfried Line for the third, and last, time. Once the Seventh Army secured its Rhine River crossing at Worms, the 991st was shifted back to the 3d Armored Division and had to motor march 400 miles to rejoin this fast-moving "Spearhead."

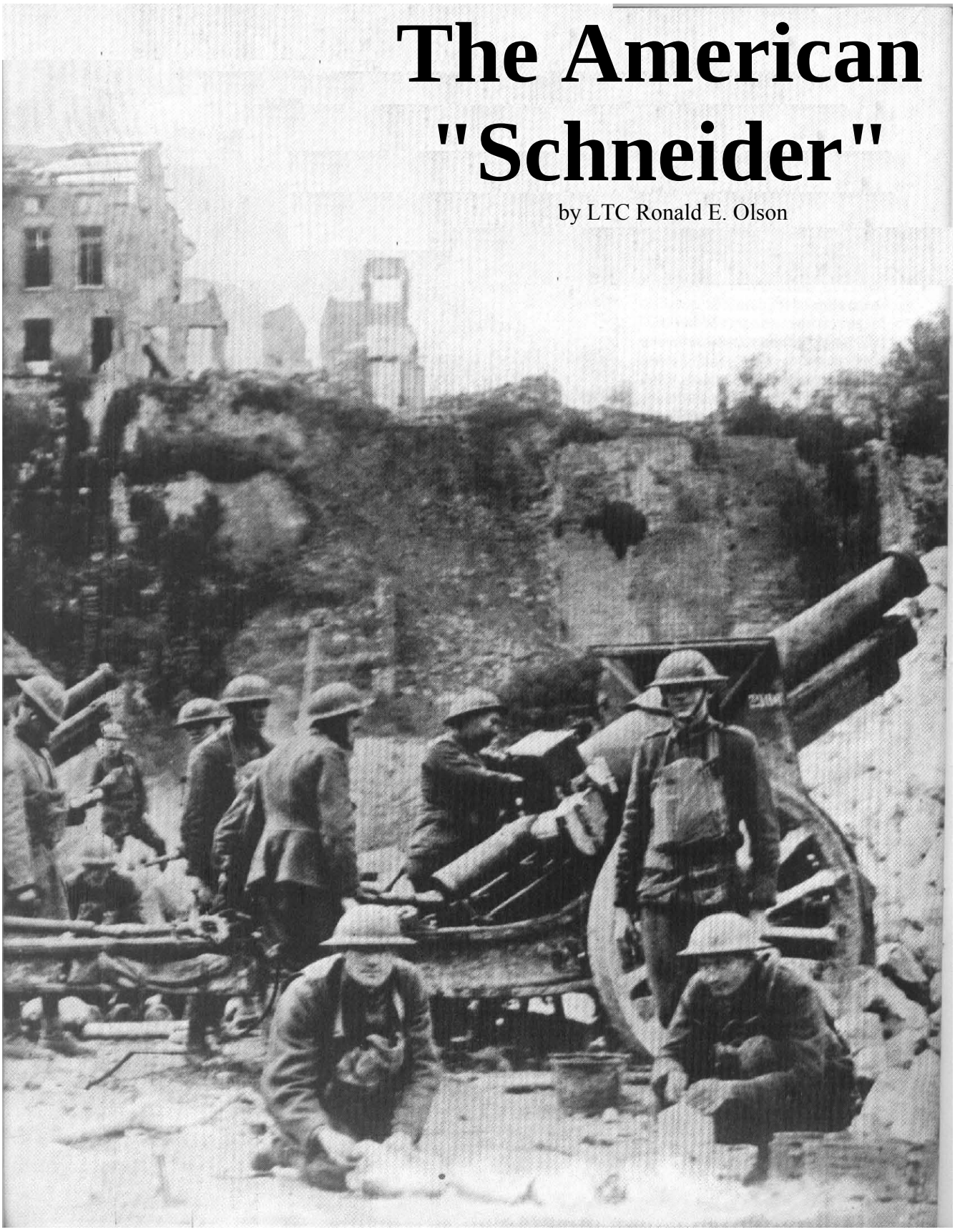
The needs of war had led the M12 battalion from the beaches of Normandy to the plains of Saxony, a mere 60 miles from Berlin. During this entire period, the 991st FA Battalion engaged in combat (except for one week of refitting in January 1945) until withdrawn from action at Dessau on the Elbe River on 25 April 1945. The battalion had worked with six US Army corps and was attached—at least components—to 13 divisions. From 11 July 1944 to 25 April 1945, the Long Toms of the 991st FA Battalion fired a total of 48,937 rounds. In recognition of the self-propelled Long Tom's invaluable contribution to final victory, the cannoneers serving them received a Distinguished Service Cross (posthumously), 2 Silver Stars, 85 Bronze Stars, 7 Air Medals, and 14 Bronze Oak Leaf Clusters to the Air Medal.

Even though the aging 155-mm gun has been eased out of active service in the US Army, any weapon that has served for over a half a century, racking up countless laurels along the way, deserves a place in the memory of American artillerymen. If there is justice amidst the thunderous roar of those heavenly cannons, a spark of remembrance will forever linger for those fabulous Long Toms, so rich in memories.

Mr. Truman R. Strobridge is Historian of the US European Command.

The American "Schneider"

by LTC Ronald E. Olson



As the smoke drifted away from "Calamity Jane" across the Heights of the Meuse, an uneasy calm settled upon the country. The war was over. Said to have fired the last round of World War I in the Bois de la Haie near the Laneuville-Beauclair road was "Calamity Jane," a 155-mm "Schneider" howitzer belonging to Battery E, 11th Field Artillery (attached to the 89th US Division). The date was 11 November 1918 and the official time was 10:59.59 A.M. However, someone's watch was incorrect because according to the Signal Corps photographer who photographed the last firing, the time was 11:05 A.M.

Before World War I, the celebrated 155-mm howitzer had only been built in the factory of its original designer, the great firm of Schneider et Cie. in France. This powerful weapon was a fine example of the French gun builders' art in a country where gun-making had reached a perfection unknown anywhere else in the world. It is a testimonial to the adaptability and skill of American industry that we were able to successfully duplicate the famous 155-mm howitzer in this country.

The history of the 155-mm howitzer dates back to the nineteenth century. In its development, the French designers had so strengthened its structure, increased its range, and improved its general service ability, that in 1914 it was ready to take its place as one of the two most-used and best-known weapons of the allies (the other being the French 75-mm field gun).

Weighing 7,600 pounds (howitzer and carriage), the 155-mm was extremely mobile for a weapon of its size. It could deliver a high-explosive shell or shrapnel projectile more than seven miles and was capable of firing several times a minute due to a hydropneumatic recoil system. With the tube pointing upward at an angle of 45 degrees, the recoil mechanism would restore the gun to battery in less than 13 seconds.

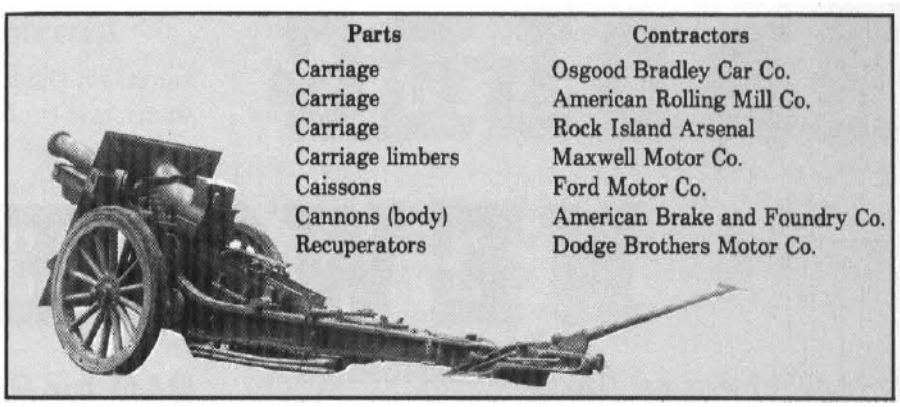


Figure 1. Contractors for 155-mm howitzer parts.

The carriage of the gun was extremely light, being constructed of pressed steel parts with many ingenious design features to reduce the weight. The shell and propelling charge were separate-loading, producing a muzzle velocity of 1,480 feet for the 95-pound projectile.

The American-built 155-mm howitzers were practically identical to those produced in France, and all of the important parts were interchangeable. The United States, however, used rubber tires on the wheels of the field carriage and gave the weapon a "straight," rather than curved, shield of armor plate. (This latter feature identifies those weapons made in America and those made in France.)

In the spring of 1917, the US bought the plans for the howitzer from Schneider et Cie. and at once began the tedious task of translating specifications into American measurements. This work monopolized the efforts of an expert staff until October of that year.

To speed up production in America, separate parts of the weapon were placed in the hands of different contractors (figure 1). There was, of course, the usual difficulty in finding manufacturers willing to undertake production of such intricate devices and who possessed machine shops that had the equipment and talent for such work. The recuperator systems presented the greatest problem since there were no plants in the US capable of turning out such a highly complicated, precise, delicate device. Finally, after much Governmental search and long negotiation, the Dodge Brothers of Detroit motor car builders agreed to accept the responsibility.

The first 155-mm gun body, built by the American Brake Shoe and Foundry Company, was delivered in February 1918, but the recuperator (being much more difficult to manufacture) was not ready until July of that year. The other parts of the howitzer had been proof-tested by using a recuperator of French manufacture.

During August and September of 1918, regiments first equipped with 155-mm howitzers were made ready at Aberdeen Proving Ground. All arrangements had been made to assemble units and crate their equipment for overseas shipment at the Erie Proving Ground, Port Clinton, Ohio. The big weapons were packed and on the dock ready for shipment when the armistice was signed. None of the American-made 155-mm howitzers reached the American Expeditionary Forces before 11 November 1918, but the French had furnished 747 until that date.

In the years that followed, the enemies of the United States and her allies felt the fury of the American "Schneider."

LTC Ronald E. Olson is the Illinois National Guard State Historian and also historian for the 2d Battalion, 123d Field Artillery, ILARNG.

REDLEG NEWSLETTER

USAR education tips

To obtain an information packet and an enrollment application for the Command and General Staff College (CGSC) correspondence course, individuals should submit their requests to:

USACGSC
ATTN: Registrar, ATZISW-DECA-ET
Fort Leavenworth, KS 66027

After receiving the packet, unit members must forward applications through command channels. (Individual Ready Reserve (IRR) officers forward applications through their Personnel Management Officer (PMO).)

To obtain correspondence course catalogs, the following procedures should be followed:

• IRR officers request DA PAM 351-20 series, for branch you are interested in, from:

USATSC-IPD
ATTN: ATTSC-AI-PO (MAJ McGrann)
Fort Eustis, VA 26304

• Troop Program Unit (TPU) officers request the pamphlets from their unit training officer.

USAR Officers enrolled in correspondence courses can communicate with the Institute for Professional Development (IPD) at Fort Eustis, VA, by calling:

	AUTOVON	Commercial
Field Artillery	927-4575	(804) 878-4575
Air Defense	927-4571	(804) 878-4571
Infantry	927-4776	(804)878-4776
Armor	927-4571	(804) 878-4571

The above telephone numbers are for normal duty hours 0800-1745 (EST). After duty hours, call Code-a-Phone AUTOVON 927-3085 or commercial (804) 878-3085.

MILPERCEN gets new CSM

CSM Ray L. Martin assumed the duties of MILPERCEN Command Sergeant Major on 1 September 1980. He was previously assigned to the 25th Infantry Division in Hawaii where he served as Division Command Sergeant Major from June 1977 to August 1980.

BAQ for Reservists

Reserve members without dependents in grade E4 with more than four years of service who are ordered to annual training are entitled to basic allowance for quarters (BAQ) for the period of authorized travel to and from home to training station. (See the Department of Defense Military Pay and Allowances Entitlements Manual, Table 3-2-3, Rule 28.)

Payment is not authorized if individuals travel to the training site by Government transportation or privately owned vehicle and utilize sleeping accommodations under field conditions (bivouac or contract quarters). Futher, partial BAQ is not payable since the members are in a travel status until they reach the training site.

Reserve members are entitled to partial BAQ from the date of arrival at the training station through the day before departure, provided Government quarters are occupied and full BAQ is not payable. Members otherwise qualified are entitled to full BAQ for the travel time from the training station to home even though travel may start and end on the same day.

Overseas tour cuts

As of 1 October this year, single first-term soldiers now serving overseas on three-year tours will be affected by the Army's adjustment plan and new 18-month tour policy.

To qualify for the adjustment plan as shown below, soldiers must have at least six months remaining on their enlistments before the date eligible for return from overseas (DEROS). Those with less than the required six months may extend their enlistments or reenlist. The extension would then permit them to participate in the new tour length and receive a stateside assignment after completing the overseas tour.

Date reported CONUS	New adjusted DEROS	New tour length
April-June 1979	October 1981	28-30 months
July-September 1979	November 1981	26-28 months
October-December 1979	December 1981	24-26 months
January-March 1980	January 1982	22-24 months
April-June 1980	February 1982	18-20 months

Management functions transferred

Effective 31 August this year, responsibility for certain military personnel management functions was transferred from MILPERCEN to the Soldier Support Center (SSC) at Fort Benjamin Harrison, IN. This transfer is the result of a Department of the Army review of military personnel management functions to provide more effective response to current Army requirements and to insure the proper organizational placement of policy, doctrine, and operational functions.

The DA Deputy Chief of Staff or Personnel (DCSPER) will continue to be responsible for policy functions. Doctrine functions will be grouped together and assigned to Training and Doctrine Command (TRADOC) organizations, to include the SSC. The operation and maintenance of current military personnel management systems will continue to be assigned to MILPERCEN.

Under this transfer plan, no personnel or organizational spaces will be moved in the near future from Alexandria, VA, to SSC Headquarters in Indiana. The Service Support Center will establish a Deputy Commander and Administrative Office in Alexandria, VA, to manage the new SSC offices. In August, 114 personnel positions, 48 military and 66 civilian, were transferred to SSC. In June 1981, 10 additional personnel positions, 7 military and 3 civilian, will be transferred to SSC.

Areas transferred

The major functional areas being transferred to SSC include:

• Development of future personnel and administrative information systems (SIDPERS II).

• Management of the project to eliminate records administration duplication (ERAD) which includes implementation of the Individual Record Brief (IRB) system.

• Provision of an analytical capability to examine near-term force structure and manpower changes for impact on personnel readiness and distribution. Evaluation of new concepts/doctrine, force structure changes (TOE/TDA), and new equipment to determine personnel support requirements and impact on officer and enlisted career fields.

• Development of future officer and enlisted evaluation systems. The current MILPERCEN Evaluation Systems Office will continue to function under MILPERCEN control until completion of Phase 3 (User In-Progress Review) of the new Officer Evaluation System Master Monitorship Plan. Phase 3 is scheduled for completion on 1 June 1981. At that time, the Evaluation Systems Office functions and personnel will be transferred to SSC control. This function includes responsibility for policy clarification, evaluation of requests for exceptions or changes to existing policies, and responding to inquiries, complaints, and suggestions about the evaluation systems. After June 1981, MILPERCEN will continue to answer questions from the field regarding the administrative management of the evaluation systems.

• Management of the Army Attitude and Opinion Survey Program to include proponency for AR 600-64 and DA approval authority for all additional surveys.

• Management of Army personnel selection and classification tests and the Defense Language Proficiency Tests. This function includes proponency for AR 611-5 and DA PAMs 310-8, 611-1, and 611-2.

• Management of the Army Occupational Survey Classification System that includes the development of Military Occupational Specialties (MOS) and Special Skill Identifiers (SSI) specifications, standards of grade authorization, and enlisted MOS progression structures. This function includes proponency for ARs 611-1, 611-101, 611-112, and 611-201.

Office addresses and telephone numbers for the new SSC offices will soon be distributed to Army units worldwide by message and command information publications.

West Point applications

Sons and daughters of career military personnel (active, retired, or deceased; Army, Navy, Marine Corps, or Air Force) are eligible by right of birth to receive a presidential nomination to the United States Military Academy. A nomination, either Congressional or sevice-connected, is necessary for all applicants prior to competing for admission. Soldiers are entitled to apply for a nomination in a category specifically designed to encourage maximum numbers of West Pointers from the enlisted ranks. Personnel interested in more information about the exceptional education opportunity should write to: Director of Admissions, US Military Academy, West Point, NY 10996.

OENCO Course

Commander of US Army Training and Doctrine Command (TRADOC) recently approved the continuation of the Organizational Effectives Noncommissioned Officer Course and is looking for volunteers in the grades of E7, E8, or E9 to attend the course beginning in January 1981 at Fort Ord, CA. Selection criteria is as follows:

• Volunteer grades E7 through E9.
• Proficient in PMOS.
• ANCOES graduate.
• High promotion potential.
• Two years of college desired. (Preferably a behavioral science background.)
• Not overweight.
• Not in a shortage MOS.
• No record of court-martial or Article 15 in the last 10 years.

Extensions for OTRA officers

Army policy allows commanders to initiate applications for extension on active duty beyond the 20-year mandatory release date (MRD) for those other than Regular Army (OTRA) officers whose services are required because of proven cogent military necessity. The definition of cogent military necessity has been expanded to include any category of officers whose retention is necessary to meet bona fide needs of the Army. These categories include, but are not limited to, the following:

- An officer who is involved in a critical Army project and is the only individual in the Army qualified to complete the project.
- An officer who holds a unique skill critical to the Army's needs.
- An officer who is a Professor of Military Science and is at midyear with no replacement immediately available.
- Senior field grade female officers, lieutenant colonel and above.
- An officer in an underaligned specialty who will serve in that specialty at current duty station.

Applications for extension beyond MRD for cogent military necessity must be command initiated and indorsed. Applications will indicate that the officer concurs with the extension action. The retention period need not be limited to one year if a longer period is required to meet the requirements of a specific assignment. Officers are retained under this policy with their consent. In the absence of any other service obligation, such officers may be released any time their consent is withdrawn.

Officers will continue to process for separation until the extension is approved. This will preclude any unnecessary hardship if the retention is not approved. Approval authority for all applications for extension beyond MRD because of cogent military necessity is the Assistant Secretary of the Army (Manpower and Reserve Affairs).

Selective continuation

The Secretary of the Army has recently approved a selective continuation program to assist in alleviating officer shortages at certain grades and specialties. Now, other than Regular Army (OTRA) officers in the grades of captain and major who twice have failed to be selected for temporary promotion may apply for continuation on active duty in their present grades. Officers who have 18 years or more of active Federal service are not eligible for consideration since they are automatically retained until they complete 20 years of service.

Officers who apply for continuation are considered by a board that is convened for this specific purpose. Those who are selected will remain on active duty for a period of three years or until they are eligible for retirement. In those cases where the three-year continuation period does not place an officer in a retirement eligible category, the officer may ask to be considered for an additional continuation period. Failure to apply for further continuation constitutes a voluntary separation, and the officer will not be entitled to readjustment pay.

While in the continued status, an officer will be considered for promotion and, if selected, all provisions of the continuation will be voided unless promotion is declined.

Addenda to Officer Evaluation Reports

Since implementation of the new Officer Evaluation Report (OER) system, many questions have arisen from the field concerning OER addenda policy. Paragraph 5-36, AR 623-105, Officer Evaluation Reporting System, lists those inclosures which are authorized for attachment to DA Form 67-8 OERs. These are the only attachments which are to be accepted for filing in the Official Military Personnel File (OMPF).

The only commanders' statements authorized for attachment to DA Form 67-8 are those which result from a commander's investigation of allegations that wrongdoing had occurred in the preparation of the OER. Even those statements are not automatically included in the OMPF, but rather are disposed of as deemed appropriate on a case-by-case basis.

Army Regulation 623-105 requires that supplementary reviewers be designated in certain circumstances and that these reviewers add inclosures to OERs. The intent of these inclosures is clearly stated in the AR. They are not to be used to add unnecessary remarks in the OER. Reviewer statements which merely amplify, paraphrase, or indorse the comments of other members of the rating chain are in violation of the intent of the regulation and therefore will not be accepted for filing.

USAR ADT tours

Requests to support Annual Training sites, ROTC Summer Camps, and other training activities for up to 179 days of active duty training (ADT) requires the Personnel Management Officer (PMO) to maintain a roster of officers who, because of flexible work schedules, are available to fill those positions. Individual Ready Reserve officers who have such flexibility should notify their PMO as to length and date(s) available. Selection of officers to fill known requirements is based on grade and specialty skill identified for the position. Additionally, the PMO will take into account the frequency of similar type tours officers have performed in past years. The OPMS-USAR objective is to provide a balanced and comprehensive range of training opportunities to all members of the Individual Ready Reserve.

Personal personnel file

USAR Personnel Management Officers (PMOs) continually receive calls requesting copies of documents in the Official Military Personnel File (OMPF). Common items requested are appointment letters, oaths of office, DD Forms 214, and course completion certificates. To satisfy the Troop Program Unit or Individual Ready Reserve officer, the PMO must first request the OMPF and then forward it to the Personnel Services Directorate which has authority to release items from personnel records to the individual.

This all takes time and effort and, as such, there is a better way. Officers should consider starting their own personal file. Items to be maintained in addition to the above are:

- Pay vouchers.
- Leave and earning statements.
- Promotion letters.
- Retirement points records.
- Officer evaluation reports.

This file could prevent a delay in promotion or aid in the selection process for service schools. Additionally, it will provide backup documentation for creditable retirement years.

Extended active duty tours in Europe for ARNG captains

Army National Guard captains can now apply for extended active duty (EAD) tours with US Army, Europe (USAREUR). This program was implemented to provide the Active Army with 200 ARNG captains on a continuing, "first come, first serve" basis. Selected officers will be assigned to brigade, battalion, or company size units.

To be eligible, captains must have been in grade for less than four years and be qualified in one of the following specialties: 11, 12, 13, 14, 15, 21, 25, or 71. In addition, they must have served at least one year in an ARNG unit.

Information on eligibility criteria and application procedures may be obtained from local ARNG headquarters.

Tour lengths for EAD with USAREUR will vary from 20 to 30 months. The application period began 1 October 1980 and will continue until the 200 positions are filled.

The extended duty tour will provide ARNG captains with valuable training in overseas operations, and the Active Army will benefit from the knowledge and expertise of these officers.

"Right" shoulder patch

Soldiers who served in hostile fire areas during the following periods are authorized to wear their former "combat" patch on the right shoulder:

- World War II—7 December 1941 through 2 September 1946.
- Korea—27 June 1950 through 27 July 1954.
- Korea—1 April 1968 through 31 August 1973. Soldiers who were awarded the Purple Heart, Combat Infantryman Badge, Combat Medical Badge, or an overseas service bar during this period in Korea are authorized to wear the "wartime" patch.
- Vietnam—1 July 1958 through 28 March 1973.
- Dominican Republic—Soldiers who served there after 19 April 1965 in the XVIII Airborne Corps, 82d Airborne Division, and the 5th Logistical Command are authorized to wear their unit patch. Soldiers serving there who were not assigned to one of these units may wear the OEA, the Spanish equivalent of the Organization of American States patch.

Christmas "early-out"

If you're scheduled to leave active duty 12 December 1980 through 6 January 1981, you'll be eligible for an "early-out." Eligible soldiers will be separated during 11-17 December or as soon after as possible unless they want to stay until their normal release date.

DA Circular 612-80-1, which lists the release schedule, also provides for a liberal leave policy for the holiday season. Soldiers with approved terminal leave will have their leave date adjusted to meet the new separation schedule as follows:

Current ESA/ETS date	Target separation date
12-26 Dec 80	11 Dec 80
27-28 Dec 80	12 Dec 80
29 Dec 80-1 Jan 81	15 Dec 80
2-4 Jan 81	16 Dec 80
5-6 Jan 81	17 Dec 80

Personnel not eligible for early release are:

- Officers who are needed for unit operations.
- Reserve component soldiers on active duty for training.
- Soldiers scheduled for retirement.
- Officers having DA-approved release or resignation dates or those who are being involuntarily separated.
- Personnel affected by flagging actions under AR 600-31.

Overseas commanders are to make sure members being separated under this program are released in time to meet this schedule.

The Battery Scout

by CPT Ricky E. Hardie

If it is possible to write heresy in this time of rapidly changing doctrine, then this short article may qualify. It challenges the validity of doctrine that has general acceptance by the Field Artillery Branch, which requires the battery commander to *perform* reconnaissance, selection, and occupation of position (RSOP). I believe the evolutionary impact of this doctrine has relegated the commander to the role of *battery scout*.

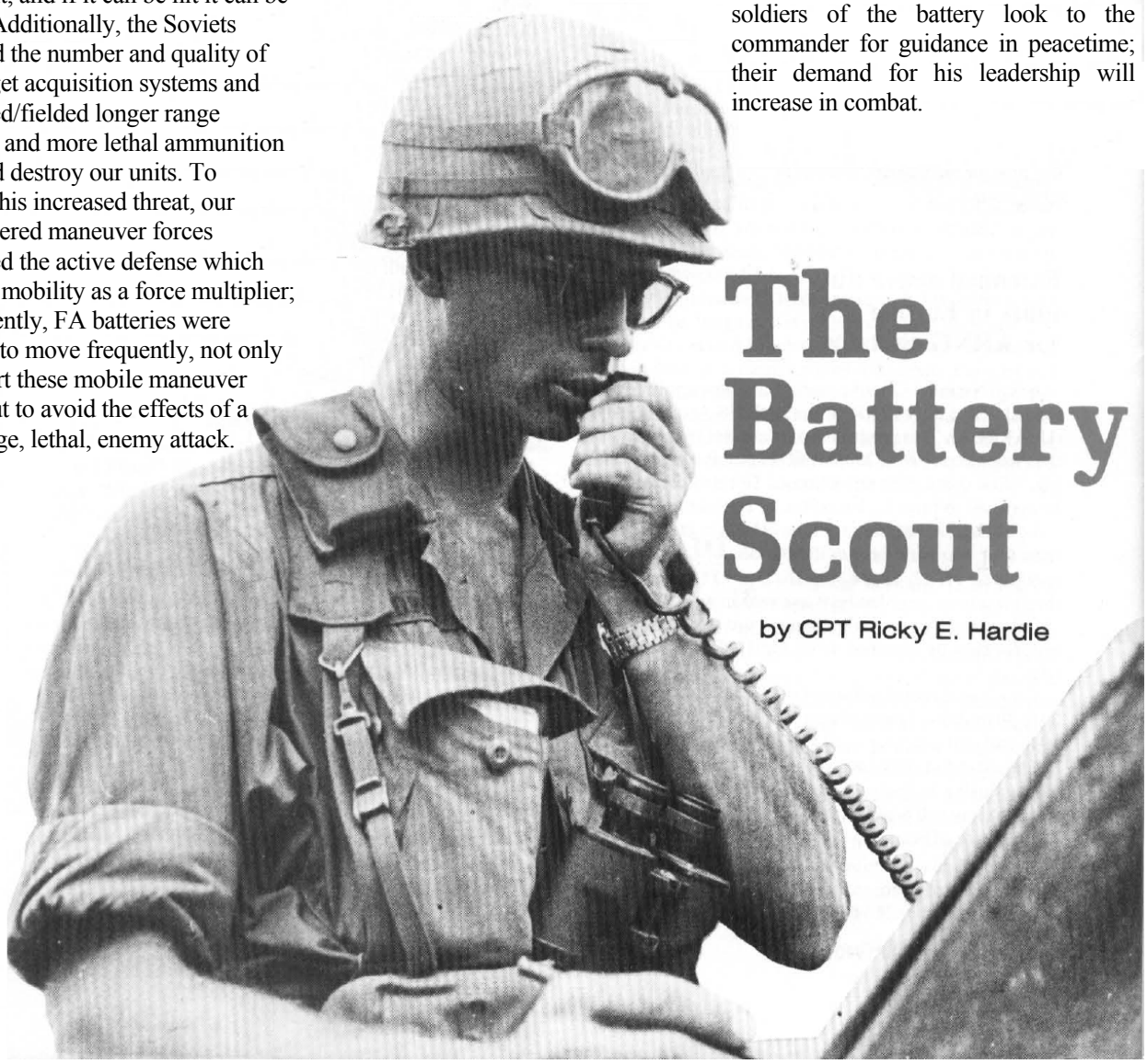
Until about 10 years ago, the artillery battery changed firing positions based on support requirements for maneuver units. Time was available to dig in and harden the position to withstand enemy attack; therefore, the battery commander could perform RSOP for each position and still spend the majority of *his* time with *his* unit.

Then, the Army's attention turned to the mid-intensity battlefield where we learned that "if it can be seen it can be hit, and if it can be hit it can be killed." Additionally, the Soviets increased the number and quality of their target acquisition systems and developed/fielded longer range weapons and more lethal ammunition to hit and destroy our units. To counter this increased threat, our outnumbered maneuver forces developed the active defense which employs mobility as a force multiplier; consequently, FA batteries were required to move frequently, not only to support these mobile maneuver forces but to avoid the effects of a long-range, lethal, enemy attack.

Instead of one or two moves per day, studies showed that from 6 to 17 moves per day might be required. Subsequently, the time spent in reconnaissance, selection, and occupation of firing positions increased accordingly, and with it the battery commander's time away from his unit.

The tasks performed during RSOP *are* important and a necessary component of successful military operations; however, the commander *must* command his unit. His relegation to the role of battery scout is unacceptable for the following reasons:

- Time is an inflexible resource. Time spent away from the battery precludes the fulfillment of other possibly more important functions of command.
- Experience is a scarce asset in today's Army. The most experienced people belong where the most important decisions must be made.
- We must train as we will fight. The soldiers of the battery look to the commander for guidance in peacetime; their demand for his leadership will increase in combat.



• Our command and control philosophy is imbedded in the force structure of the US Army. Lines of communication established in peacetime must serve during combat; the process of establishing new ones is time-consuming.

• Critical decisions are required in combat. Our "How to fight" manuals tell us the commander makes these decisions. Let's assume the battery commander is absent from his unit performing RSOP 40 percent of the time (it could be more). Almost half of his time then is spent accomplishing one of the 16 specific responsibilities of the commander (FM 6-50).

The commander cannot afford to be absent from his unit when critical decisions such as the following must be made:

• The decision to move. The authority to move the unit normally rests with the battalion operations officer, but may be delegated to the battery commander when the action status "move to an alternate position" is appropriate to the tactical situation. If the battery is attacked, or attack is imminent, the battery commander exercises this authority based on available information. If the action status "stay in position" is prescribed, the commander is obliged to remain in position to deliver indirect fires until the intensity of the enemy attack precludes the ability to perform the mission. The battery commander may then move to the alternate position. In either case, the order to move must be based on a knowledge of the status of the supported unit, the level of training of the battery, and the level of damage which is unacceptable to continue indirect fire operations. The best place to gather this information is in the battery area and the only individual to make the decision is the battery commander.

• The decision to resupply the battery. The battery executive officer and fire support officer are capable of determining when ammunition or fuel supplies are low. They usually do *not* have other information upon which supply operations must be decided; e.g., ammunition and fuel requirements for near-term and future operations and the advantage of effecting resupply during lulls in the battle or during periods of darkness and limited visibility. (Three methods for resupplying the battery are taught in the Officers Advanced Course, *not* the Basic Course. By process of elimination of decision makers, the battery commander must make these decisions and locate where he can gather the information to do so.)

• Tactical fire control decisions. Normally, the battery fire direction center (FDC) conducts technical fire control and the battalion FDC conducts tactical fire control. In the offense, we purposely decentralize these control functions to increase responsiveness. The dedicated battery is the extreme example. In the defense, we opt for more centralized control; however, the target rich environment of the European battlefield and wide dispersion of batteries place an extreme burden on our command and control capability. In effect, the battalion FDC will be flooded with requests for fire and will probably control only the most critical missions. Therefore the decisions such as which target and how much and what type ammunition will be made at battery level with knowledge of the current status of the maneuver unit, priorities of fire established by the maneuver commander and availability of reinforcing fires. These decisions require the experience of the commander.

• Other decisions and actions involving unit morale require the presence of the battery commander in the battery area. For example, an occasional hot meal, mail, and the hasty evacuation of casualties.

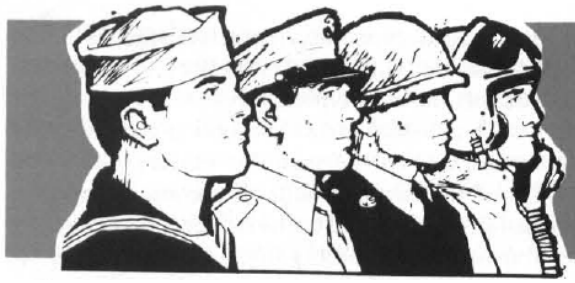
It is clear that the battery commander must remain with the battery. Who then, will perform the RSOP? The likely candidates are the battery executive officer, battery fire direction officer, chief of firing battery, or the battery gunnery sergeant. All of these soldiers have the requisite experience to perform the following required RSOP tasks:

• Organize the advance party (normally an item of SOP).
• Select a route to the new position.
• Select positions for the battery and the howitzers.
• Scale a direction from a map and use a compass.
• Formulate a "track" plan.
• Train and supervise the other members of the advance party in the performance of their duties.

These tasks are not difficult. An officer who has completed the Field Artillery Officers Basic Course performs them adequately during RSOP after only a minimum of training. Additionally, several field units have deployed to the field and conducted all tactical operations, including firing, totally under the command and control of enlisted leaders. (The German artillery entrusts these duties to a highly trained soldier in the grade of E7.) Finally, in the tactical employment of the 3x8 battlion, the firing platoon leader will conduct RSOP for his platoon.

In summary, the battery commander must be at the point of decision during critical times in combat and, most of the time, this means with his battery. He can and should perform reconnaissance when time permits, particularly when the position selected is critical to the mission (a dedicated battery position). And while we have the battery commander where he is doing the most good, let's put the first sergeant where the critical tasks are as well; he is the most experienced soldier in the battery and should be where he can attend to his solders' needs and lead them in the defense of the position that he has planned. The tasks required for RSOP, relatively easy to accomplish, should be delegated to some other *battery scout*.

CPT Rickey E. Hardie is assigned to Headquarters, Special Troops Battalion, 59th Ordnance Brigade.



With Our Comrades In Arms

notes from other branches and services

Ballistic Liners Improve M113 Survivability Rate

A major advance in improving the survivability of the M113 family of armored personnel carriers in combat environments is emerging as a result of the US Army Materials and Mechanics Research Center's (AMMRC) program to develop ballistic liners for ground vehicles.

The empirical investigation, employing classical R&D armor materials technology, has successfully addressed the Army's goals for increased personnel protection/survivability. This was achieved by maximizing the ability of combat systems to withstand attack from weapons with conventional antitank munitions (chemical and kinetic energy) to nuclear weapons and biological agents.

The M113 and other lightly armored aluminum hulled vehicles are capable of engaging conventional .30 caliber small arms fire. They can also defeat the great majority of fragments from HE shells. However, these vehicles have been shown to be highly vulnerable to higher order battlefield weapons as documented by destroyed/damaged vehicles during the Vietnam War and Israeli conflicts.

Armor penetrations cause much more than the direct effects of a shaped charge jet or kinetic energy projectile. Spall fragments, vaporific (pressure, heat, luminosity), and tertiary (toxic gases) effects also occur. This is especially true for HEAT penetrations of aluminum armor which result in more personnel incapacitation and lethality than penetrations of steel armor.

A comprehensive data package generated by AMMRC with participation of government and industry has confirmed the superior effectiveness of ballistic liner materials in suppressing spall fragments. The materials are also effective with behind-the-armor effects when impacted/penetrated by a typical battlefield multi-threat mix including HEAT rounds, AP projectiles, and fragmenting munitions.

Spall suppression materials ranged from ballistic Kevlar 29/49 to conventional glass reinforced plastic. More than 100 HEAT ballistic tests were conducted, employing 3.2-inch BRL precision charges, 1.52-inch M42 grenades, and 5-inch TOW warheads.

The tests initially screened liner ballistic materials. Developments of optimal liner candidates in contact and spaced configurations and evaluations of bare M113 aluminum armor were also an objective of the tests.

The most dramatic enhancement in personnel protection resulted in laminated Kevlar 29/49 which effectively stopped all of the large number of high-velocity widely dispersed fragments from the aluminum armor.

It was also determined that an optimum combination of liner weight and air space was required to maximize performance. Kevlar, a Dupont trade name, an ultrahigh, modulus-high tensile strength aramid fiber, emerged as the primary armor material to defeat fragment threats.

For the optimal liner system a complete mass, velocity, and spatial distribution characterization of residual spall fragments was performed versus the 3.2-inch HEAT device representative of the Soviet RPG-2/7 rounds (infantry deployed and fired from the Soviet BMP-1 IFV mounted with a 72-mm smooth bore gun) and versus the 1.52-inch HEAT round representative of overhead threats.

In addition, full ballistic evaluations including resistance to penetration in terms of V_{50} limits, residual mass and velocity determinations versus small arms (.30 and .50 caliber projectiles), automatic cannon (23-mm AP and 30-mm GAU-8 heavy density ammunition), and munition fragments have provided additional data to substantiate the effectiveness of Kevlar liners in ballistically augmenting aluminum armor.

Preliminary experimental and computer code analyses have also demonstrated the beneficial neutron attenuation effects of Kevlar liners.

Currently, vulnerability calculations and survivability assessments are being generated via computerized models versus an array of modern battlefield scenarios.

FMC Corporation is under AMMRC contract to construct and install optimal Kevlar liners within M113 ballistic hulls. FMC will conduct sophisticated overpressure, temperature/fire, and toxicity tests to validate the effectiveness of liners in reducing vaporifics. FMC will also have liners in operational M113 vehicles and test them with a proper complement of vehicle personnel. (*Army RD & A magazine*)

Revision of Nike Hercules Soldier's Manuals

The US Army Air Defense School, Fort Bliss, TX, will revise the existing Soldier's Manuals for Nike Hercules MOS 16B, 16C, 24P, 24Q, and 24U during fiscal year 1981. The new manual will cover only those tasks peculiar to the Nike Hercules system to include tasks dealing with test equipment. Common tasks, such as first aid, individual weapons, map reading, etc., will be in a separate Soldier's Manual of Common Tasks, which will be distributed Army-wide in 1981.

Recognizing the importance of the Soldier's Manuals in training Nike Hercules MOSs, the Air Defense School solicits recommendations on how to improve the existing manuals. Since the target date for distribution to the field is during the March-May 1982 time frame, all comments/recommendations must be submitted not later than January 1981 because of the long development, printing, and distribution cycle. All correspondence should be forwarded to Commandant, USAADS, ATTN: ATSATD-PHD, Fort Bliss, TX 79916.

Lightweight combat vehicles

Beginning in July this year, the US Army Combat Developments Experimentation Command (CDEC) at Fort Ord, CA, has been assisting the US Marines in a Department of Defense test called Advanced Antiarmor Vehicle Evaluation (ARMVAL).

Using realistic tactical scenarios, ARMVAL consists of a number of two-sided, force-on-force experiments, designed to evaluate the contribution of lightweight combat vehicles (LCVs) to the effectiveness of forces engaging in combat missions.

To make this assessment, friendly combined arms forces conduct combat operations, first using current antiarmor systems to obtain baseline data and then substituting the LCVs.

The "enemy" forces use conventional tanks and simulated Warsaw Pact weapons systems to counter the punch of the friendlies and their LCVs. In addition to LCVs, the Marines use their own LVTP-7 amphibious personnel carriers. Both forces are composed of both Army and Marine Corps personnel.

Major issues of the test include an analysis to determine what contributions the LCV can add to force effectiveness on the battlefield and whether LCVs—which trade off heavy armor protection for high agility and mobility—will be survivable as members of combined arms forces on the battlefield?

The US Army Tank Automotive Research and Development Command (TARADCOM) has modified 10 M551 Sheridans to provide greater speed, mobility, and agility. The LCV is a light armored vehicle with an improved suspension system, high horsepower-to-ton ratio and advanced fire control. The LCV weighs only 13 tons, about half the weight of an M551 Sheridan and can reach speeds up to 60 miles per hour.

For the Advanced Antiarmor Vehicle Evaluation, the LCV does not have a main gun. Instead, each player fires a low-power, eye-safe laser, with computer simulations representing a high velocity 75-mm cannon.

The collected data and experience gained through planning, instrumentation, conduct, and analysis of this evaluation may provide the basis for a future Joint Operational Test and Evaluation Phase for an LCV. ARMVAL will contribute significantly to the LCV validation process and provide data to support future decisions concerning possible lightweight development programs.

The first production model of a laser rangefinder-equipped telescopic sight for the airborne TOW missile system undergoes tests at Hughes Aircraft Company. The sight enables gunners of the US Army Cobra attack helicopters to accurately fire TOW antitank missiles, cannon, and rockets. Delivery of the sight, called the Laser Augmented Airborne TOW (LAAT), is part of a modernization program currently underway to upgrade the performance of the Cobra helicopters. Hughes will manufacture 157 LAAT sights under a US Army Missile Command contract. Shown here an engineer from Hughes' Electro-Optical and Data Systems Group, Culver City, CA, looks through an infrared viewfinder to check sight alignment as the laser is fired into a collimator. The mini-laser rangefinder will improve the accuracy of cannon and rocket fire by providing almost instantaneous target range to the Cobra's fire control computer. The laser transmitter, one of the smallest ever developed for production, was designed to fit the available space within the gyro-stabilized telescopic sight.

Improved TOW missile

The US Army is conducting a two-step program to improve the performance of the TOW (tube-launched, optically-tracked, wire-guided) antitank missile against enemy armor.

The first phase of the upgrading program is design of an improved five-inch diameter warhead to increase the missile's armor piercing capability. The second step, called TOW 2, will include use of a heavier six-inch warhead with even greater armor-piercing capability and an improved guidance system.

Hughes' Missile Systems Group, Canoga Park, CA, is the prime system integrator on the improvement efforts. More than 275,000 TOWs have been produced by Hughes for the US Army and Marine Corps and the armed services of 32 foreign countries.

The existing elements in the TOW system will be utilized to the fullest extent. The more potent five-inch warhead can be fitted on all existing TOW missiles and will not require any changes in the launcher or guidance hardware. Additionally, the five-inch warhead improvements will be applicable to all TOW system platforms including helicopters and tracked vehicles.

The TOW 2 modifications feature a microprocessor-based digital missile guidance set which will provide greater flexibility in guidance programming and higher precision. To compensate for the added weight of the heavier warhead and other missile modifications, the flight motor will be reloaded with an improved propellant to provide a higher impulse. The TOW 2 modifications can be retrofitted into early versions but will require more sophisticated procedures. However, any earlier TOW missile can be fired from the launcher after the modifications for TOW 2 are accomplished.

The Defense Department has requested $105.2 million in FY 1981 to purchase 18,000 of the new five-inch warhead kits to retrofit to existing TOWs and $76.6 million for 12,000 new missiles with this improved warhead. In addition, $20.6 million is being sought to continue development work on the TOW 2 changes.

Development and testing on both phases of the improvement program are now underway. TOW missiles with the improved five-inch warhead are expected to be ready for deployment in the near future, but the TOW 2 will not be available until later in the decade.

TANK TRACKER— A TOW antitank missile is launched from a British Army Lynx helicopter during recent firing trials. Under a Ministry of Defense contract, British Aerospace Dynamics will produce the airborne TOW system under license from Hughes Aircraft Company. TOW, the tube-launched, optically-tracked, wire-guided missile system developed by Hughes for the US Army, has been deployed with the air and ground forces of 30 other nations.

Additive guide

A document, entitled "Guide For Policy and Methodology of Aftermarket Fuel Additives," has been developed by the Fuels and Lubricants Division of the Energy and Resources Laboratory, US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA. The guide outlines the purpose, background, and procedures required for testing both gasoline and diesel fuel aftermarket additives. It also lists sources and reference information for interested manufacturers and suppliers.

The energy shortage has spawned a great deal of interest in reducing petroleum fuel consumption. As a result, there has been a significant increase in the number of companies and distributors marketing proprietary aftermarket additives designed to reduce fuel consumption, improve engine efficiency, and reduce exhaust emissions. Many of these companies have requested that the Department of the Army approve their product, stating that the eventual use of their additive would significantly reduce fuel consumption.

The Army's policy in such cases has been, and will continue to be, to request sufficient technical data to adequately support any claims being advertised and to verify the absence of any potentially adverse side effects resulting from the additive. Apparently, this requirement for technical data was not clear to some companies, so the guide was developed to explain in detail the necessary steps to be followed by a prospective additive supplier.

In developing test requirements, the Fuels and Lubricants Division coordinated its efforts with the Environmental Protection Agency and an Ad Hoc Industry Advisory Group composed of engine manufacturers, oil companies, and additive suppliers.

The guide is being forwarded to Department of the Army for inclusion in the Army's Petroleum Management Regulations. Interested manufacturers and suppliers may obtain copies by contacting the Fuels and Lubricants Division, Energy and Water Resources Laboratory, US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA 22060.

Quick Response Multicolor Printer

The Commander and Director of the US Army Engineer Topographic Laboratories (ETL), Fort Belvoir, VA, recently announced that development of an advanced prototype xerographic color map reproduction system, the Quick Response Multicolor Printer (QRMP) will officially begin. After several months of negotiations, representatives from both the Xerox Corporation and the Federal Government agreed on a $6.4 million contract for development of the system.

The QRMP is a significant breakthough in mapping reproduction technology. Personnel at ETL, originators of the QRMP, believe that the xerographic color reproduction technique will make it possible to meet military requirements for quick production of high quality, cost effective, multicolor reproductions of topographic maps, terrain intelligence information, overlays of existing maps, and multicolor overprinting onto conventional maps.

The addition of a laser scanner has improved the "dry copying" process by making it possible the high resolution necessary for map reproduction. New laser technology will provide greater reliability and simplification, making the QRMP easier to repair and maintain.

It is estimated that the QRMP will produce 24- by 30-inch maps at a speed greater than one map per minute with one run through the printer. A single-color press now in use in the field requires about eight hours to print 500 five-color maps. Furthermore, the QRMP will weigh significantly less than current presses, be mobile enough to move from place to place, and require less manpower and a lower skill level to operate and maintain.

It is estimated that the prototype, to be built by Electro-Optical Systems Division of Xerox, Pasadena, CA, will be completed by mid-1983.

Commanders Update

BG Joe S. Owens
III Corps Artillery
COL Raphael J. Hallada
82d Airborne Division
COL Herbert H. Wasson
528th Artillery Support Group
LTC Robert H. Veen
2d Battalion, 1st Field Artillery
LTC Ralph M. Mitchell
1st Battalion, 11th Field Artillery
LTC Harold M. Nelson
2d Battalion, 12th Field Artillery
LTC Kenneth E. Hamburger
1st Battalion, 15th Field Artillery
LTC Michael W. Keaveney
2d Battalion, 34th Field Artillery
LTC Charles K. Flint
3d Battalion, 35th Field Artillery
LTC Walter A. Vaughan
6th Battalion, 37th Field Artillery
LTC James L. Koster
2d Battalion, 41st Field Artillery
LTC Donald R. Shipp
6th Battalion, 80th Field Artillery
LTC Arthelius A. Phaup
1st Battalion, 83d Field Artillery
LTC Joseph B. Spagnoli
2d Battalion, 320th Field Artillery
LTC Joseph R. Simino
2d Battalion, 321st Field Artillery

LEGIONNAIRE: MY FIVE YEARS IN THE FRENCH FOREIGN LEGION, by Simon Murray, Times Books, New York, 1978, 314 pages, $9.95.

At last we have a book about the modern French Foreign Legion written by a real English legionnaire who actually served a five-year hitch, although he never mentions his Legion *nom de guerre.* Simon Murray pulls no punches. He describes the Legion exactly as he saw it—not as treacherous cutthroats and thieves nor spit-and-polish *troupes d'elite*, but as a far more uniquely complex organization lying somewhere between the two.

Readers can follow this modern-day *beau geste* into a world as remote from contemporary American life as living on the dark side of the moon. *Legionnaire* is written in diary form and recorded as the author witnessed events, such as his enlistment in Paris, the wait in Marseilles, the trip to Algeria, basic training, preparachute instruction, jump school, and assignment to the *Regiment Etrangere de Parachutistes*. He also gives a frightful account of the war against the *fellagha* of the *Front de Liberation National*, the countless marches across the Algerian mountains, the relief and excitement of combat, the hardships, death, and solitude of an often senseless existence. Brutal discipline, filthy living conditions, meaningless destruction, blind drunkenness, as well as pride, courage and self-sacrifice, hallmark this true life adventure.

Much has been written about the Foreign Legion but never as evenhandedly and descriptively as in *Legionnaire*. Very little has reached the public concerning the modern Foreign Legion. Unfortunately most of the old Legion books are fiction, or worse yet, written by deserters.

Simon Murray has gathered together his story with scholarship and humor. His many descriptions bring back memories for anyone who has had like experiences and nothing but respect from those that have not. For example:

"Coldness is enemy number one—hunger and heat are tolerable—but cold kills morale. The misery of crawling into a sleeping-bag which is wet and sodden in total blackness on top of a mountain with the rain pissing down and the wind howling and people in great galumphing mud-chocked boots wandering around tripping over each other, with boxes and poles and equipment lying everywhere in total chaos, is misery without parallel. And when on top of that somebody tells you that you are on guard duty from 0300 until 0500, well then you throw."

Legionnaire is well written and vibrantly characterized, and Murray's accounts are often spiced with English dry wit and a haunting sense of helplessness.

As a former legionnaire, I found this book brought back many vivid memories. For any of you who have ever let the thought of becoming a modern day *beau geste* cross the paths of your dreams, reading this book is a must!

William M. Brooks is assigned to Company B, 1st Battalion, 120th Infantry, 30th Training Brigade (Mech), NCARNG.

THE BOMBER IN WORLD WAR II, by Alfred Price, Charles Scribner's Sons, New York, 1979, 150 pages, $10.95.

In his book, *The Bomber in WWII*, Alfred Price explains the evolution of aerial bombardment during the six years of that war. He makes it clear that advances were not due solely to aircraft design, but were a product of new tactics and equipment as well. *The Bomber in WWII* is divided into three sections, the first being devoted to aircraft and aircraft equipment. The second part presents a detailed examination of the six aircraft that the author considers to be among the best, while the third and final section contains an analysis of wartime bomber tactics to include techniques and formations used by aircrews to reach their targets and survive.

The book is highly informative and presented in an easily understood and interesting format. The text is short, sharing its 150 pages with 131 photographs and line drawings. Although the author does not go into perhaps as much detail nor cover as many subjects as might be desired, the reader can still gain a knowledge and appreciation of the great strides made in the art of bombing during World War II.

COL Warren E. Norman is the Senior US Air Force Representative at Fort Sill.

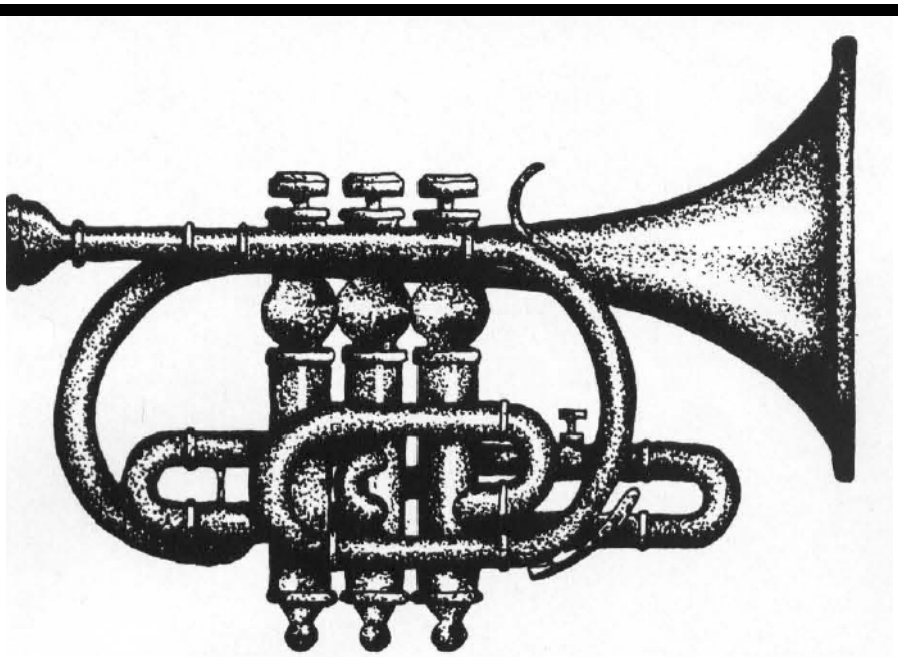
COVER-UP: THE POLITICS OF PEARL HARBOR, 1941-1946, by Bruce R. Bartlet, Arlington House, New Rochelle, NY, 1979, 185 pages, $8.95.

If you have ever wondered how such a totally devastating surprise attack as the one at Pearl Harbor could have happened, this book gives most of the answers. *Cover-Up* uses many recently declassified documents to explain the "how," but the author is careful to avoid the temptation to pin down the "why."

This thoroughly footnoted book gives literally hundreds of details of the critical period before the Japanese attack that crippled the Pacific Fleet. Extensive quotes from the several governmental hearings are cited to describe who gave which messages to whom and when they were delivered. If you don't like President Roosevelt, there is ample evidence for pinning the blame on him. Roosevelt wanted the United States in the war, but could not risk the political clout of the anti-interventionists by committing a unilateral offensive act.

The report of the various military and congressional investigations is a true case study in searching for a scapegoat. While the delays in getting at the full truth can be understood because of the desire to prevent the Japanese from learning that we had broken their message codes, these delays also insured that the truth of who was to blame would never be known.

LTC W. A. Cauthen is the Public Affairs Officer at Fort Jackson, SC.



Bugle calls

An old Army tradition which still plays a part in a soldier's life is the bugle call. In many ways the notes of the bugle still regulate the soldier's day—when to get up, when to eat, when to go to work, and finally when the work day is over.

Bugle calls are divided into four classes: warning calls, formation calls, alarm calls, and service calls.

Warning calls

Warning calls indicate some formation or action is about to take place. Some of the common warning calls still in daily use are:

- First call—A warning to prepare for reveille, retreat, or some other formation.
- Drill call—Warning to fall out for drill.
- Mess call—Announces breakfast, dinner, and supper.
- Fatigue call—Warns those who have fatigue duty to report to the designated place.
- Church call—Notification that church services are about to start.

Formation calls

- Assembly—Signal to assemble or to execute a warning call previously sounded.
- Adjutant's call—Warns that the adjutant is about to form the battalion, regiment, brigade, or division.

Alarm calls

Alarm calls are not commonly used in the Army today. These calls were designed to spread the alarm, a job that can now be done by faster means of communication. Two of the most common of the old alarm calls were "fire call" and "to arms."

Service calls

The largest group of bugle calls is the service call category. Only the most common calls—those in daily use—are listed below:

- Reveille—Signal for morning roll call or other morning formation.
- Retreat—Marks the end of the official day.
- Tattoo—Signals that lights in barracks are to go out in 15 minutes and that all noises and loud talk will cease.
- Call to quarters—Used to summon troops not authorized to be absent from their quarters for the night.
- Taps—Last call at night; used to signal that all unauthorized lights are to be turned off. This call is also used as the last honors at a military funeral.
- Sick call—Signal for the sick to report to the surgeon or his representative.
- Recall—Signal for certain duties to cease. At one time, recall was used to signal the stopping of pursuit of the enemy.
- To the Colors—Sounded as a salute to the National Colors, usually at a retreat formation when no band is present.

A comparison of the bugle calls listed above will enable soldiers to become familiar with them and recognize each individual call.

Although the bugler is now gone from the TOE (there used to be a bugler in each company-size unit), the notes of the bugle still float over Army posts, a pleasing and still useful tradition from bygone days.

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