

Field Artillery Journal



July-August 1980

MLRS The Soldier's System



Field Artillery Journal



the journal of fire support

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On the Move




During the last few years, we have begun to see the maturation of perhaps the most extensive modernization of the Field Artillery since the advent of the breech loader. Copperhead, Firefinder, TACFIRE, MLRS—all are either entering the force or are about to enter. With new technology has come both the requirement and the opportunity to innovate in doctrine and force structure. FIST, the FA Brigade, and the Target Acquisition Battery are only a few of the results.

Absorbing this unprecedented change poses and will continue to pose a major organizational challenge—to Fort Sill as the institutional trainer and formulator of doctrine and to the artillery in the field which refines the training and tests doctrine in the crucible of reality. It is a challenge neither can possibly meet alone; and effective communication between the Field Artillery Center and the field has therefore never been so essential. The *Journal* is a vital element of that critical dialogue, and I therefore urge your continued support of it.

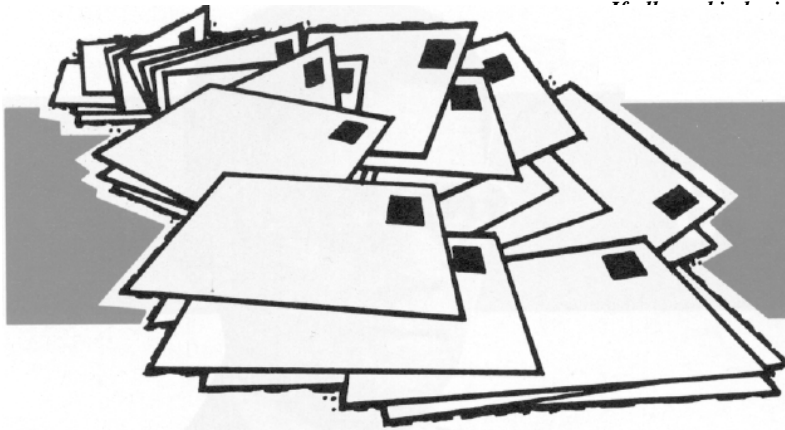
But working together to manage the demands of *today's* battlefield is only half our common problem. We must look to tomorrow's battlefield as well. As direct fire hit and kill probabilities approach unity, the real scope for enhanced combat effectiveness lies increasingly "over the hill"—in the attack of enemy Second Echelon and supporting forces *before* they are able to bring their combat

power to bear. Developing the systems and doctrine for this task must be the Army's main goal over the next decade.

The doctrinal and technological challenges presented by this task are at least as formidable as those with which we are already confronted. In meeting them, we can expect the full cooperation of our sister arms and services. But as the Army's principal fire supporters, we must lead the way.

After nearly three years as your "Master Gunner," I am confident we can and will provide that vital leadership. 

As final preparations for this issue were near completion, official announcement was received from Department of the Army that Major General Merritt had been nominated for reassignment as Commandant, US Army War College, Carlisle Barracks, PA, effective 1 July 1980. Major General Edward A. Dinges, Assistant Commandant, USAFAS, assumed duties as new School Commandant on 27 June 1980.



Incoming

T

During the past few years there have been tremendous advances in Field Artillery target acquisition devices. We now have (or shortly will have) equipment in the field that can provide target location with such accuracy that a first round fire-for-effect may be a very real possibility. Target selection is a function of the man on the scene—for forward observer (FO), but does he know which target to attack first? We need a methodology for target selection that allows us to use our limited cannon assets to maximum effect.

If the highly centralized command and control (C&C) structure of Warsaw Pact armies is still the correct model to examine, then certain targets can be logically assumed to be worth more than others by virtue of the occupants' place in the C&C structure. For example, destroying a tank platoon leader's (PL) or company commander's (CO) vehicle is more important than attacking any other tank in the platoon. Similarly, recon vehicles provide a more valuable target than those of the main force since they provide the commander of the main force with vital combat intelligence.

Using this assumption, attack tables can be easily constructed which provide a *guideline* for FO target selection of common Threat units in expected meeting situations (table 1).

In almost every case, the first target to hit is the senior commander, followed by air defense artillery (ADA) fire elements and radar, and then senior commanders, standard vehicles, and logistical support. It should be obviously clear that the proposed tables represent a personal idea on setting up methodology of target selection for *FO/FIST personnel*. I am not dictating to the supported unit commander what he should attack first; rather, I am trying to give the artillerymen supporting him some ideas of which targets will be most valuable for attack with Copperhead or other terminally guided munitions (TGMs). The rationale for this concept is the fact that cannon batteries will

not be able to support armor/infantry units for long periods of time with vast amounts of ammunition. "Three rounds and run" will probably be the standing operating procedure of NATO artillery during the first stages of any European conflict. Artillery support then should help free other assets, most notably TACAIR and attack helicopters, by suppressing and/or destroying ADA, C&C, and electronic warfare elements of the Threat force.

Major General Merritt has previously mentioned that the greatest value of Field Artillery units may be in their ability to destroy the Threat division's 80 percent "soft" targets, leaving the "hard" targets for direct fire weapons. The average FO however may never see a "soft" target when he in fact has artillery assets available to attack it. With this in mind, the FO should be able to select targets for TGMs that will have the maximum effect on the Threat assault. If, for example, a FIST has four laser designators and can have a four-gun platoon fire a "Platoon One" at an oncoming tank company, proper target selection could result in the loss of all platoon leaders and the commander of that unit. Regardless of what other targets are destroyed or neutralized by artillery fires, the loss of those troop leaders will have immediate and lasting effect on the battle. The supported unit's direct fire weapons could rapidly eliminate the remaining enemy assault vehicles and start on support vehicles as needed. But none of this is possible unless our FOs know which targets to attack and in what sequence.

When Threat units are in an assault formation on line, the center vehicle of each three-vehicle grouping will probably contain the platoon leader based on the "go where I go, shoot what I shoot" philosophy inherent with rigid Warsaw Pact battle doctrines. (The CO is usually in a two-vehicle group to the rear of the center platoon.) If we fire four TGMs at these five vehicles, we have a great chance of wiping out the platoon leaders and

a 50 percent chance of getting the commander. In a column formation, the CO is to the rear of the leader platoon to best take action as a situation develops. Destroying the lead vehicle in any two- or three-vehicle group while in a column formation will again have a high probability of getting commanders.

We also must instruct our FOs to look for vehicles with unique signatures in a formation; e.g., pennants, extra antennas, one or two of a type of vehicle mixed in a formation of armored personnel carriers (APCs) or tanks, etc. Additionally we should increase FO awareness of NATO vehicles and Warsaw Pact vehicles, since our allies would be rather upset if we started shooting them out of ignorance.

The 1st Battalion, 112th Field Artillery, will be instituting classes to increase FO target selection capabilities and vehicle recognition. I expect to report favorably on the results in the near future.

Larry A. Altersitz
CPT, NJARNG
Cherry Hill, NJ

The selection and prioritization of targets for close support of maneuver should not be confused with target selection standards which are the responsibility of the counterfire officer at the div arty tactical operations center.

It is agreed that some terminally guided munitions (TGM) employment methodology should be developed; however, the subject is too complex and fluid to be reduced to a reference table. The target priority, type, and amount of ammunition to be expended will depend on the tactical situation.

As indicated by the author, the concept of placing priorities on certain maneuver targets that a FIST could acquire is a prerogative of the maneuver commander. On a highly mobile battlefield, the FIST chief must use TGMs against the most lucrative targets although the

most immediate threat to the supported maneuver force may not be a TGM target. It appears the author considers command and control and air defense artillery threats as his first priority targets. His reasoning is sound, but the destruction of command and control assets will not have as immediate effect on the battle as would neutralizing, suppressing, or destroying the actual weapons of the threat force.

Meticulous attention must be given to all direct support needs of the maneuver commander. The effective and timely use of TGMs is only one component of this close support.—Ed.

Two "eights" on the M88?

Last week while performing routine maintenance in the track park, an M88 passed where I was standing and its size and power invited comparison with the M110s parked on line.

I thought no more about the M88 until the other day when I was reading an article about eliminating battery positions and going to a battery "area" with vehicles widely dispersed. This was to be accomplished by giving each howitzer a gyro/self locator device to tell position and direction.

This sounded good (eliminating the target we present for counterfire) but seems to me to be too expensive to put on every howitzer and too complicated and unreliable for normal use by gun crews. Then I remembered the M88! If we mounted two 8-inch cannons in a turret on an M88 chassis, it would make its capability enough to make the gyro/self locator cost-effective. It would offer these advantages:

- Double capability of battery without increasing number of personnel assigned.
- Large vehicle could store ammo inside (possibly eliminating the M548).
- Increased armor protection would require direct hit to knock out crew or vehicle.
- A 6400-mil capability.
- CBR protection could be easily included.
- Two vehicles could fit in a C-5A (same as M110) even though weight is more.
- Parts compatible with M60.
- All equipment is "off shelf" except turret.
- Could allow for more efficient organization of personnel assignment; e.g., no battery survey party is needed, no battery commo personnel are needed, the fire direction center (FDC) could be reorganized with a warrant officer heading

the FDC and one in the battery operations center (BOC), with no assistant executive officer. The warrant officer would also insure proper lay of guns (two platoons, two warrants).

- An aiming circle would no longer be required.
- Argument that one breakdown causes loss of two tubes is not valid because two tubes are replacing one anyway.
- Fewer registrations required (if met data is available).
- Variable piece correction built in for good target coverage.

Steven J. Miller, SGT
HHB, 2-5th FA
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Although you are to be commended for advocating an improvement in Field Artillery survivability/effectiveness, the weapons system retrofit you have postulated is not feasible for a number of reasons to include weight and size. The current 8-inch howitzer M110A2 weighs a total of 62,500 pounds and is 10 feet 4 inches wide. Your proposal to mount two 8-inch howitzer tubes, gun mounts, loader rammer etc., on an M88A1 chassis would result in a vehicle weighing in excess of 250,000 pounds and would be over 25 feet wide. This system would not be air transportable, would not be able to traverse the European railroad tracks and tunnels, and would be incapable of traversing most of road networks.—Ed.

Old issues

I can no longer store the magazines listed below. I will send any part or all of them to the first person requesting them in exchange for reimbursement of postage expense.

<u>Publication</u>	<u>Issue</u>
The Field Artillery Journal	March-April 1949 May-June 1950
US Army Combat Forces Journal	August 1950 - July 1954
Army	July 1958 - February 1960 (various issues)
Artillery Trends	June 1958 - February 1972 (various issues)
Infantry School Quarterly	July 1950 - April 1953

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Combating the "E-Syndrome"

As I listened to a recent School guest speaker comment on leadership, it occurred to me that one aspect of this subject seldom addressed is *delegation of authority*. An effective officer must possess the ability to properly delegate *authority* to those working for him. All too often the young officer fails to realize that an enlisted soldier expects and deserves the responsibilities and authority commensurate with his rank.

I believe the US Army's way of addressing enlisted service members undermines effective delegation of *authority*, which in turn poses a serious detriment to effective leadership. I am referring to what might be called the "E-Syndrome," or the habit of addressing enlisted men as "E4" or "E5," etc. It seems almost everyone has adopted this form of address, and it has so permeated the system that even the enlisted men refer to each other and themselves in this manner.

As a former noncommissioned officer, I was able to state, "I am a Sergeant," with a great deal of pride. I certainly would never have referred to myself as an E5 when asked my rank—yet this is common practice today. I believe that to refer to soldiers by pay grade is demeaning and demoralizing. An officer who refers to an enlisted man by pay grade is suggesting that the enlisted man or woman is doing no more than collecting a paycheck in a given amount. We *must* begin to reestablish pride in our soldiers by addressing them by the rank they have earned.

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USAFAS
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Reunion

The 7th Field Artillery Association will hold its 13th annual reunion on 19-20 September 1980 at the Ramada Inn (on the cape), 287 Iyanough Road, Hyannis, MA. Former members associated with any unit of the 7th Field Artillery Regiment, at any time, and their wives and friends are cordially invited to attend. For further information write to Mr. Thomas J. Sonia, President, 3 Linden Road, Gloucester, MA 01930 or Mr. Robert B. Denis, Secretary/Treasurer, 34 Butternut Lane, Methuen, MA 01844.

Ironhorse artillery innovations

The 4th Infantry Division (Mechanized) Redlegs have introduced several material, facility, and procedural innovations which I wish to share with *Journal* readers. These innovations are not ours alone (one came from a National Guard unit); however, I believe we have been particularly successful with their production and integration into all units.

Powder can wrench

Most artillerymen have gone through the frustrations of opening powder canisters under stress, using everything from blocks of cardboard to leather headed mallets. Approximately a year ago one of the 4th Div Arty's supported Nebraska National Guard units (168th Field Artillery) arrived for training with a powder can opener wrench which greatly facilitates this procedure (figure 1). We have produced 66 of them, one for each of our howitzer sections, and the cannoners really like them.

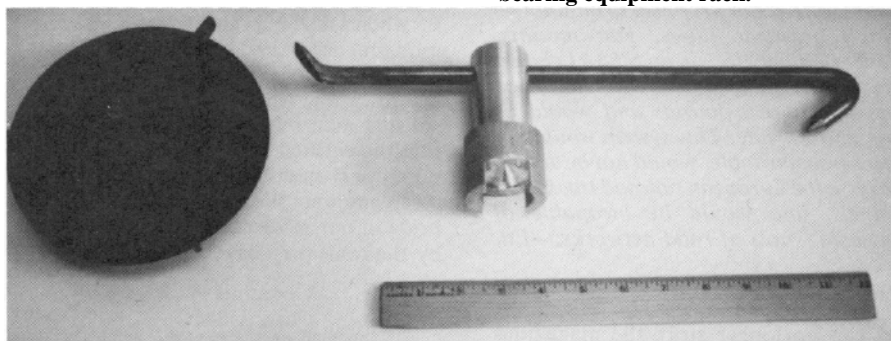


Figure 1. Powder canister wrench with powder canister lid.

T-bar

Orderly, accessible storage of small arms and load bearing equipment is a constant problem in the firing battery. Several units partially solved this problem with a simple, unit constructed T-bar (figure 2). The base of this three-piece device is a salvaged 1/4-ton wheel which precludes a requirement for noisily driving a shaft into rocky or frozen ground. We also produced 66 of these for our firing sections with more planned for FDCs, field messes, and maintenance sections.

TA-50 storage

Readily removable TA-50 balconies consisting of two lengths of 2-inch angle iron and a 4 by 8 foot sheet of plywood form a convenient balcony in each of our

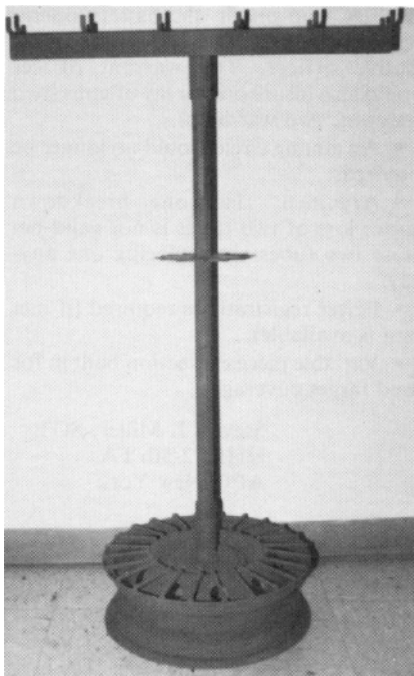


Figure 2. T-bar weapons and load bearing equipment rack.

66 M548 ammunition vehicles, thus keeping the TA-50 secure from the elements while easily available when needed (figure 3).

Fabricated winterization kit

Winterization kits for the M110A1 howitzers cost \$10,359.00 which is prohibitive for this organization. Soldiers of our 8-inch battalion (1st Bn, 27th FA) designed a very acceptable substitute at a savings of \$9,273.77 per copy. The prototype was locally fabricated and tested (figure 4).

Standardized FDCs

Recent standardization of our 12 battery and 4 battalion FDCs began with painting the M577 interiors white (figure 5). This provides greatly improved light reflectivity and prompts improved housekeeping by the crew. All operations are conducted within the armored vehicle to enhance survivability and rapid march order. The extension is used only at night for crew rest when displacement is not anticipated. Modular construction of the consoles provides storage space for manuals, tabular and graphical firings tables, hand-held calculators, forms, and writing materials and also provides writing space. The bench seating arrangement clears the center floor and permits ready viewing of the FADAC and chart by the chief computer and fire direction officer.

The 4th Div Arty has made major improvements in FIST operations dictated by shortages of personnel and equipment. An aerial fire coordination team (AFCT) has also been tested and proved



Figure 3. Balcony in M548 for storage of TA-50.



Figure 4. M110A1 fabricated winterization kit with front curtain rolled up. Side curtains will also roll up, and top provides storage for camouflage net in transit.

to be very effective in assisting the maneuver brigade commander in seeing the battlefield. Descriptions of these innovations will soon appear in another *Journal* issue.

It is my experience that command interest at the O6 level is a prerequisite to seeing these innovations through to fruition. Completion time varied from approximately four months to one year following conceptual meeting date. We have found all of them well worth the cost in time and resources (figure 6) and I would urge interested organizations to write us for more details.

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Field Artillery misrepresented

As an ROTC officer who was "force-branched" Field Artillery and who left the Army after completing the required two years active duty, I read Major General Merrit's editorial on officer retention with great interest. Before coming to the Field Artillery, my exposure to it consisted largely of a presentation at ROTC summer camp which emphasized the "clean hands" of the artillery disdainfully tossing shells toward a far away battle while drinking champagne, and the well-known verse from the ROTC "BS" song:

They made me a second lieutenant
They gave me two bars of gold
They made me a forward observer
And I lived to be three seconds old.

Taken as a whole, this is not an image calculated to encourage enthusiasm. My actual experiences, however, were very different. The training at the School was thoroughly professional and the vast majority of artillerymen with whom I served were dedicated and competent. Serving both as an instructor in the School and as a Combat Developments staff officer, I left the Army with a deep feeling of respect for and loyalty to the Field Artillery. While my own decision against an Army career was motivated by such factors as age, temperament, and the desire to become a lawyer, I would like to offer some comments about officer retention from the bottom of the rank pyramid.

First, the image and professional outlook of the officer have changed greatly over the past 20 or 30 years. To the junior officer, this is quite noticeable as a difference in attitude between senior officers who entered the Army before 1960 (as a round figure) and the field grade officers

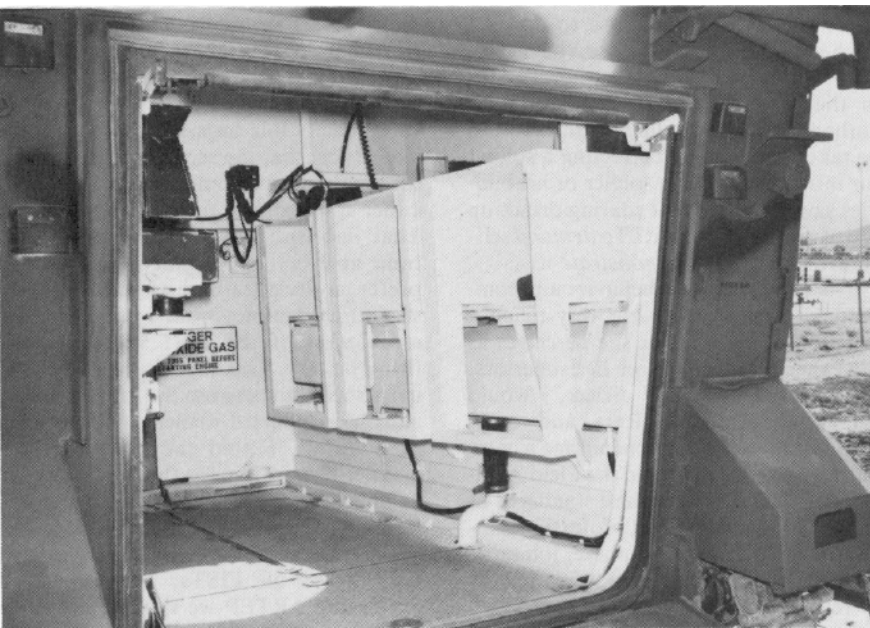


Figure 5. Standardized FDC with three consoles installed.

Project	Materials	Man-hours	Total unit cost
Powder wrench	\$ 6.00	2 at \$12.00 per hour = \$ 24.00	\$ 30.00
T-bar	\$ 15.00	6 at \$12.00 per hour = \$ 72.00	\$ 87.00
TA-50 balcony	\$ 9.25	3 at \$12.00 per hour = \$ 36.00	\$ 45.25
Winterization kit	\$ 470.31	51.3 at \$12.00 per hour = \$615.23	\$ 1085.23
FDC module	\$ 21.00	2 at \$ 9.50 per hour = \$ 19.00	\$ 40.00
Figure 6. Unit cost for materials and labor.			

who have entered since 1960. To a large degree, I feel this shift parallels the shift in civilian society from the owner-entrepreneur to the professional manager. The owner takes a longer view of his interests and those of the enterprise, whereas the professional manager's interest and loyalty are geared to the short run and to actions which enhance his career.

Perhaps the single greatest disincentive to the sort of dedicated, bright and talented young officer, which I believe the Army and the Artillery wants to retain, is watching *careerist* officers (whose concern is with short term results and looking good) rewarded, while officers who are willing to stick their necks out for their troops and their convictions are not. Most officers are not careerists, but even seeing a few of them, or serving under one, has a strong effect.

In addition to the important steps which Major General Merritt urges, I would call on senior officers and commanders to make a concerted effort to look beyond the simple performance measures such as ARTEPs to see how the officer achieves performance in his unit and the atmosphere he or she creates among officers and soldiers. No commander's decisions can always be popular, but I submit there is a significant difference between high standards obtained at the cost of excessive hours, strained family relationships and fear, and those same results obtained from loyalty and commitment to a common goal.

I had the good fortune to work for a colonel who engendered loyalty and whose demands never seemed to be beyond the requirements of the situation. Further, the Director of Combat Developments during my tour did the same. They encouraged initiative and a forthright exchange of views within the framework of good discipline. On the other hand, one friend of mine was asked to falsify a vehicle readiness report to make the battalion commander look good. Another friend worked in a battery where the commander expected 12 hour days as a matter of course, pushing people until they couldn't take it and then, individually, giving them a few days off to recover. The battery commander I knew, who had the best performance record, insisted that his troops work a normal day under normal circumstances, trained hard when appropriate, and had little or no complaints when he asked for an extraordinary effort. Were I rating these two battery commanders, even given identical ARTEP scores, I would

rate the latter much higher.

The other aspect of officer retention I would address is the need to involve the young bachelor officer in the Army community. While the restrictiveness of the old Army is perhaps best gone with brown shoes, junior officers cannot be left to shift for themselves off duty if they are to develop the sense of tradition and group commitment which becomes important when career decisions are made. This cannot be done merely with formal parties and officer's calls. Rather, it requires commitment on the part of commanders, senior officers, and their wives to make the young officer welcome and encourage his social development within the Army as much as his professional development. Officers must know and be able to count on each other. The most successful armies had a close knit officer corps. But, there are few sights more forlorn, or which bode less well for the Army, than a group of lieutenants sitting off to one side while senior officers and their wives are enjoying themselves at a formal party, or a group of junior officers grossly behaving in a public bar because there isn't much else to do as a bachelor. In the first case, bachelors don't feel a part of the community and, in the second, it detracts from their authority. How can a lieutenant expect to be taken seriously in correcting a soldier for misbehavior if the soldier or his buddies saw the lieutenant roaring drunk up town on Saturday night? To demand self-control, one must demonstrate it.

The young officer's behavior and commitment to the Army are very much a function of what he or she perceives as the expectations of his or her superiors. So, as a former junior officer, I would call upon senior officers and commanders to expect and encourage a commitment to the Army and the Field Artillery and demand the highest standards of loyalty and personal and professional integrity. In such an atmosphere, job satisfaction should increase and the chances of retaining the best junior officers will improve.

C. R. Perelli-Minetti
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Los Angeles, CA

FIST—The commander's perception

This is a report to update the Field Artillery Community on the development of the fire support teams (FISTs). Much of the data is based on personal observations and interviews with the commanders of two battalions organic to the 4th Brigade, 4th Division (Mechanized). These commanders were involved with the implementation of

the FIST concept and actual organization of the first fire support teams in Europe.

In December of 1977, the 2d Battalion, 20th Field Artillery was the first battalion to begin organizing FISTs. The task presented to them was to provide FISTs for the maneuver battalions of 4th Brigade, 4th Division (M).

The fire support teams are just over two years old. Are they trained and providing the improved fire support visualized in their planning? According to LTC John M. Grimshaw, Commander, 2d Bn, 20th FA, "Oh yes, I think it's much better." LTC Grimshaw is no stranger to the FIST concept. He came to 2d Bn, 20th FA, last summer from the 101st Airborne Division (Air Assault) at Fort Campbell, KY, where he served as the Division Artillery S3. When he arrived at 2d Bn, 20th FA, the FISTs were consolidated in Headquarters and Headquarters Battery (HHB) as Fort Sill had visualized in their initial planning. LTC Grimshaw had other plans. "We do things a little different here. I've attached my FISTs to the firing batteries. With the shortage of captains, the fire support officer (FSO) is often not much more experienced than the FIST chief; this impacted on my decision. I feel that the recommended structure makes the assumption that you are either at war or out training all the time. That just isn't the case here. Sure, we train at every opportunity; however, I prefer a decentralized structure. This structure promotes what I call *habitual association* of the FIST with a given firing battery. This then fosters a habitual association between the firing battery and the supported maneuver battalion. In addition, I hold the battery commander responsible for the development of the FIST chief and the individual training for the entire FIST. The brigade FSO is then responsible for the collective training of all FISTs. Last summer during the ARTEP we shot well during annual gunnery. This indicates to me that our FISTs are coming along pretty well."

Having a factual and straightforward view from the artillery commander's perception, the question now is "how do the supported maneuver battalions view the FIST concept?" I asked LTC Richard E. Davis, Commander, 3d Bn, 28th Inf (Brigade '76 fame), that same question. "FIST is a good concept. There have been some growing pains. To enable us to derive the maximum benefit from the FIST concept, we require a battalion fire support officer who is knowledgeable

and totally integrated into the methods of operation for the specific battalion he supports. I have commanded this battalion for eight months, and I am on my *fourth* FSO. We need greater stability for our FSOs. During CONSTANT ENFORCER I had been in command for about four months; I was not and neither were my company commanders accustomed to working with FISTs. The FISTs know their jobs, but the thing we have to work on together is coordinated tactical training. My battalion and 2d Bn, 20th FA, are in the process of solving that kind of problem. The FISTs have to identify with their maneuver companies. As LTC Grimshaw said, habitual association is a key factor."

The comments of the battalion commanders seem to indicate that the FISTs are well trained in their individual roles. From the maneuver battalion perception, it would appear that there is a high correlation between the abilities of the battalion FSO and the effectiveness of the FISTs.

The importance of training is obvious and cannot be overemphasized. The FIST concept is viable, but viability can only be assured through tactical training which is coordinated, and consolidated, at maneuver company level.

Field Artillerymen must insure that the maneuver commanders have confidence in their fire support system. Joint tactical training is a must.

Jack D. Cairnes
MAJ, FA
Director, DPCA
APO New York

It is good to hear that the field is actively involved in making FIST work even during this period of personnel shortages. The attachment of fire support teams was addressed as a local commander's option in the original Close Support Study Group. The battalion fire support sections appear to have been left out of the training cycle; therefore it is the responsibility of the battalion FSO to train the FIST chief. If the battalion FSO is not trained to be the trainer, perhaps more emphasis should be placed on selection and retention of personnel for the fire support sections. They, too, are representatives of the FA commander and, as such, must be intimately involved in all aspects of planning, training, and operations of the FISTs as well as being a credible section to their maneuver element.—Ed.

Hope for Lance training

MAJ Robert H. Kimball's article "Lance Tactical ASP for Europe?" in your March-April 1980 issue brings out some good points; however, some of his facts are a little misleading. First, to clarify, the Lance Tactical ASP Plan Major Kimball refers to is a joint product of the Field Artillery Missile Systems Evaluation Group (FAMSEG) and the 9th Missile Group.

Major Kimball and all those in Europe concerned over the sterile environment and lack of training benefit gained from firings at the NATO Missile Firing Facility (NAMFI) on the island of Crete, should know that we at FAMSEG share your concern. Starting in April 1980, FAMSEG will provide the US share of the NATO Lance evaluation team at NAMFI. These people will be assigned to FAMSEG with duty station at NAMFI for one year. As a part of the Lance team, FAMSEG will do its best to improve the NAMFI operations to provide a more realistic training environment. We solicit comments and recommendations.

MAJ Ronald J. Taylor
Field Artillery Missile
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Commanders Update

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COL James W. Doukas
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2d Battalion, 4th Field Artillery

LTC Charles B. Tiggie
2d Battalion, 17th Field Artillery

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2d Battalion, 29th Field Artillery

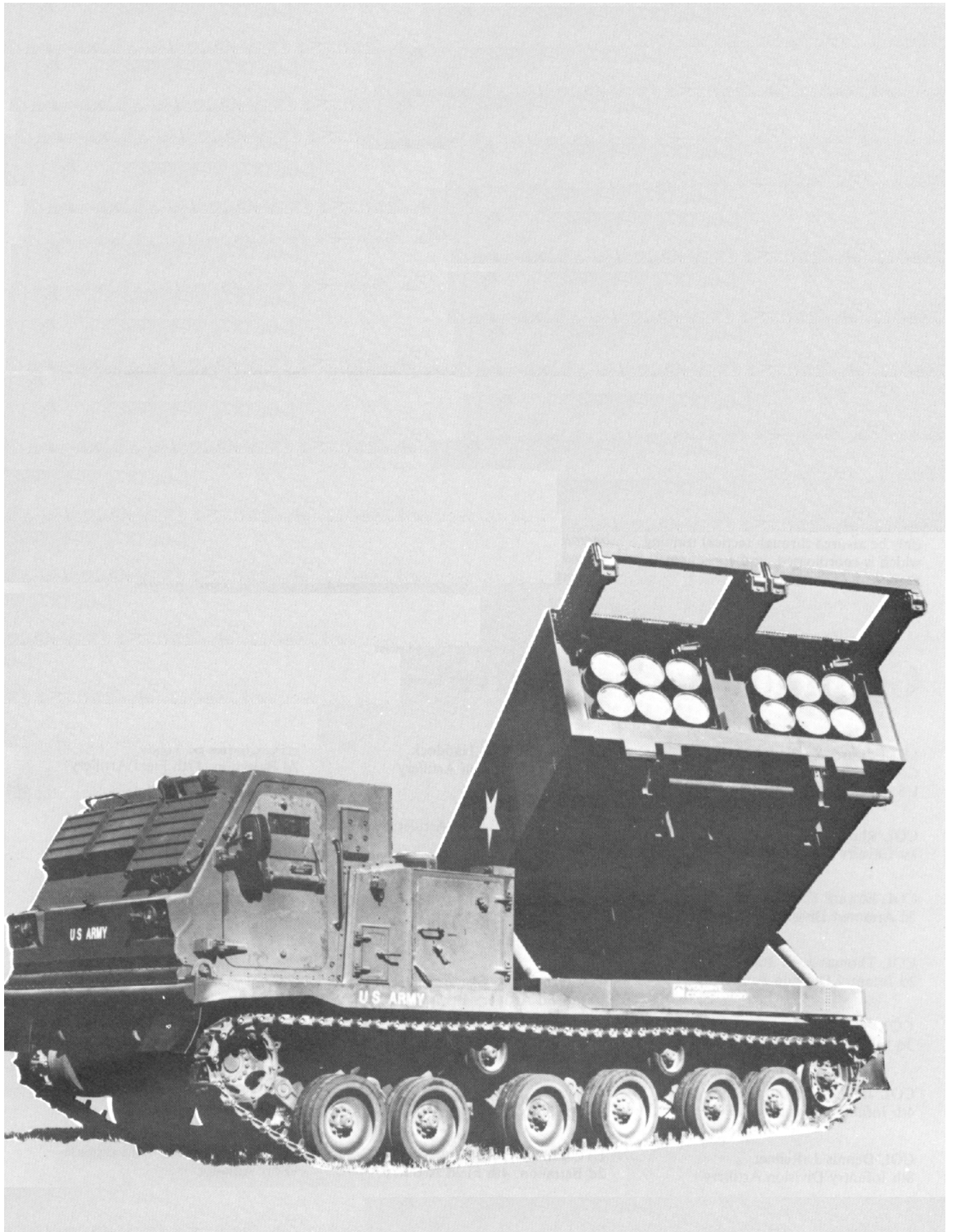
LTC Albert E. Carlson
2d Battalion, 83d Field Artillery

LTC John C. Cartland
1st Battalion, 92d Field Artillery

LTC Randall J. Anderson
1st Battalion, 320th Field Artillery

LTC William K. Malone
1st Cannon Training Battalion

LTC Arthur N. Crowell
Support Battalion, 193d Brigade
Fort Amador



The MLRS is a highly mobile, automated rocket system that permits a 3-man crew with minimum training to accurately shoot a complete 12-rocket load, quickly reload, and fire again. As mentioned earlier, the purpose of the MLRS is to complement cannon artillery during combat—especially against surging forces. It is designed to give NATO forces more firepower against potentially massive enemy forces by accurately firing against many individual targets in succession, day and night and in all types of weather. Each launcher with a full 12-rocket load has potential to neutralize or defeat the following tube targets:

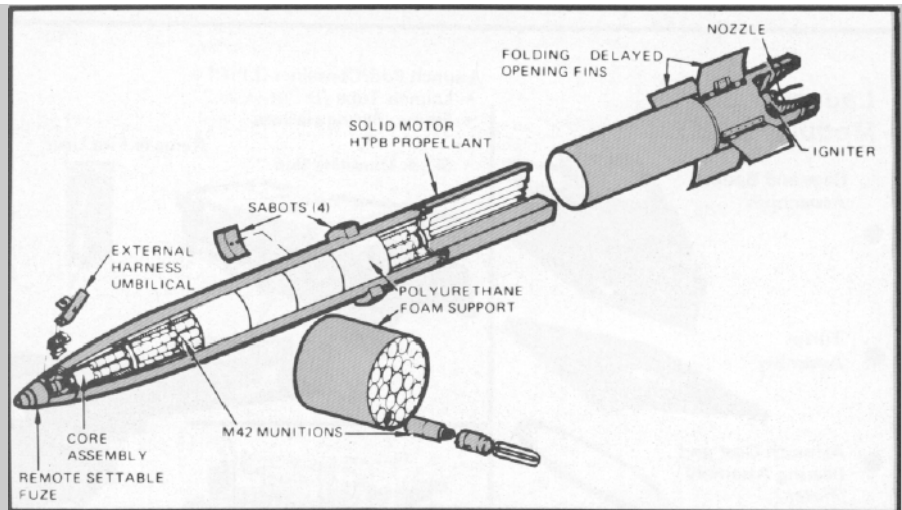
- Tube artillery and rocket counterbatteries.
- Air defense concentrations.
- Vehicles
- Light armor and personnel carriers.
- Supportive troop and supply concentrations.

Rockets

Rockets used in the launcher have the following characteristics:

- Type—artillery, surface-to-surface.
- Guidance—none (free rocket).
- Maximum range—more than 30 kilometers (18 miles).
- Length—4 meters (13 feet).
- Diameter—227 millimeters (9 inches).
- Maximum number of rockets carried by launcher—12.
- Maximum launch rate—rapid ripple, 12 rockets in less than one minute.
- Warhead—dual-purpose anti-materiel and antipersonnel M42, submunition dispensing.
- Motor—solid propellant.

With a range in excess of 30 kilometers, each rocket with warhead can cover an area as large as six football fields with more than 600 M42 submunitions. Each M42 has about the same destructive power as the standard hand fragmentation grenade



Rocket cutaway (Vought photo).

and contains a shaped charge that allows it to penetrate light armor.

The MLRS could also include development of other warhead types such as:

- Scatterable antitank mines.
- Guided antitank submissiles.

Propulsion system

A low-cost solid propellant rocket motor is being developed following a series of more than 180 ground and flight tests to prove the effectiveness of the propulsion system. The design evolution process included extensive cost and performance studies to insure that the propulsion system met all design objectives at the lowest possible unit cost.

Innovative concepts were included which make the design particularly adaptable to economical high-rate production, such as:

- Use of low-cost commercially available Hydroxy Terminated Polybutadiene (HTPB) propellant ingredients.
- Low-cost insulation and igniter designs.
- Use of quick-cure chemical processes to minimize tooling costs and manufacturing cycle times.
- An economical deep drawn 4130 steel motor case.
- A net-molded plastic nozzle.

Another important feature incorporated into the MLRS propulsion system design is the employment of technology which is readily adaptable to high-volume production both in the United States and NATO countries.

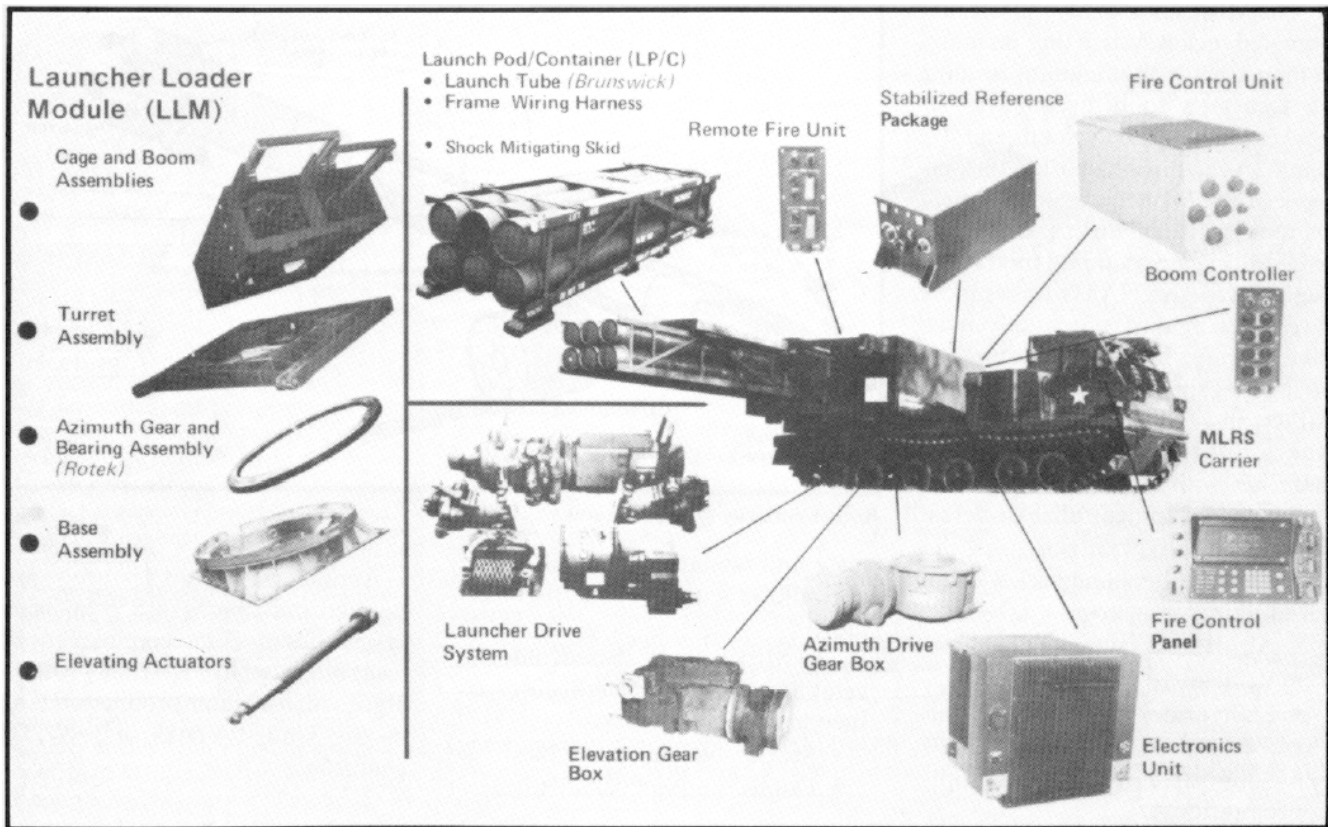
Self-Propelled Loader Launcher

The highly mobile Self-Propelled Loader Launcher (SPLL) is a complete system as it contains its own fire control, stabilized reference package, launcher drive system, and self-loading and self-unloading devices. It uses its own internal systems to aim the rockets and monitor system characteristics during rocket firing.

Fire missions can be performed automatically or manually, but are always under the control of the crew. In either mode, the on-board fire control computer does most of the work, simplifying the interface between the crewman and the fire control system. (It even prompts the crewman on the next action to be taken.)

The launcher carries two sealed launch-pod containers (six rockets in each) that have a 10-year storage life without requiring any special environmental protection or field maintenance.

The chassis and running gear of the tracked mobile launcher are the



Self-Propelled Loader Launcher (Vought photo).

same as those used for the US Army's new Infantry Fighting Vehicle (IFV), which give the MLRS a cross-country capability comparable to the new XM1 tank. The large 25-ton tracked vehicle is 6.9 meters long (almost 23 feet), 2.5 meters high (almost 9 feet), and 2.9 meters wide (almost 10 feet).

The launcher is powered by a Cummins 500-horsepower, four-cycle diesel engine and can travel over land at 64 kilometers (40 miles) per hour and accelerate from 0 to 48 kilometers (30 miles) per hour in 19 seconds. It can traverse a 60-degree slope, a 40-degree side slope, a 91-centimeter (36-inch) vertical wall, and a 229-centimeter (90-inch) trench. The launcher can also ford 102 centimeters (40 inches) of water. Because it is constructed from suspension and powertrain components common to the Army's new M2 Infantry Fighting Vehicle and the M3 Cavalry Fighting Vehicle, logistics

and maintenance in the field are simplified.

The launcher accommodates a crew of three (driver, gunner, and commander) and is designed so that the crew can proceed to a firing site, conduct an entire fire mission, and move without ever leaving the cab.

Reloading can be accomplished in one of three ways: from a self-loading resupply vehicle, from an ammunition transport vehicle, or from the ground.

The cab is equipped with an overpressure ventilation system to prevent rocket exhaust fumes from entering



Reloading the MLRS (Vought photo).

during launches and to provide protection in a CBR environment. Armor protection, heating, ventilation, and noise attenuation are also provided for crew safety and effectiveness.

If necessary, the system can be operated by a single crewmember, including loading and firing.

The entire launcher system is designed to be transportable on standard Army trailers, US and foreign railroads, ocean transports, and C141 or larger aircraft.

Fire control system

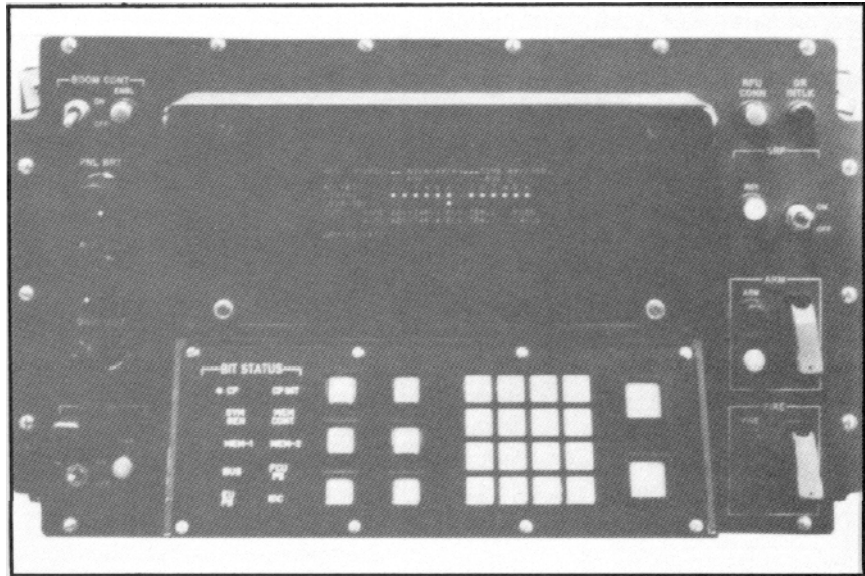
The fire control system in the MLRS, designed for the field artilleryman, is simple to use, reliable, and rugged in design. The fire control system (the heart of the MLRS) provides efficient, accurate execution of fire missions and consists of five basic elements:

- An electronics unit which directs all systems activities.
- The fire control unit which interfaces with the rockets.
- A fire control panel for the operator.
- Two small hand-held units for remote firing and loading and unloading launch pods.

Primary functions of the fire control system include:

- Digital communications with the Battery Computer System (BCS).
- Semiautomatic processing of fire missions.
- Re-aiming between rockets during ripple fire.
- Ballistic computations.
- Load/unload operations.

During a fire mission, data for these functions can be entered automatically or manually. The on-board system has a 256-character alphanumeric fire control display panel that communicates to the operator in plain language rather than code and is capable of communicating in any native language, thus making it more attractive to non-English speaking nations. Additionally, the system



Fire Control System (Vought photo).

provides automatic re-targeting, allowing a rapid, accurate volume of fire on many individual targets. For example, during ripple fire operations, each rocket is quickly and automatically fired by the fire control system which repositions and re-aims remaining rockets after each shot. The SPLL is able to ripple fire 2 to 12 rockets and can fire the entire rocket load in less than one minute.

The fire control system has the capability for expansion and can readily accommodate new warheads or functions. Additionally, the use of other communication systems poses no problems since NATO compatibility is achieved through the use of common interface modules and standard communication techniques.


Joint development

Besides the US, the United Kingdom, Germany, and France participated in the recently completed testing; therefore, requirements set by all four countries are being considered in continuing development of the system. In the short term, the European countries are providing "up front" development money or equipment. In the long term, joint development makes the

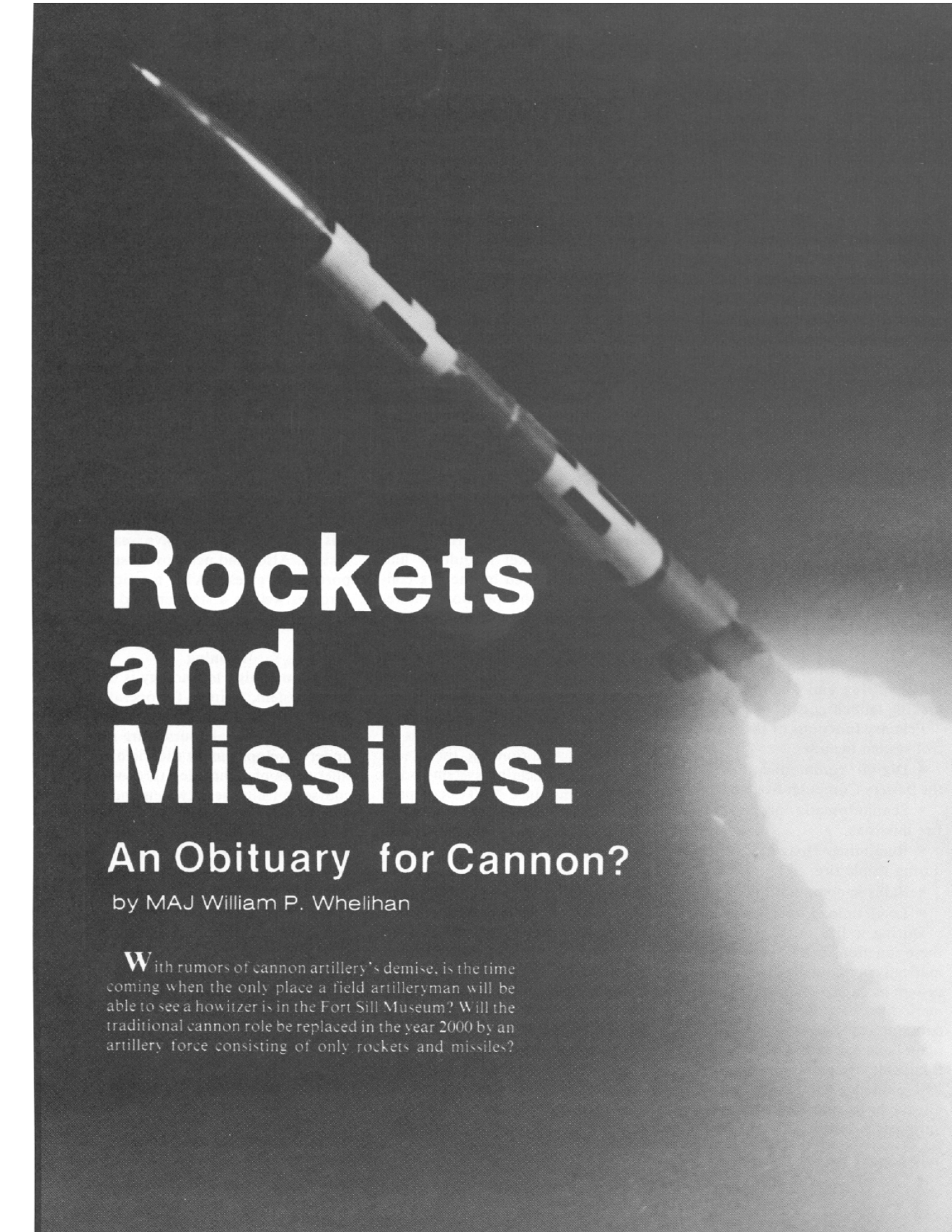
system affordable for all the countries; one nation alone would find it difficult to finance development of this extensive and expensive weapon system. Also, and perhaps most important, it gives NATO a unity of force as well as a standardized and interoperable system.

Training

Although high technology is used in the system, training for operators proved to be relatively easy during tests. Instructional courses are now under development by the Field Artillery School to include a three-week course to train the crewmen and resupply vehicle operators. Current plans also include training the organizational mechanic (less the tracked vehicle mechanic) at Fort Sill.

The MLRS offers manpower savings, massive firepower, and mobility. When fielded, MLRS will be more accurate than any known artillery indirect-fire, free-rocket system. 

Mary L. Corrales is the Managing Editor of the *Field Artillery Journal*.



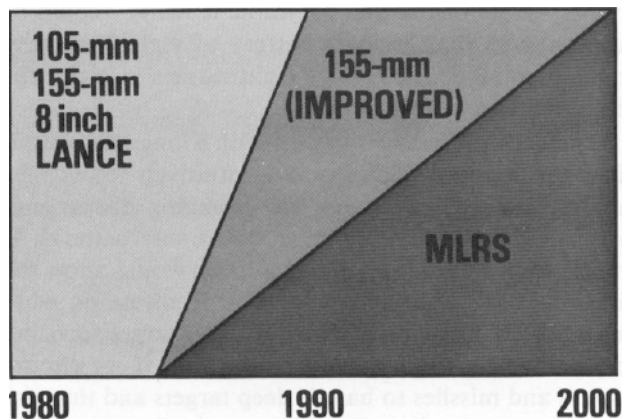
Rockets and Missiles:

An Obituary for Cannon?

by MAJ William P. Whelihan

With rumors of cannon artillery's demise, is the time coming when the only place a field artilleryman will be able to see a howitzer is in the Fort Sill Museum? Will the traditional cannon role be replaced in the year 2000 by an artillery force consisting of only rockets and missiles?

These and other questions were aired during a recent gathering of experienced artillerymen (active and retired) at Fort Sill. It was suggested that the concept of a "rocket/missile only" alternative to the traditional cannon artillery role be seriously studied as a possible field artillery fire support solution to the problems associated with the modern battlefield. A graphical representation, presented by our combat developers, is as follows:



The simple suggestion that the Field Artillery would ever seriously examine the proposal of some day doing away with cannon artillery should stir, and rightfully so, a strong response from traditionalists worldwide. Individuals who are strongly entrenched in the "cannons forever" philosophy might ask why anyone would think of making such a suggestion. Thus, some background that outlines the thrust of future field artillery cannon developments is appropriate.

ESPAWS

Approximately two years ago the office of the TRADOC System Manager for Cannon was established and subsequently made responsible for the task of managing the Army's effort to improve the field artillery heavy brigade direct support capabilities in the 1990s and beyond. This project, known as the Enhanced Self-Propelled Artillery Weapon System (ESPAWS) program, examined the existing and projected deficiencies and shortcomings among current heavy brigade/division direct support field artillery weapons systems. Based on the idea that our howitzer systems could be upgraded to keep pace with our rapidly developing and improving target acquisition and data processing capabilities, the two main objectives of the ESPAWS program are:

- First, to achieve the effect of having a "tube multiplier" on the battlefield (more firepower with the same (or fewer) number of systems and people).
- Second, to be capable of fighting after the "nth" day

of the battle (achieve a high degree of weapon system operational availability and survivability).

This program includes alternatives such as designing an altogether new howitzer system, continued product improvement of existing systems, or possibly the acquisition of a developmental foreign built system. It is a search for affordable revolutionary improvements that will increase responsiveness, operational availability, and survivability to the point where we would assure ourselves of being able to compete successfully on the modern battlefield.

Ranging for interdiction

The range capabilities of our artillery force came under close scrutiny several years ago when we recognized the growing need to defeat (interdict) targets deep in the enemy's zone—that is, before they could enter the central battle. In scenarios where our forces (and artillery tubes) would be greatly outnumbered, interdiction was viewed as a prerequisite for success. An interdiction role for cannon, however, would mean extended range cannon artillery with some anticipated problems such as:

- Reduced lethality and accuracy of long range guided projectiles.
- Blast overpressure
- Tube wear and fatigue limits.
- The impact on reliability of high energy propellants.

A longer range capability would probably also mean some trade-offs with short range capabilities. The foregoing obstacles prompted some to ask "Why cannon?"

The alternatives

Rockets and missiles compete with cannon systems as a means of performing the overall field artillery fire support role. Rockets, for example, would logically be considered as alternatives to those things (i.e., interdiction) that cannon may have difficulty with, could not do, or would be less cost-effective in accomplishing. However, if a trend develops toward a missile and rocket heavy artillery force, what is the best role for cannon on the modern battlefield? Or will there be a role? Can the Multiple Launch Rocket System (MLRS) platform be developed to handle the target servicing and counterbattery roles as well as the interdiction mission? These are questions that the combat developers and analysts at Fort Sill will examine during the next few years. The MLRS system, when fielded, will offer some attractive features such as excellent mobility, three-man crews, large and varied payloads, and a long range capability. The correspondingly labor intensive self-propelled existing cannon systems, with anticipated poor combat survivability and reliability, have inherent limitations that may not be easily or cheaply resolved.

Problems with extended cannon ranges

The problems weapon developers have today in improving cannon systems have centered primarily on trying to achieve extended ranges with cannon launched (fired) projectiles. For example:

- Our newest 155-mm towed howitzer can reach 30 kilometers with the rocket assisted projectile (RAP) and the M203 propellant charge (super zone 8), but has significant blast overpressure problems which are currently being evaluated by the Surgeon General.
- Our 155-mm self-propelled systems cannot reach 30 kilometers simply because the high energy M203 charge has too much of an adverse impact on reliability, availability, and maintainability (RAM), plus the overpressure problem.
- High energy propellants needed for longer range capabilities significantly increase tube wear and reduce fatigue life (1,750 EFC rounds for the M198). Additionally, they generate high temperatures quickly, thus limiting rates of fire and presenting safety problems.

For those that think the evolutionary curve in cannon development has begun to flatten, I propose that perhaps for long range cannon capability they may indeed be correct. (Note that extended range guided projectiles could be developed—but may be less cost-effective at engaging moving masses or columns of tanks and vehicles than rocket-delivered terminally guided submunitions.) However, the most fertile ground for significant cannon improvements appears not to be centered on increased range, but on responsiveness, operational availability, and survivability with a reasonable range capability that will show:

- Requirements for smaller crews.
- Capability of effectively engaging significantly more targets in less time.
- Improved crew and system survivability in a "dirty" battle.
- Improved reliability, maintainability, availability, and survivability of individual systems and components.

Now, back to our basic question: Will an MLRS type system eventually render obsolete today's cannon systems? I don't think so.

Cannon's unique contributions

There will continue to be a strong role for cannon systems well in to the next century—and here are some of the reasons why:

- An exploding cannon delivered projectile—accurate, responsive, and timely—can be the maneuver commander's best friend before, during, and after contact with the enemy. It is useful as a deterrent influence, as well as a target killer.
- Cannon projectiles are cheaper and more abundant than rockets of the size used in MLRS. Therefore, they

would be more readily available and frequently used to support the company and battalion commander.

- Cannon projectiles come in a great variety. Could we develop cost-effective rockets that would give us the illumination, smoke, chemical, etc., capability we now have with cannon projectiles?

- There is an inherent flexibility that can be developed for cannon systems that give the maneuver commander a great amount of depth in fire support. Cannon responsiveness—rate of fire and projectile lethality—could be developed so that a single battery of eight howitzers could simultaneously engage eight targets in eight different directions.


- A rocket or missile system—with a long range capability and large payload capacity—intuitively seems to be more suitable than cannon for engaging deeper and larger targets (both interdiction and counterbattery). If employed in this manner, such systems would allow the direct support cannon systems to concentrate on what they do best—close-in, accurate, precise target servicing for the frontline troops. Note, too, that if we choose rockets and missiles to handle deep targets and thus use cannons to concentrate on the near and intermediate range targets (0 to 20 kilometers in front of the forward line of troops) we may be able to field a direct support cannon that will be free from the following problems:

- Blast overpressure.
- Reliability with high energy propellants.
- Reduced payloads in extended range projectiles.
- Frequent cannon tube replacement due to wear and fatigue.

The direct support cannon "belongs" to the maneuver commander. Sophisticated, expensive rockets and missiles could not be expected to be consistently available for response to his requests in certain situations, but rather would run the risk of being preempted by higher authority for targets outside of his immediate operational area.

Room for all

Corps support, general support, assault breaking—whatever you choose to call them—rocket and missile systems introduce an almost unlimited potential toward improving our overall field artillery fire support capabilities. But, they cannot and, I believe, will not *replace* cannon artillery. What they will do is turn cannons loose so that they can concentrate on, and better accomplish, those missions for which they were designed and have traditionally done so well.

When the dust has settled and the analysis is complete, the answer should reflect the best mix of rocket *and* cannon systems to optimize our all-inclusive field artillery fire support capabilities. 

MAJ William P. Whelihan is assigned to the Cannon Division, TRADOC System Managers, Fort Sill, OK.

Field Artillery Journal

Computer Set, Field Artillery, General

Calculator-assisted technical fire direction for all cannon Field Artillery units is now a reality. Fire direction center (FDC) integration procedures are being developed by the Gunnery Department, USAFAS, to further enhance the utility of the computer set for the field. The intent of the set was to augment the present FADAC/manual fire direction center in data calculation. Commonly referred to as the programmable hand-held calculator (PHHC), officially, the nomenclature for the Texas Instruments (TI-59) calculator is "computer." The TI-59 is the heart of the computer set and provides a small, lightweight, portable computation capability. Routines for cannon and other applications have been programmed in firmware modules which are contained in the various program kits.

Cannon units requisitioning the Computer Set, FA, General, must make sure that the nomenclature, National Stock Number (1220-01-082-1646), and Part Number (11784958) are correct. Otherwise, units may receive another type of scientific calculator available through the General Services Administration.

by CPT Larry D. Gahagan and Mr. Donald J. Giuliano



The computer set does not contain firmware modules. One firmware module is included in a program kit along with keyboard cue cards and overlays for the particular application. Additionally, Reference Note (GD05HC) is included in the program kit as an operator's guide to explain detailed setup, functions, and keystrokes. Cannon unit users must order the specific program kit for their particular weapon system and the special situation program kit for each computer set ordered. Insure that only the authorized number of program kits are ordered because requests for extra kits not allocated in the issue plans will not be filled. (Requisitioning authority was first given by DA Message DAMO-ROA 212000Z Jan 80, subject: Authority to Requisition Programmable Hand-Held Calculator. Major commands have also issued directives to subordinate field units with other specific information on how to order the sets and kits.)

Using the PHHC to compute met corrections

One of the best ways the fire direction center can integrate the PHHC into technical fire direction procedures is the computation of concurrent, subsequent, and met + VE corrections. This is accomplished by using the program capabilities contained in the program kit for Computer Set, FA, Special Situation (NSN 1220-01-082-1628). The proper use of the PHHC will insure timely, more accurate computation of met mathematics.

The met technique program contained on the special situation module is designed to meet the doctrinal and sequence requirements for computation as described in chapter 6, FM 6-40, and in the introductory sections of all weapons tabular firing tables. Chapter 6, sections III and IV, FM 6-40, list the sequence for manual solution of concurrent and subsequent met corrections. Reference Note, GD05HC, Computer Set, Field Artillery, General, Cannon Gunnery Applications, (pages B-36 through B-46), list operator procedures for met computations with the PHHC. These procedures are applicable to all weapons systems since only the ballistic correction factors change from weapon system to weapon system. PHHC users may determine slightly different values for the calculator's computed met position constants and total corrections when compared with manually computed values. These differences exist because of the increased computational accuracy achieved with the calculator over the manual process.

Concurrent met application

The gunnery program design of the PHHC is limited to applying a "one-plot GFT setting" in the form of a range K, deflection correction, and fuze K. Do not use average total corrections from a two- or three-plot GFT setting, since the PHHC is not programmed for this application.

Figure 1 (Concurrent Met Data Correction Sheet) is


the Fort Sill Test Form for solution of concurrent met data with the PHHC. This form was initially developed by a group of US Marine Corps Officers during their Battlefield Research Project for the Field Artillery Officers Advanced Course. It lists in worksheet format the required keystrokes to use in the PHHC solution of a concurrent met message. Individuals at the Field Artillery School recently used the PHHC and the form in figure 1 to successfully complete the solution of a concurrent met message well within the stated ARTEP time standard (under 9 minutes). Field units are requested to use and comment on this form. (The form as shown is suitable for local reproduction.) Any comments and/or improvements should be forwarded to: Commandant, US Army Field Artillery School, ATTN: ATSF-G-RA, Fort Sill, OK 73503.

To use the Concurrent Met Data Correction Sheet, the calculator operator works through each block in sequence and records values in the spaces provided as they are entered or displayed by the PHHC. The worksheet thus becomes the written record of the met computation.

The PHHC is very useful in solving concurrent as well as subsequent met corrections. Time saved, combined with increased computational accuracy, makes the PHHC a preferred tool for manual met computations in the FDC. Figure 2 (Subsequent Met Data Correction Sheet) shows another Fort Sill Test Form suitable for local reproduction and use in subsequent met computations, including 8-direction met, met + VE, and nuclear met techniques. The form is consistent with the procedures outlined in paragraph 6-11, FM 6-40.

The Subsequent Met Data Correction Sheet (figure 2) has sequentially numbered blocks for recording, in the spaces provided, position corrections determined from either the concurrent met or latest subsequent met message. In met + VE applications the POS DF CORR will always be zero. After the module is set up for use, inputs are recorded for each entry in the rectangles provided at each step number and any PHHC displayed values are recorded in the spaces provided. This process is repeated for each block until all computations are complete.

Block VIII in figure 2 contains a "lazy Z" diagram to aid in determining the new GFT setting. The TOT DF CORR, TOT RG CORR, and TOT FZ CORR are recorded in the appropriate spaces and the diagram is completed manually to determine the GFT setting.

The programmable hand-held calculator is an additional and viable computational tool available now to the field artilleryman. It should prove to be very useful for manual met computations. 

CPT Larry D. Gahagan and Mr. Donald J. Giuliano are assigned to the Research and Analysis Division, Gunnery Department, USAFAS.

Field Artillery Journal

CONCURRENT MET DATA CORRECTION SHEET

(For Use With Computer Set, FA, General)

<p>I. SET UP (Use Spec Sits Module)</p> <p>Step 1. PGM 01 E 2. PGM 08 (FOR M549AIRAP) 3. ENTRY RAB</p>	<p>II. CONSTRUCT GFT SETTING</p> <p>ADJ RG U ADJ EL EL TI</p> <p>GFT CHG LOT RG EL TI</p> <p>ADJ DF - CHT DF = (L-) TOT DF CORR - DFT - GFT (R-)</p>	<p>III. INPUT REGISTRATION DATA</p> <p>Step 4. A ADV 5. (CHT RG) ADV 6. (ADJ RG U ADJ EL) ADV 7. (ADJ EL) ADV 8. (TI U ADJ EL) ADV 9. (ADJ TI) ADV 10. (CHT DF) ADV 11. (ADJ DF) ADV</p>	<p>IV. INPUT BATTERY DATA</p> <p>Step 12. B ADV 13. (BATTERY ALTITUDE) ADV 14. (ALTITUDE OF BURST) ADV 15. (SITE) ADV 16. (DIR OF FIRE) ADV 17. (PROJ WT) ADV 18. (STD PROJ WT) ADV 19. (PROP TEMP °F) ADV</p>
<p>V. INPUT MET DATA</p> <p>Step 20. C ADV MET Line No Wind Dir Wind Sp Air Temp Air Den 21. (ALT MDP)(10m) ADV 22. (MDP PRESS)(0.1%) ADV 23. (WIND DIR)(100°)(Enter 4 digits) ADV 24. (WIND SPEED)(KT) ADV 25. (AIR TEMP)(0.1%) ADV 26. (AIR DENSITY)(0.1%) ADV</p>	<p>VI. COMPUTE POSITION DF CORRECTION</p> <p>Step 27. D ADV - Displays Tbl B Entry Arg RG. VI MINUS SIGN INDICATES NEG VI 28. (COMP RG) ADV Displays Tbl C Entry Arg 29. (CW COMP)(R = +/-) ADV 30. (RW COMP)(H = +/-) ADV Displays Tbl F Entry Arg ENTRY RANGE 31. (DRIFT)(0.1µ) ADV 32. (CROSS WIND CORR) ADV Displays Tbl I Entry Arg 33. (AZ ROT CORR) ADV Displays Met Df Corr 34. E ADV = POS DF CORR</p> <p>(If calculator does not compute after input of AZ ROT CORR repeat Steps 27-34)</p>	<p>VII. COMPUTE POSITION VE</p> <p>Step 35. A ADV = Displays Tbl D Entry Arg + - Btry above MDP - Btry below MDP 36. (CORR TO TEMP-DT) ADV 37. (CORR TO DEN-DD) ADV Displays Tbl E Entry Arg PROP TEMP (If Necessary go to Interpolation Routine) 38. (PROP TEMP CORR) ADV * Displays Tbl F Entry Arg (Skip to Step 40) NOTE: If M549AIRAP, Displays Tbl E.1 Entry Arg. Go to Step 39. 39. (RG CORR DUE TO RMT) ADV Displays Tbl F Arg Go to Step 40. 40. (MV DECREASE) ADV 41. (MV INCREASE) ADV 42. (RG WIND HEAD) ADV 43. (RG WIND TAIL) ADV 44. (AIR TEMP DECREASE) ADV 45. (AIR TEMP INCREASE) ADV 46. (AIR DEN DECREASE) ADV 47. (AIR DEN INCREASE) ADV 48. (PROJ WT DECREASE) ADV 49. (PROJ WT INCREASE) ADV Displays Tbl H Entry Arg RG AZ TO TGT (Express RG to 500m) 50. (ROT CORR) ADV 51. (LAT CORR) ADV Displays MET RG CORR 52. B ADV = POS VE</p> <p>(If calculator does not compute after input of LAT CORR REPEAT Steps 35-52)</p>	<p>VIII. COMPUTE POSITION FUZE CORR</p> <p>Step 53. C ADV = Displays Tbl J Entry Arg FUZ SETTING 54. (MV DECREASE CORR) ADV 55. (MV INCREASE CORR) ADV 56. (RW HEAD CORR) ADV 57. (RW TAIL CORR) ADV 58. (AIR TEMP DECREASE) ADV 59. (AIR TEMP INCREASE) ADV 60. (AIR DEN DECREASE) ADV 61. (AIR DEN INCREASE) ADV 62. (PROJ WT DECREASE) ADV 63. (PROJ WT INCREASE) ADV Displays MET FZ CORR 64. D ADV = POS FZ CORR</p> <p>(If calculator does not compute after input of PROJ WT INC repeat Steps 53-64)</p>
<p>INTERPOLATION ROUTINE</p> <p>Step 1. 2nd PGM 10 2. 2nd E 3. (PROP TEMP BASE VALUE #1) A 4. (PROP TEMP BASE VALUE #2) B 5. (PROP TEMP BASE VALUE #3) C 6. (CORR FACTOR U 1) 2nd A 7. (CORR FACTOR U 3) 2nd C 8. 2nd B = TEMP CORR FACTOR 9. 2nd PGM 08 (Return to Step 35)</p>		<p>OLD VE _____ + NEW VE _____ ÷ 2 = AVG VE _____ OLD FZ CORR _____ + NEW FZ CORR _____ ÷ 2 = AVG FZ CORR _____</p>	

Figure 1. Concurrent Data Correction Sheet.

SUBSEQUENT MET DATA CORRECTION SHEET (For Use With Computer Set, FA, General)

BATTERY	TGT No.	DATE/TIME	DEPRESS \pm IF VALUES ARE MINUS (-) RIGHT (R) HEAD (H)
<p>I. POSITION CORRECTIONS (From CONC MET)</p> <p>(POS DF CORR) (POS VE CORR) (POS FZ CORR) (POS FZ CORR) NOTE: For MET plus VE GFT Setting use Ave POS Constants for VE & FZ CORR. Use (0) for POS DF CORR. (See FM 6-40)</p> <p>SET UP (Use Spec Sits Module)</p> <p>Step 1. 2nd PGM 09 2. 2nd E (for 8" HES & 155 NUC MET TO TGT) ENTER NUC (for M549A1 RAP) ENTER RAP</p>			
<p>II. INPUT POSITION CONSTANTS</p> <p>Step 3. A (POS DF CORR) ADV 4. (POS VE CORR) ADV 5. (POS FZ CORR) ADV 6. (POS FZ CORR) ADV</p>			
<p>III. INPUT BATTERY DATA</p> <p>Step 7. B (CHART RANGE)(10M) ADV 8. (CHART DF)(1μf) ADV 9. (BATTERY ALTH)(1M) ADV 10. (ALT OF BURST)(1M) ADV 11. (DIR OF FIRE)(1μf) ADV 12. (PROJ WT) (NUC LBS) ADV 13. (STD PROJ WT) (NUC LB) ADV 14. (PROP TEMP) (F) ADV</p>			
<p>V. INPUT MET DATA</p> <p>Step 16. C NOTE: For MET plus VE GFT Setting Use CONC MET Line No. For MET to TGT Enter TBL B with RG.VI MET Line No Wind Dir Wind Sp Air Temp Air Den 17. (ALT MDP)(10m) ADV 18. (MDP PRESS)(0.1%) ADV 19. (WIND DIR)(100μf) ADV (Enter 4 digits) 20. (WIND SPEED)(KT) ADV 21. (AIR TEMP)(0.1%) ADV 22. (AIR DENSITY)(0.1%) ADV</p>			
<p>VI. COMPUTE TOTAL DF CORR</p> <p>Step 23. D Displays TBL B Entry Arg RG. VI MINUS SIGN INDICATES NEG VI 24. (COMP RG) ADV Displays TBL C Entry Arg CHT DIR OF WIND 25. (CW COMP) ADV (RW COMP) ADV Displays TBL F Entry Arg RANGE 26. (DRIFT)(0.1μf) ADV (CROSS WIND CORR) ADV Displays TBL I Entry Arg RG. AZ (AZ ROT CORR) ADV Displays MET DF CORR 27. E Displays TOT DF CORR (If calculator does not compute after input of ROT CORR repeat Steps 23-30)</p>			
<p>VII. COMPUTE TOTAL RANGE CORR</p> <p>Step 31. 2nd A Displays TBL D Entry Arg Δ h +. Btry above MDP -. Btry below MDP (CORR TO TEMP-DT) ADV (CORR TO DEN-DD) ADV Displays TBL E Entry Arg PROP TEMP NOTE: If Necessary use Interpolation Routine on CONC MET SHEET To return to SUBSEQUENT MET PROGRAM 2nd PGM 09 Return to Step 31 (PROP TEMP CORR) ADV Displays TBL F Entry Arg (SKIP TO STEP 36) NOTE: If M549A1 RAP, Displays TBL E.1 Entry Arg. Go to Step 35. (RG CORR DUE TO RMT) ADV Displays TBL F Arg Go to Step 36. (MV DECREASE) ADV (MV INCREASE) ADV (RG WIND HEAD) ADV (RG WIND TAIL) ADV (AIR TEMP DECREASE) ADV (AIR TEMP INCREASE) ADV (AIR DEN DECREASE) ADV (AIR DEN INCREASE) ADV (PROJ WT DECREASE) ADV (PROJ WT INCREASE) ADV Displays TBL H Entry Arg RG.AZ (ROT CORR) ADV (LAT CORR) ADV Displays MET RG CORR 2nd B Displays TOT RG CORR</p>			
<p>VIII. COMPUTE TOTAL FUZE CORR</p> <p>Step 49. 2nd C Displays Corrected Range (CHT RG + TOT) RG CORR (MHL) (CHT RG) (ADJ EL) (ADJ TI) (TI) (ADJ EL) (ADJ TI) TOT DF CORR - DFT = GFT DF CORR (TI) (ADJ EL) Displays TBL J Entry Arg FZ SETTING (MV DECREASE CORR) ADV (MV INCREASE CORR) ADV (RW HEAD CORR) ADV (RW TAIL CORR) ADV (AIR TEMP DECREASE) ADV (AIR TEMP INCREASE) ADV (AIR DEN DECREASE) ADV (AIR DEN INCREASE) ADV (PROJ WT DECREASE) ADV (PROJ WT INCREASE) ADV Displays MET FZ CORR 2nd D Displays TOT FZ CORR (If calculator does not compute after input of PROJ WT INC repeat Steps 49-60)</p>			
<p>NEW GFT SETTING: GFT _____ CHG _____ LOT _____ RG _____ EL _____ TI _____ GFT DF CORR _____</p>			

Figure 2. Subsequent Met Data Correction Sheet.

REDLEG

NEWSLETTER

Mobilization designation

A significant number of the Department of Defense commands and agencies and other Governmental organizations which must undergo immediate and rapid expansion during the early phases of a mobilization have key positions which must be filled at that time. Preselected, specially qualified USAR officers and enlisted men are trained during peacetime to augment Active Army personnel to effectively accomplish the expanded activities upon mobilization. Reservists assigned to these positions are known as Mobilization Designees and are assigned to the USAR Control Group (MOBDES) in a Ready Reserve status.

This program is based on the premise that the skills required by these reservists cannot be fully satisfied by branch, grade, and MOS qualifications alone. Mobilization Designees, therefore, are selected by name and are given pre-mobilization orientation and qualification training in the positions for which they have been selected. This is accomplished during a 12-day Annual Training tour performed with their proponent agency. These tours are performed in a pay status and are arranged on an individual basis between the reservist and his proponent agency.

No formal application is required for the reservist training in his mobilization designation assignment. In some cases, an individual may request training other than with his proponent agency. All requests for training in lieu of, or in addition to, mandatory tours must be submitted on DA Form 1058 through the proponent agency to Commander, US Army Reserve Components Personnel and Administration Center (RCPAC), 9700 Page Boulevard, St. Louis, MO 63132. RCPAC will publish appropriate orders if the proponent agency concurs in the training and if RCPAC has the necessary funds and spaces available.

Federal employees must be declared available for mobilization by their employing command or agency. Army civilian employees may not be assigned to MOBDES positions within the same office or the same functional area within the Army agency in which they are employed as civilians. They may not hold MOBDES positions within the Department of the Army staff, either

general or special, if currently employed there. Neither may they hold USAR mobilization positions within the same command in which they are employed, or any of its subordinate elements; nor may they be assigned to any position within Department of the Army in the same functional area in which employed. A reservist in this category must notify RCPAC immediately of his Civil Service employment conflict.

For additional retirement points, reservists may also request attachment in a non-pay status to a mobilization designation detachment or an appropriate Reserve unit for training and retirement point credits. Additional points may be earned by participation in the USAR School program and/or enrollment in the US Army Correspondence Course program.

Mobilization Designees are considered for promotion under non-troop unit criteria. The fact that a reservist may have been selected for a position requiring a grade higher than his present grade does not affect his promotion eligibility date.

Retirement rules change

Officers and enlisted soldiers may now apply for retirement up to 13 months before their retirement dates.

Changes to AR 635-100 and AR 635-200 permit soldiers to apply for normal voluntary retirement and retirement in lieu of permanent change of station (PCS) when they have completed 18 years and 11 months of active Federal service.

Those who apply more than six months early must request a retirement date by the end of the month during which they attain 20 years of service.

Individuals requesting retirement to avoid a PCS have 30 days from the time they are notified to apply for retirement. Enlisted soldiers are notified in writing. Officers may receive written or oral notification.

The new policy, effective 1 April this year, offers some servicemembers a greater opportunity to retire at 20 years. Under the old system, soldiers received alerts or orders up to six months before a scheduled retirement.

Special aid for Vietnam vets

If you're a Vietnam Era veteran who served on active duty between 4 August 1964 and 7 May 1975, the Veterans Administration offers a new program called "Operation Outreach."

The primary focus of the new program is psychological readjustment counseling of Vietnam Era veterans. The counseling will be provided in more than 80 "store front" Vet Centers across the nation by more than 300 expert counselors, most of whom are Vietnam Era veterans themselves.

Designed to provide "help without hassles," the new VA service has as its major goal the readjustment and motivation of veterans who are not mentally ill, but who may need counseling for a variety of civilian readjustment problems.

The counselors will attempt to show the Vietnam Era veterans how to deal with stress and cope with the problems of everyday life.

In addition, there will be peer group seminars for those who suffer from nightmares, flashbacks, anxiety, depression, loneliness, fear, and confusion as a result of memories of Vietnam.

If family problems exist, the counselors will work with the spouses and children and try to iron out conflicts.

Each of the Vet Centers will have full information on the training programs that the Veterans Administration and State and local agencies offer, as well as community-based organizations that can help with discharge review, veterans benefits, drug and alcohol treatment, medical care, legal aid, and emergency services.

If you or someone you know needs help along these lines, contact the nearest Veterans Administration office for information on the Vet Center locations.

To file or not to file

Soldiers enrolled in Army correspondence courses are not required to file individual subcourse certificates in their Official Military Personnel File (OMPF). Only the final document showing course completion should be made permanent record.

Subcourse completion certificates for individuals in grades E1 through E5 are filed in the personnel records jacket where they are assigned and, upon completion of the course, are removed. (Staff sergeants and above do not file subcourse materials.)

When a correspondence course is completed, the appropriate Army school is responsible for forwarding a copy of the final certificate for inclusion in the soldiers OMPF. Individuals should check with local MILPOs to insure that proper credit for the course has been posted.

Reduction for civilian crimes

A change to AR 600-200, effective 1 May 1980, requires commanders to initiate reduction action on some soldiers convicted of "civilian" crimes.

This new policy will:

- Require commanders to automatically reduce to grade E1, soldiers who are sentenced to one year or more in jail.

- Require commanders to seek reduction-board action against E5s and above who are sentenced to jail for a period of 30 days to one year.

No board action is necessary to reduce E4s and below who are sentenced by a civilian court to terms of 30 days to one year.

Prior to the change, commanders had the option to decide whether to seek reduction board action against a soldier convicted of a civilian crime regardless of the severity of the sentence.

Participation in nuclear testing

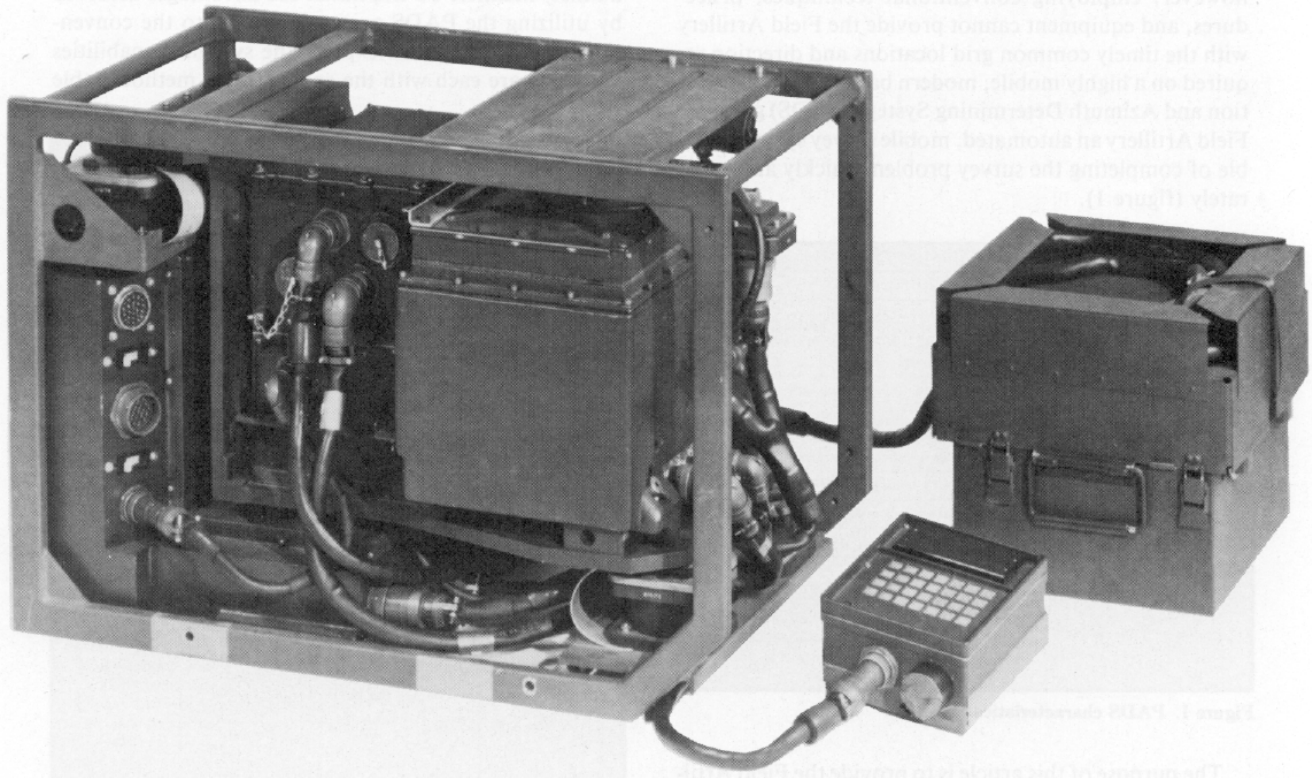
For more than a year the Department of Defense has been attempting to identify former military and civilian Defense personnel who participated in the atmospheric nuclear tests conducted from 1945 to 1962.

If you participated in these tests, which were held largely in Nevada and at Bikini and Eniwetok atolls in the Pacific, contact the Defense Nuclear Agency at toll-free number 800-336-3068 in continental United States; from Virginia, outside the Washington, DC area, call toll-free 800-572-6845; from Alaska (or Virginia in the Washington, DC area) call 202-274-9161 (collect, if long distance); from Hawaii call collect 808-422-9213; or write to Defense Nuclear Agency, Washington, DC 20305.

The Defense Nuclear Agency is compiling a history of the atmospheric nuclear test program, including names of participants and any radiation doses they may have received. One of the purposes of this effort is to enable the National Academy of Sciences and other scientific organizations to determine whether there are health hazards resulting from participation in the tests.

Based upon research to date, it is believed that radiation exposures were low. While medical science has no proof that exposure to low radiation levels is hazardous to health, it is generally assumed by scientists that even low levels of exposure carry some slight risk.

If you are concerned that possible exposure may have adversely affected your health, you are urged either to consult your doctor or, if you are a former servicemember, to contact the nearest Veterans Administration Hospital, where you may obtain a physical examination at Government expense.



by MAJ David R. Rogers and CPT Robert R. Roe

The mission of the Field Artillery is to destroy, neutralize, and suppress the enemy by cannon, rocket, and missile fire and to integrate all fire support means into a combined arms operation. Gunnery, as one of the key elements of the Field Artillery System, allows for the timely conversion of calls for fire into firing data which allows the field artillery to put "steel on the target." The final accuracy of gunnery computations depends on the accurate location of friendly firing elements as well as target location. It is the responsibility of the Field Artillery surveyor to provide accurate location information for the Field Artillery to complete its mission.

The mission of Field Artillery survey as defined in FM 6-20 is to provide a common grid which will permit massing of fires, delivery of surprise observed fires and effective unobserved fires, and transmission of target data from one point to another. The present-day survey party,

PADS

Positioning and Azimuth Determining System

however, employing conventional techniques, procedures, and equipment cannot provide the Field Artillery with the timely common grid locations and direction required on a highly mobile, modern battlefield. The Position and Azimuth Determining System (PADS) gives the Field Artillery an automated, mobile survey system capable of completing the survey problem quickly and accurately (figure 1).

Dimensions	25.8 by 30.5 by 19.5 inches
Weight	316.5 pounds
Operation temperature limits	-50° to +125°F
Operation altitude limits.....	from -150 to +4500 meters above mean sea level
Warm-up, mission calibration..... and alignment time	30 minutes; increasing to 45 minutes below (-5°F)
Survey accuracy (original design specifications):	
Horizontal position error.....	20 meters circular error probable (CEP)
Vertical position error.....	10 meters probable error (PE)
Azimuth error	1 mil root mean square (RMS)
Mission duration.....	Up to 6 hours
Latitude limits	+75° to -75°
Survey area	Within a circle with a radius of 55 kilometers from initialization point. (Use of a second initialization point will increase survey area an additional 55-kilometer radius.)

Figure 1. PADS characteristics.

The purpose of this article is to provide the Field Artillery Community with current information on PADS, to include the characteristics, capabilities, informal evaluation results, Basis of Issue Plan (BOIP), training program, New Equipment Training Team (NETT), Initial Operational Capability (IOC), and the Field Artillery survey standardization study relative to this system.

The PADS is a self-contained, inertial surveying system capable of rapidly determining accurate position, elevation, and azimuth when utilized in either ground or airborne survey operations. The system may be installed in an M151 utility vehicle for ground operations, mounted in an OH-58 light observation helicopter, or transported in a CH-47 cargo helicopter (by driving the M151 into the cargo compartment) for airborne survey operations. PADS is used to conduct Field Artillery surveys critical to all Field Artillery systems and will provide a common grid system, linking battery centers, target acquisition sites, and observation posts. Finally, it will determine azimuths of orienting lines for pointing weapon systems in relation to grid or true north. This surveying system is capable of expediting the completion of critical survey missions in order to provide the Field Artillery with first round observed or unobserved accuracy.

As previously stated, the current conventional survey party and computational methods cannot deliver the required common grid and directional control to the user in a timely manner. To emphasize the advantages

achieved by utilizing the PADS as an alternative to the conventional method, we will explore the systems capabilities and compare each with the conventional method (table 1).

<u>Capability</u>	<u>PADS</u>	<u>Conventional</u>
All weather	Yes (Unless weather severely restricts vehicular mobility.)	No (Limited by cold weather (restrictions by protective clothing); poor visibility conditions; hot weather (heat wave distortion).)
Night operations	Yes (Operations are limited only to the extent in which darkness conditions restrict or hinder vehicular mobility.)	Limited (Operating under night-time conditions causes much slower survey mission completion times due to visibility restrictions, violates light discipline, more personnel are required.)
Reliability	Yes (Consistently high reliable results well under original design capabilities. Minimum operator input results in increased accuracy.)	Yes (Limited if computations do not produce results within closure accuracies of 1:3,000 or 1:1,000. More personnel involved in measurement and computational procedures results in greater chance for error.)
Data Availability	Immediate	Untimely (The manual completion of the survey problem time plus computation time delays the quick accurate data production required.)
Maintenance	Very limited crew/operator maintenance is required. The system is very rugged and durable. Equipment mean time between failures for the PADS was 139.58 hours during Operational Test (OT) IIa.	Extensive, daily maintenance and quarterly calibration required on equipment. Instruments and other equipment subject to possible breakage or unserviceability at an increased rate.
Speed	Fast (Rates in vehicular mode; 20 km/hour travel time; 10 min/point surveyed.)	Slow (Rates for taping and using distance measuring device: 1 km/hour—taping and 2 km/hour—DM-60.)

PADS operation

To begin an operation, the PADS is installed in an M151 to utilize the vehicle's power source. (Prior to starting the survey mission, the system must complete an initialization process which takes approximately 30 minutes.

- The operator then places required data into PADS through the control and display unit (CDU). Input includes the present spheroid, zone, easting, northing, and elevation of the initialization position.

- The vehicle and system are left alone to minimize external movements that could affect the overall system's accuracy. Once this process is completed, the PADS is driven to a known survey control point to begin the survey operation. The maximum allowable movement time is 10 minutes, no matter what operation is being completed.

- At the end of 10 minutes, the operator must stop the vehicle to allow the PADS to correct for developing system errors and to maintain its surveying accuracy throughout the entire mission.

- The PADS plumb bob arm is maneuvered over the survey control point, and a plumb bob is hung off the arm to increase the location accuracy data of the system.

- The operator next performs an update procedure which requires that the vehicle be stopped with the plumb bob directly over the known survey control point (SCP). Accurate data on the SCP is entered into the computer and when the system has accepted the information, the PADS is ready to be moved to the next position requiring accurate survey data.

- The operator will direct the driver to the proposed location, perhaps a field artillery battery. The operator will mark the battery center with a hub and witness stake

while recording the actual coordinates of that location and the location of the orienting station. The operator will direct the driver to the orienting station to conduct another mark and then to the end of the orienting line where another mark will be completed and the azimuth from the orienting station to the end of the orienting line will be computed by PADS. This data will be attached to the witness stake at the orienting station for future use by the battery.



The PADS operator updates the system by precisely locating it over a known survey control point.



The Control and Display Unit (CDU).



PADS operator prepares to install a stake for the battery center.

- The operator will then direct the driver to move on to the next location requiring survey.
- After locating all elements in the survey plan, the operator directs the driver to the closing point. The original or second known survey control point is marked and updated. The actual coordinates of the survey control point are again entered into the computer and the accuracy of the survey mission is checked.
- All initial data is adjusted by the system upon closure, and computed data is stored and available for recall or future reference by the PADS operator.

PADS evaluations

Formal evaluations, Operational Tests II and IIA, conducted by the Field Artillery Board and informal evaluations conducted by the Counterfire Department (CFD), USAFAS, revealed that the system could continually achieve much greater accuracy than required by the original design specifications. The Counterfire Department's informal evaluation was conducted from September 1979 to April 1980. The purpose of the evaluation was to determine whether PADS could, in fact, meet the accuracy and timeliness requirements of the Field Artillery systems of today and to determine the criteria required to designate a PADS traverse as a fourth or fifth order system as in the linear conventional survey method. The results of these evaluations are included in tables 2 through 6 to specify the actual test scenario constraints and to announce accuracies achieved during each phase of the evaluation. A brief synopsis and comparison of the OT IIA and CFD evaluations (table 7) reveal a small difference, well within the original design parameters of the system.

Table 2. Division artillery survey evaluation.

1. Test Outline:

a. *Mission:* To extend survey control forward to establish survey control points (SCPs) for three direct support battalions, one general support battalion, two missile battalions, and one target acquisition battery; locate position and provide orientation for three miscellaneous positions.

b. *Survey Test (PADS mounted in M151):* Three runs will be required with first run stopping every 10 minutes for *zero velocity update; second run, 6 minutes for zero velocity update; third run, 3 minutes for zero velocity update.

2. Evaluation Results:

Average time to install: 5 hours, 50 minutes.

Average length of survey: 113 miles/183 kilometers.

3. Accuracies:

*Zero velocity update	Average position CEP (meters)	Average radial error (meters)	Average azimuth PE (mils)	Average elevation PE (meters)
10 minutes	7.09	4.74	0.236	1.94
6 minutes	3.50	2.43	0.120	1.00
3 minutes	2.99	1.94	0.012	0.84

*The driver stops the vehicle and appropriately notifies the system. Update is then conducted by the PADS computer which removes the cumulative excess motion errors (vibrations caused by bumps or nonlevel terrain, etc.) from the survey calculations. When the errors have been removed, the system notifies the operator to continue with his mission.

Table 3. Target acquisition battery survey evaluation.

1. Test Outline:

a. *Mission:* To extend survey control to establish survey control points for four flash observation posts; locate position of a six-microphone, four-second, straight regular sound ranging base; locate position of a six-microphone irregular sound ranging base; locate position and orientation for a counterbattery radar and a moving target locating radar.

b. *Survey Test (PADS mounted in a M151):* Three runs will be required with first run stopping at 10 minutes for zero velocity update; second run, 6 minutes for zero velocity update; third run, 3 minutes for zero velocity update.

2. Evaluation Results:

Average time to install: 2 hours, 15 minutes.

Average length of survey: 30.3 miles/48.5 kilometers.

3. Accuracies:

Zero velocity update	Average position CEP (meters)	Average radial error (meters)	Average azimuth PE (mils)	Average elevation PE (meters)
10 minutes	1.13	0.80	0.07	.50
6 minutes	1.16	0.88	0.02	.46
3 minutes	1.05	0.77	0.66	.12

Table 4. Artillery battalion survey evaluation

1. Test Outline:

a. *Mission:* To extend survey control to three primary battery centers; establish orientation for each battery; establish target area survey control point (SCP); location position and provide orientation for counterbattery radar. (No alternate gun positions were included in this survey scenario.)

b. *Survey Test (PADS mounted in M151):* Three runs will be required with first run stopping at 10 minutes for zero velocity update; second run, 6 minutes for zero velocity update; third run, 3 minutes for zero velocity update.

2. Evaluation Results:

Average time to install: 58 minutes.

Average length of survey: 7.5 miles/12.1 kilometers.

3. Accuracies:

Zero velocity update	Average position CEP (meters)	Average radial error (meters)	Average azimuth PE (mils)	Average elevation PE (meters)
10 minutes	2.54	1.84	0.26	1.26
6 minutes	0.90	0.68	0.24	0.14
3 minutes	0.72	0.53	0.22	0.19

Table 5. OH-58C evaluation (division artillery survey scenario)

1. Test Outline:

a. *Mission:* To extend survey control to establish survey control points for three field artillery battalions and two missile battalions; locate position and provide orientation for one counterbattery radar position.

b. *Survey Test (PADS mounted in OH-58C):* One run is required and will stop every 10 minutes for zero velocity update.

2. Evaluation Results:

Average time to install: 55 minutes.

Average length of survey: 50 miles/80 kilometers.

3. Accuracies:

Zero velocity update	Average position CEP (meters)	Average radial error (meters)	Average azimuth PE (mils)	Average elevation PE (meters)
10 minutes	6.37	4.42	0.160	0.92

Table 6. CH-47 evaluation (division artillery survey scenario)

- 1. Test Outline:**
 a. *Mission:* To extend survey control to establish survey control points for three field artillery battalions, and two missile battalions; locate position and provide orientation for one counterbattery radar position.
 b. *Survey Test (PADS mounted in M151 in CH-47):* One run is required and will stop every 10 minutes for zero velocity update.
- 2. Evaluation Results:**
 Average time to install: 60 minutes.
 Average length of survey: 50 miles/80 kilometers.
- 3. Accuracies:**

Zero velocity update	Average position CEP (meters)	Average radial error (meters)	Average azimuth PE (mils)	Average elevation PE (meters)
10 minutes	5.88	4.02	0.083	1.13

The results of the Field Artillery Board OT IIA test and the informal evaluation by the Counterfire Department support and emphasize the high degree of reliability and accuracy of the system far beyond the original design specifications.

The accuracy requirements for locating all field artillery assets have continually been very easily achieved by PADS. Additionally, the requirement to provide these assets with an accurate direction has also been met. However, the most stringent requirement and test of the system's capability to provide an accurate location was the survey emplacement of microphones of a straight regular sound ranging base. The accuracy of weapon locating information provided by the sound ranging base degrades rapidly when microphone location errors greater than one meter are present. The PADS, using three-minute zero velocity update procedures, repeatedly produced location accuracy data well within the one-meter accuracy constraint. Although the PADS was built as a fifth order (1:1,000) system, the evaluations substantiate the conclusion that PADS will produce data sufficient to meet *all* present day and known Field Artillery survey accuracy requirements. But what do these results actually mean to the users in the field asking, "what will the PADS do for me?" A good example would be the questions of an artillery battalion commander who needs accurate survey control to his firing batteries prior to or immediately after occupation. Results of the CFD evaluation substantiate that the PADS can supply his firing

batteries (using 3-minute zero velocity updates) with battery centers and elevations with accuracies of less than one meter and an azimuth accurate to less than 0.3 mil in approximately one hour after beginning the survey. These accuracies and times will allow his battalion to complete its mission in a timely and accurate manner.

Basis of issue plan

The current basis of issue plan (BOIP) reveals the issue levels of the PADS and the resulting TOE structural changes of the survey parties from battalion to division artillery. However, future funding constraints may limit the number of PADS actually purchased for the Army.

Unit	Quantity	Survey parties
Howitzer battalion	One	PADS
	One	5-man conventional party
ACR 155-mm battery, Lance battery, or Pershing battery	One	PADS
	One	5-man conventional party
	Two	PADS
HHB, division artillery	One	DME (distance measuring equipment) party (8 men)
	One	PADS
Target acquisition battery	One	PADS
	Two	DME parties (8 men per party)

The Division '86 study of future needs and requirements for personnel and equipment to support new US Army structural changes reveals recommendations to decrease conventional survey party requirements while increasing PADS.

Training

Upon receipt of the 12 PADS and supplemental training aids, USAFAS will incorporate the required operator task training into the existing 82C Artillery Survey Specialist Course. The PADS training slice of the total 82C instruction will be three to four days. All officers attending the Field Artillery Cannon Basic Officer Course (FACBOC), Field Artillery Target Acquisition Survey Officer Course (FATASOC), and Field Artillery Officer Advanced Course (FAOAC) will receive orientation and general system overview instruction on the system,

Table 7. Comparison of OT IIA and CFD evaluations.

Measurement	OT IIA accuracies				CFP accuracies	
	Requirement	Achieved		Requirement	Achieved	
		Unadjusted	Adjusted		3-minute zero velocity update	10-minute zero velocity update
Horizontal-meters CEP	20 meters	3.06	2.00	20 meters	1.58	4.60
Vertical-meters PE	10 meters	2.81	1.98	10 meters	1.08	3.20
Azimuth-mils RMS	1 mil	0.51	0.58	1 mil	0.30	0.16

as will noncommissioned officers attending Combat Survey Target Acquisition Advanced Course (CSTAA), Field Artillery Cannon Advanced Course (FACA), and Field Artillery Missile Advance Course (FAMA).

To facilitate proper utilization of PADS upon initial issue to the field, a New Equipment Training Team (NETT) will travel to each major unit headquarters to instruct key personnel on the operating procedures of the system. All major unit headquarters in CONUS and USAREUR will be visited. Presently, the NETT is scheduled to travel on a part-time basis from February through July 1982. The two-man team will be composed of a person from TSARCOM, the agency responsible for the fielding of the system for the Army, and one USAFAS instructor to provide instruction on system operation, training, and doctrine.

Standardization

The ability of the Field Artillery surveyor to meet all survey requirements in a *timely* manner is of paramount concern to the FA Community. The highly mobile, ever-changing and challenging battlefield of today and the future causes the surveyor to take a hard, in-depth, inspection of his equipment, organization, and personnel. The question arises of how can the FA surveyor best complete his mission requirements? The answer to this question is "standardization!" The actual standardization process presently being considered could result in some or all of the following changes:

- Standardized equipment for conventional survey parties at all levels of Field Artillery survey. The common Field Artillery survey chest would include the TI-59 calculator, T2 (0.002-mil) theodolite, the present SIAGL (survey instrument, azimuth gyro, lightweight), and in infrared distance measurement device with a range of 10,000 meters.

- Delete the fourth and fifth order survey concept with its inherent accuracy requirements and replace with a common order of "Field Artillery Survey" that will incorporate the accuracy capabilities of the PADS system and conventional parties, as well as those required by standard NATO agreements.


- Introduction of a standard survey vehicle along the lines of a 3/4-ton or 5/4-ton personnel carrier with trailer is needed to augment the PADS M151 vehicle and replace the nontactical M880 and/or undesirable M561 gama goat.

- Introduction of a standard X-man survey party with appropriate career level schools and promotion progression patterns.

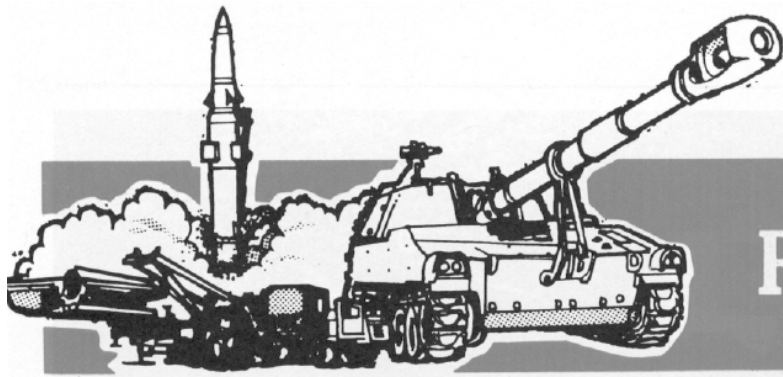
The justification for these recommendations is that these concepts, along with the introduction of the PADS and the use of the TI-59 calculator, would allow for standardization and tactical interoperability of survey procedures within cannon, missile, and target

acquisition units from battery to battalion to army level. This will allow all FA surveyors to gain optimum experience and maintain expertise with one type survey party, as opposed to the present fourth and fifth order parties with different equipment and techniques; thus, a more highly trained, proficient surveyor will result. This action will also simplify supply, maintenance, and procurement procedures Army-wide. Finally, these concepts would allow for standardization of all levels of survey instruction within the Field Artillery School as well as unit level training throughout the Army. To complement the standardization study that is currently on-going to improve the conventional survey capability of today, we should address the future systems that will continue to improve and update the Field Artillery survey requirement. During FY82, PADS will be fielded and will provide the Field Artillery with a much needed system improvement.

Later years could possibly see PADS parties *totally* responsible for the survey mission, depending on the total numbers of systems procured and their field success. Another possible plan could incorporate PADS parties with North Finding Modules for direction and Position Location and Reporting System (PLARS) user units for position data in each Field Artillery organization. Another possibility could be to include the North Finding Module and user segments of the NAVSTAR Global Positioning System (GPS) for accurate position information in each FA organization. PADS would still be available to provide external survey control for alternate positions planned for future operations. Many variables will affect the actual outcome of this exciting and important period in Field Artillery survey development, but the future holds many possible dynamic changes.

The major concern of the Field Artillery surveyor is insuring that all assets are fully utilized to accomplish successful completion of all mission requirements in support of the Field Artillery. The PADS has thus far revealed a dynamic and significant impact on the way we will perform field artillery survey in the field. The future restructure that incorporates PADS with the conventional survey parties, along with the adoption of the proposed standardization concept, will permit the Field Artillery surveyor of tomorrow to adequately support the cannon, missile, and target acquisition units that compose the Field Artillery System. 

MAJ David R. Rogers is Chief of the Survey Division, Counterfire Department, USAFAS. CPT Robert R. Roe is a Target Acquisition Staff Officer assigned to the Survey Division, Counterfire Department, USAFAS.



Right by Piece

III Corps Fire Support Conference

FORT SILL, OK—Combat readiness was the order of the day during the first III Corps Fire Support Conference held 22-23 April at Fort Sill, OK. BG James E. Drummond, III Corps Artillery Commander, hosted the meeting, attended by division artillery commanders and representatives from III Corps, III Corps Artillery, 4th and 5th Division Artilleries, associated Reserve Component Field Artillery Brigades, and the Field Artillery School. The purpose of the conference was two-fold:

- To acquaint field artillery commanders with one another and with current war plans.

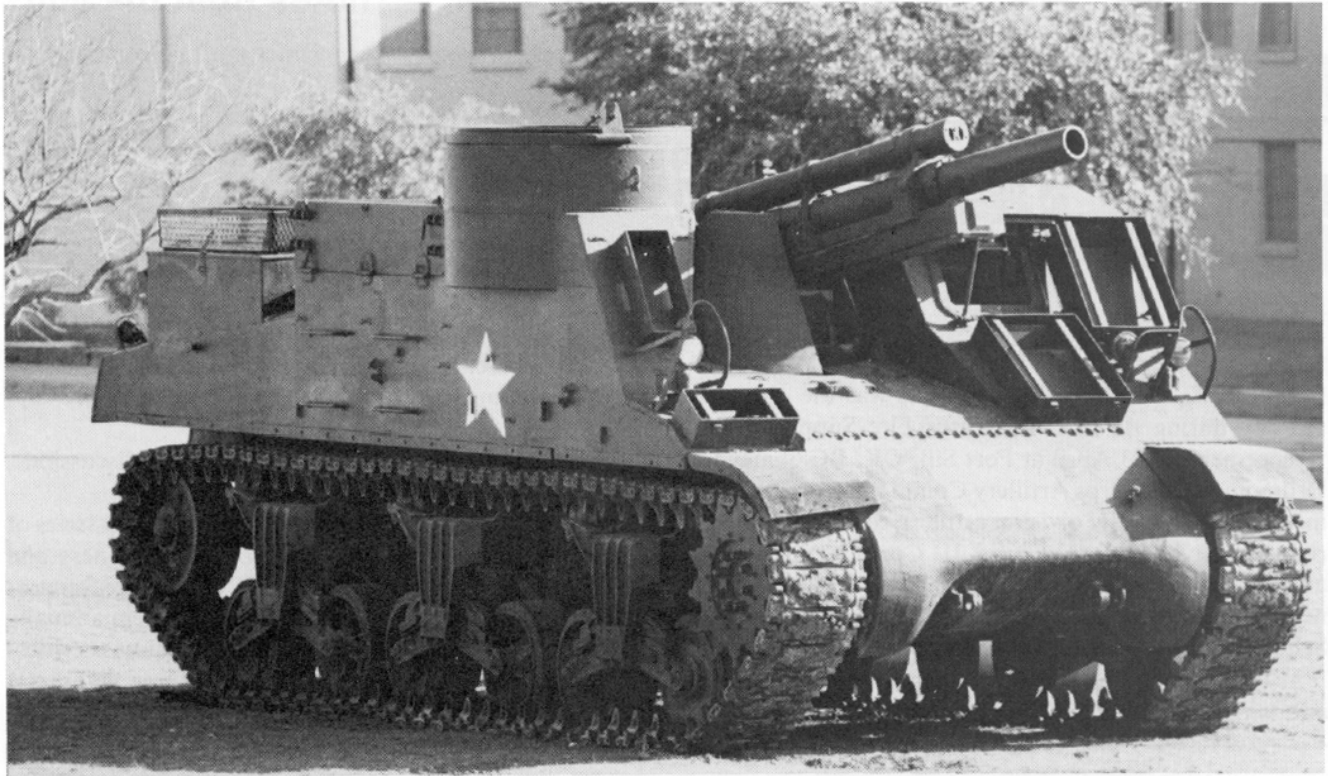
- To influence everyone with the III Corps fire support community to think alike with respect to fire support on the battlefield.

Ample time was allowed for questions, discussions, and exchange of ideas.

The conference represented an initial step in a series of measures designed to improve combat readiness and standardize operations within the III Corps Fire Support Community. Plans are being made to meet semiannually to receive an update on war plans and to discuss critical fire support standing operating procedures within III Corps Artillery.

CAMP RIPLEY, MN—Early this year, Bravo Battery, 1st Battalion, 152d Field Artillery, of the Maine Army National Guard became Alfa Battery of the 125th Field Artillery as part of an exchange program with the 1st Battalion, 125th Field Artillery. Although the normal Annual Training site for the 1-152d is the Canadian Forces Base Gagetown, New Brunswick Providence, Canada, the training at Camp Ripley, MN, offered valuable lessons in conduct of winter operations. For example, Army ARTEP standards and times required modification because of extreme cold. The most difficult and time-consuming task was "digging in" the howitzer spades. Additionally, swabbing the bore (even with antifreeze added to water) was impossible due to icing of the breechblock. Snow was seven to eight inches deep, and the temperature dropped to -25° Fahrenheit at night.





FORT HOOD, TX—The 1st Battalion, 3d Field Artillery, 2d Armored Division, has adopted a disabled Priest 105-mm M7 self-propelled howitzer. Built in 1943 and now obsolete, M7 howitzers were used extensively in combat during World War II. Though little is recorded about the combat history of this particular howitzer, it is known that it once belonged to the 1st Battalion, 92d Field Artillery, 2d Armored Division.

According to *Artillery* by John Batchelor and Ian Hogg, the M7 was first developed by combining the lower chassis of an M3 tank with the top carriage of a standard towed howitzer.

It was a serviceable and well-liked piece of equipment, though it suffered from several problems: It was overweight; and the gun's traverse and elevation were restricted.

The first M7 howitzer off the production line in 1942 was issued to the British 8th Army in the Western Desert of Africa. Those soldiers promptly christened it "the Priest" because of its pulpit-like machinegun mount.

Guns of the DMZ

CAMP PELHAM, KOREA—"Guns of the DMZ" is the motto of the 2d Battalion, 17th Field Artillery, 2d Infantry Division, whose men provide direct support to the 3d Infantry Brigade in its demilitarized zone (DMZ) mission.

Most of the battalion is located at Camp Pelham, but every month, one battery along with two 105-mm batteries from other artillery units in the division artillery rotate duty at a small compound north of the infamous Freedom Bridge. This site is officially called Fire Support Base 4-P-1, but is commonly known as "4-Papa-1," and is the only active fire base in the United States Army.

There seems to be a quiet feeling of seriousness once you've crossed Freedom Bridge. Although artillerymen at 4-Papa-1 smile and joke around, you can certainly see

a spark of realistic awareness in their eyes. It's apparent all of them know the potential enemy is positioned less than five miles beyond the nearby hill.

The fire base is usually manned by one artillery battery, and the 2d Battalion, 17th Field Artillery, units have shared in the occupation of this base for approximately 10 years.

The 105-mm howitzers are ready for action and are aimed in the direction of potential opposing forces. The soldiers who man those howitzers are ready too.

According to LTC James L. Green, battalion commander, "The Army's first mission is defense. Our battalion is prepared and equipped to counter any initial outbreak from the north."

While occupying 4-Papa-1, the 2d Battalion, 17th Field Artillery, soldiers conduct training in fire direction, forward observation, and firing battery training. (SP4 Dawn Harm)

Battery receives training in Britain

FORT ORD, CA—Bravo Battery, 6th Battalion, 80th Field Artillery, 7th Infantry Division Artillery, recently returned from Britain where they spent a month training with the 4th Regiment, Royal Artillery.

Exercise MILL RACE 80 went very well, according to Bravo Battery commander, CPT Earl Rule. The only complaints heard were about the weather.

"It was cold and rainy," said Rule, "and conditions were generally poor for a training exercise. We had some of the same problems with mud that the 88th Battery had at Camp Roberts." But he also said that the opportunities for training with new tactics and equipment made it worth the experience.

"The British artillery has some of the most advanced equipment of any Army in the world," said Rule. He mentioned the lighter guns and a smaller, more efficient computer for calculating firing data.



SGT Ernie Wettler, PFC Bobby Page, and SP4 Vernon Kennamer put a British artillery piece into action as part of the recent exchange program.

Bravo Battery trained at the 4th Regiment base in Aldershot, about 30 miles from London, while the 88th Battery took their training with their American counterparts at Fort Ord and Camp Roberts.

Bravo Battery trained at Arkhill and at Sunnybridge in Wales. They also stood in for the 4th Regiment at the Royal Artillery School while the British gunners stood guard at Buckingham Palace. The Courageous Redlegs helped provide training for young artillery officers who were responsible for setting up the firing positions of the battery. "Overall," said Captain Rule, "it was a good learning experience for everyone. A lot of close friendships developed, with a lot of the men trading unit crests and uniform items and other things to take back as souvenirs."

Exercise MILL RACE 80 ended for the Redlegs as they returned to California on a Royal Air Force VC-10. With
July-August 1980

the success of this exercise it seems probable that there is a good chance of another exchange with our British counterparts in the future. (Dana C. Spencer)



American soldiers get a class from their British counterpart on the English fire control computer.

FORT HOOD, TX—PVT Ed Duncan, a loader/driver of Battery A, 1st Battalion, 3d Field Artillery, 2d Armored Division, prepares a 155-mm howitzer during a training exercise, using the cost-saving M31 training device. The M31 can be mounted inside the main gun using the howitzer's sighting system, or it can be mounted on a tripod outside the howitzer using a separate sight. The device fires 14.5-mm rounds and operates much like a single-shot rifle with bolt action. "It works the same way as if they were using live ammunition," said 1LT Kenneth Stark, executive officer. "The only difference is that the forward observers have to have a special map that is drawn on a 10-to-1 scale. The men get basically the same training as they do using live ammo but it costs much less. A 14.5-mm training round costs about \$120 to \$130 less than the real thing. They're not working with a large round, but the fire direction procedures remain the same."



The Direct Support Field Artillery Battalion

Is it time for a change?

by MAJ Kenneth A. Owen

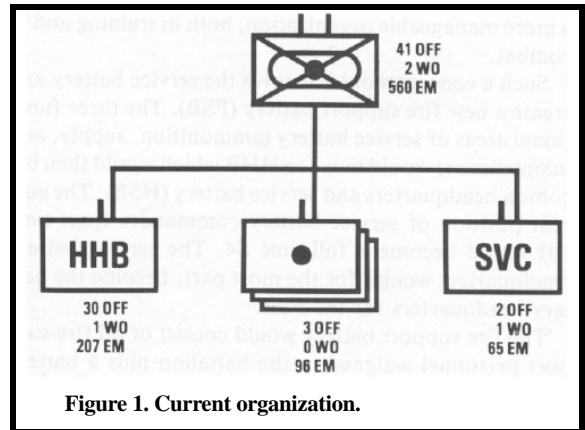


**CABL—BICC—FIST—TACFIRE—
TUFMIS** Each of these concepts or systems adds substantial complexity to the organization and management of the 155-mm direct support (DS) Field Artillery battalion. Battalion commanders manage their operating budgets more directly than ever before. With brigades commonly having four battalions, fire support personnel number over 100. The addition of TACFIRE, with its high level of sophistication, will demand that our logistics management be at its best if we are to use the system effectively. With this increased size and complexity, it is perhaps time to examine some of our

organizational concepts and consider alternate ways to accomplish our mission.

The absence of a full-time S4 on the TOE has long been an unhappy situation for many battalion commanders. With the advent of closer fund management at battalion level, this apparent disadvantage of the current DS battalion organization has assumed greater proportion. Many commanders "manufacture" the S4 by assigning an officer to an existing TOE vacancy and have him function as the S4. If the need for a full-time S4 is this great—and it appears that it may be—then the S4 should become a legitimate, full-time TOE position.

Another organizational question which has been widely discussed, but not yet answered to the field



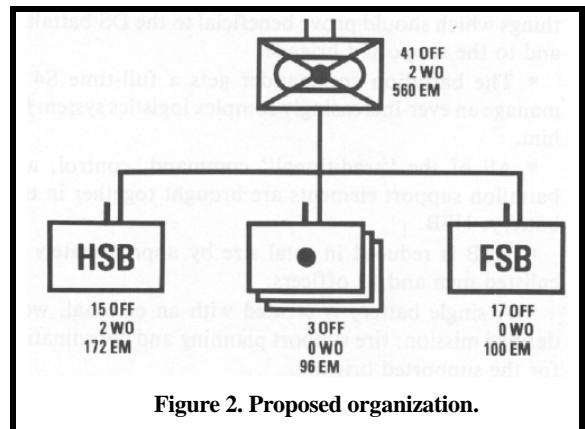
supply officers, and NBC officers—an aspect of professional education and development considered essential by most battalion commanders.

But attachment to the firing battery presents other considerations. The battalion fire support assets become fragmented among four batteries. Efficient training of fire support personnel at any level is greatly hampered. Training management and employment by brigade and/or battalion fire support officers is often degraded severely. Batteries have the responsibility of maintaining additional vehicles but have no additional maintenance assets with which to do the job. Property accountability for FIST equipment which is assigned to HHB but hand-receipted to the firing batteries makes supply sergeants and battery commanders shudder. There also arises the occasional conflict of priorities and loyalties between the FIST chief's primary duties and his attachment to "his" battery.

A possible solution to both the S4 and the FIST situation is to change the TOE of the DS battalion in a fairly radical manner (figure 2). In essence, doing away with one battery (service) and creating a new battery to manage our fire support mission may make the battalion

commander's satisfaction, is "How do we effectively organize, train, and manage our FIST?" Currently, all fire support personnel are assigned to the headquarters and headquarters battery (HHB) and, with over a hundred of these people, the HHB is rapidly approaching an unmanageable size for a training environment (figure 1). Many commanders feel that it has already passed that point. The TOE is designed to enable us to fight, but it must also allow us to train our soldiers effectively.

To counter the size problem with HHB, some commanders have attached their FISTs to the firing batteries, in a manner not unlike the older forward observer (FO) organizational concept. Such an arrangement provides young officers the opportunity to serve as motor officers,



a more manageable organization, both in training and in combat.

Such a concept would dissolve the service battery and create a new fire support battery (FSB). The three functional areas of service battery (ammunition, supply, and maintenance) would move to HHB which would then become a headquarters and service battery (HSB). The current position of service battery commander (part-time S4) would become a full-time S4. The service battery headquarters would, for the most part, become the battery headquarters for the FSB.

The fire support battery would consist of all fire support personnel assigned to the battalion plus a battery headquarters. Maintenance personnel in FSB and HSB would have to be balanced to support a different wheel-track ratio. The fire support battery would have 17 tracked and five wheeled vehicles from the former HHB and would receive three wheeled vehicles from the former service battery. The headquarters and service battery would receive 20 wheeled vehicles and two tracked recovery vehicles from the service battery. Other mess, maintenance, and supply equipment would revert from the service battery to the fire support battery.

Who would command this FSB? The only logical or sensible choice is the brigade fire support officer. He is the individual who is responsible for supervision of all fire support training and it is he who manages and supervises fire support personnel in a tactical situation. With the brigade FSO in command of the FSB, the line of staff supervision would become the chain of command as well.

Is such a concept radical? To some commanders it certainly is! It would do away with an O-3 command billet and create an O-4 command in the DS field artillery battalion. It would have an officer who is both a staff officer and a commander. That concept is not new; the Field Artillery operates under such a concept today. Likewise, majors as commanders at company/battery/troop level are not without precedent in the Army.

Such a reorganization would accomplish a number of things which should prove beneficial to the DS battalion and to the supported brigade.

- The battalion commander gets a full-time S4 to manage an ever-increasingly complex logistics system for him.
- All of the "traditional" command, control, and battalion support elements are brought together in one battery: HSB.
- HSB is reduced in total size by approximately 35 enlisted men and 15 officers.
- A single battery is created with an external, well-defined mission: fire support planning and coordination for the supported brigade.
- The line of staff supervision in the fire support area becomes the chain of command as well.

- There is no discontinuity of command when the fire support personnel are attached to the supported brigade. (The entire battery would be attached at the onset of hostilities, rather than some piecemeal arrangement for individual attachments.)


- The concentration of fire support personnel in FSB would facilitate the addition of sophisticated equipment (laser designators, TACFIRE, etc.) and subsequent training on that equipment.

- Maintenance of fire support equipment would be supported, in that a high density of M113 type vehicles would be in the FSB where an appropriate PLL facility could be built to support those vehicles. This would hold true also for laser and TACFIRE associated equipment.

So how would we employ this FSB in a tactical environment? In combat the battery would be employed in very nearly the same way that we employ fire support assets now. At the outbreak of hostilities, the entire FSB would be attached to the supported brigade. Attachment of a unit rather than several groups of individuals would be inherently faster and much more simple. Battery planning and preparation would enable the FSB to respond on a more timely basis. Likewise, the presence of a battery headquarters would insure adequate support in personnel and administrative matters. Tactical employment of the fire support sections and FIST would remain otherwise unchanged from current doctrine.

In a training environment, all of the fire support personnel would be in one unit—the fire support battery—where their energies could be devoted to training in the technical aspects of fire support planning and coordination. The tactical skills are, of course, practiced and polished through combined arms training with the respective supported companies and battalions. The FSB would enjoy some of the benefits usually associated with "centralized" training, yet would maintain the advantages of training executed at battery level or below.

Professional education and development programs for junior officers could continue in much the same manner as they are run in current organizations. FIST chiefs receive training in supply, maintenance, and other areas through their chain of command. They can give practical assistance to firing batteries in these and other areas with or without attachment as individual commanders may deem appropriate.

The concept of a "fire support battery" holds at least the possibility of giving the direct support Field Artillery battalion a more efficient and manageable organization to be well prepared to meet the challenges which will face the KING OF BATTLE in any future conflict. 

MAJ Kenneth A. Owen is the S3 of the 1st Battalion, 7th Field Artillery, Fort Riley, KS.

The most certain thing to be said about the Field Artillery in the 1990s is that it will be far different from today. It will change because it must. Projections of Soviet technology point to a capability to find and attack artillery targets at all ranges. Assessment of US and Allied technologies leads to the conclusion that our Field Artillery must have the ability to avoid destruction while fulfilling its fire support mission.

The general support echelon of future surface-to-surface fire support is already reasonably well defined. We are committed to the Multiple Launch Rocket System (MLRS) and the Corps Support Weapon System (CSWS) in concept, if not in final design. These weapons promise to deepen the battlefield, by attriting enemy units earlier and slowing the so-called presentation rate of maneuver brigade targets. Nevertheless, the targets remaining to be attacked by direct support artillery will be considerable. There will be a requirement to fire on targets varying in hardness and mobility, supported by a sophisticated counterfire system. Fire support concepts to meet the threat at the brigade level are now being developed. This article attempts to leap over 10 years of that development—a decade-worth of reviews of all sorts, bargaining with Congress, competition among government agencies and civilian contractors, short funds, and long schedules—to the ANSWER. [This is in accordance with the basic tenet of futurology: Skip the analysis and move directly to the solution, for therein lies the profit.]

Learning the language

Anyone interested in the Direct Support Field Artillery System (hereafter called System) of the future must be prepared to cope with the acronyms, nicknames, and official designations which are already proliferating, 10 years ahead of time.

Building blocks

The DS System that will be used after 1990 will benefit from major advances in three areas:

- Communications (Army Data Distribution System (ADDS) and Single Channel Ground/Air Radios).
- Automation (modular improvement of TACFIRE or Advanced Field Artillery Tactical Data Systems (AFATDS)).
- Firepower (Enhanced Self-Propelled Artillery Weapon System (ESPAWS)).

This combination will be required to respond to several needs:

- Responsiveness: React quickly; targets will be fleeting and immediately dangerous to the unit calling for fire support.
- Effectiveness: Deliver fire where needed and do the job in as few rounds as possible.
- Survivability: Survive the action of the enemy, nature, and our own operators.

Direct Support Field Artillery Beyond 1990

by LTC (Ret) William W. Breen

The weapon

The centerpiece of the System will be the autonomous self-propelled howitzer. This weapon will be capable of locating and orienting itself, processing its own gunnery solution, and firing accurately at high rates to longer ranges. The benefits of such a weapon and some thoughts on its tactical employment are discussed in two articles published in the *Field Artillery Journal*: "Battery Positions Are Out-Of-Date" (May-June 1980) and "Survivable, Affordable, and Lonely" (November-December 1977).

Components on-board the howitzer will include:

- Improved cannon and ammunition.
- Automatic loader.
- Projectile and propellant magazines.

- Processors for orientation/navigation, fire control, and communications.

- On- and off-board fuze setters.
- Enhanced optics.
- Crew chief console for central control.
- Driver's aids.

- Sensors for inventory, powder temperature, muzzle velocity, cant, etc.

Additional sensors may be added to the list depending on their potential to improve accuracy. Once muzzle velocity, meteorological (met) data, powder temperature, and projectile weight have been factored into the gunnery solution, what should be measured next? Powder moisture? Coefficient of friction? Or, are additional effects lost in the irreducible error of natural dispersion? The challenge in solving the accuracy problem will become one of selectively applying (rather than finding) technology.

While there is a limit to the amount of precision desired, the firing rate must be the best available. Two characteristics of the enemy generate this requirement:

- The hardness and the location of the target will change rapidly after the first round is delivered.
- Counterfire may be initiated before the first round has impacted.

But there is a definite limit on the rate-of-fire possible even in the nineties, probably around 10 rounds in the first minute. The tactical fire control determination of number of weapons and rounds to fire will be designed to accommodate both our firing rate and the enemy's response time. In the toughest situation, about six to eight rounds per target would be the maximum to be fired before "scooting." Considering time-of-flight, the best enemy counterfire system envisioned would be hard-pressed to put rounds on a target within two minutes of detecting that target. Performance projected for ESPAWS would allow the weapon to fire eight rounds, displace, and move 300 meters in that time (figure 1). A weapon that agile should remain immune to counterfire by a battery or single "smart" round. Of course, only a vehicle of the most advanced electronic *and* automotive design will meet the anticipated "scoot" requirement.

Now to the always arguable question of range: The answer, perhaps, is as much as we can get while keeping the weapon agile and safe for human habitation. (See "Noise, The Enemy Within," *Field Artillery Journal*, July-August 1977.) Range helps three ways:

- It extends the brigade commander's reach to the targets he'll be able to find and allow him to take part in as much battlefield interdiction as he can afford.

- Secondly, and almost alternatively, extra range allows the commander to keep his artillery beyond the reach of enemy counterfire while retaining the ability to support frontline units. This would be particularly attractive

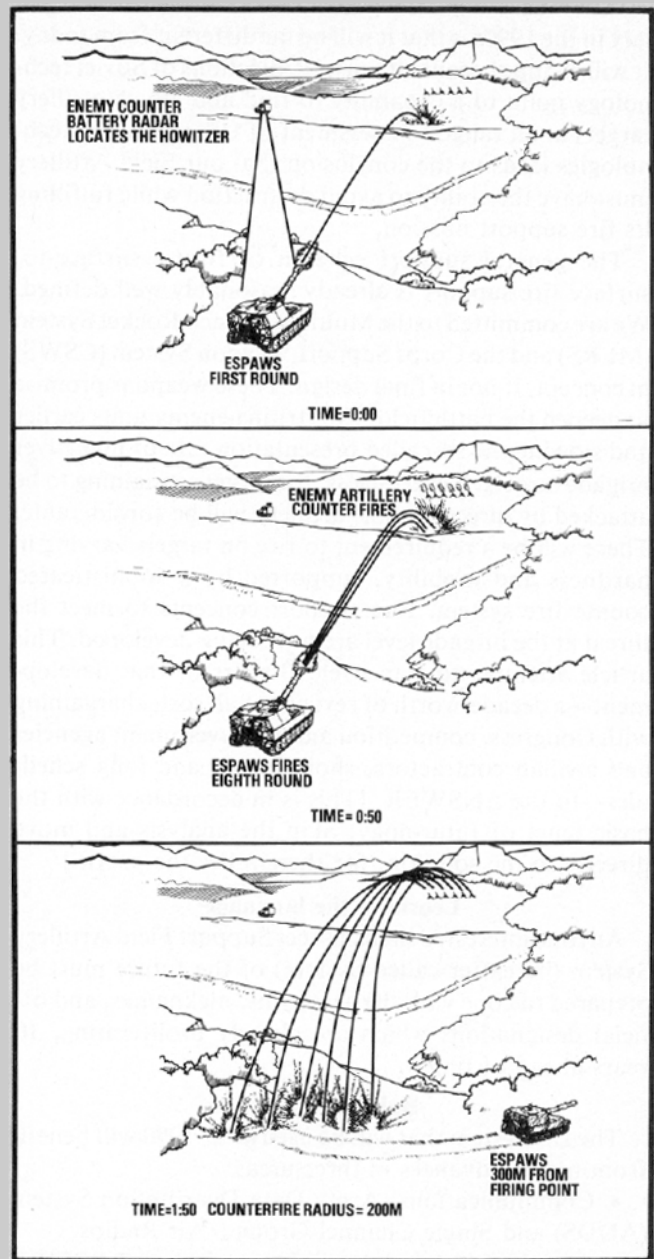


Figure 1. Performance projected for the Enhanced Self-Propelled Weapon System (ESPAWS).

when most targets are near the forward edge of the battle area (FEBA) and shoot-and-scoot tactics are not desirable.

- Lastly, and perhaps most importantly, range applied laterally yields mass, and lateral massing *without movement* is the equivalent of fire support mobility. An ESPAWS weapon with a 10-revolution-per-minute rate-of-fire and a 40-kilometer range will have nearly a *four to one* advantage in massing over the M109A2. This overwhelming advantage is based on relative rates of fire and

range only (figure 2). RAM (reliability, availability, maintainability), C³ (command, control, communications), etc. are assumed equal.

The highly desirable secondary effects of longer range and higher firing rates should not be overlooked. A direct support system that can place more than 1,400 rounds per minute at any target along the FEBA (firing all in range, 24 weapons per battalion, 12-km brigade front) is unlikely to require reinforcing fire. Therefore, the division and corps commanders will be able to retain much more centralized control of their GS resources than is possible today. This, in turn, will permit more rapid response to targets acquired by systems at or above those echelons. These commanders might also choose to husband part of their GS resources pending nuclear release.

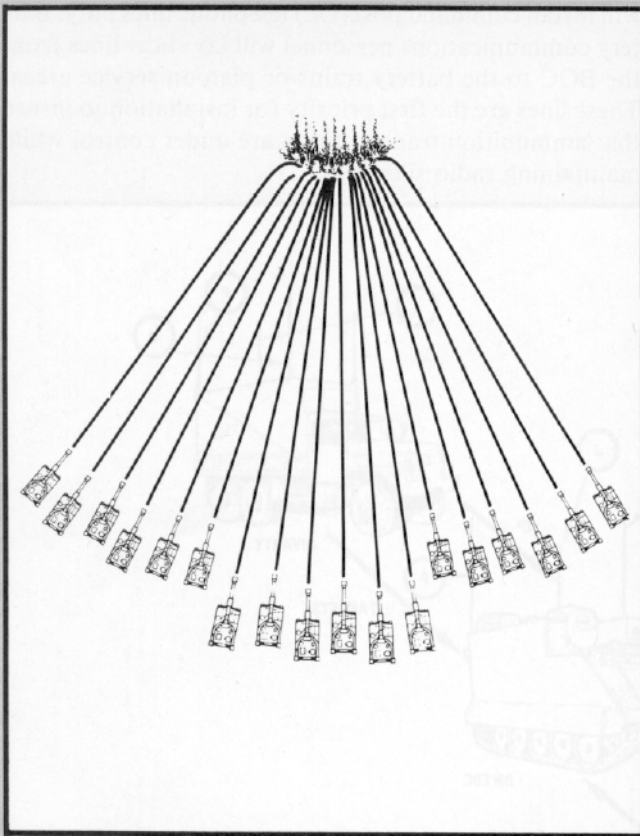


Figure 2. The Enhanced Self-Propelled Weapon System will mass nearly four times the firepower of the M109 system.

Fire direction

The implications of autonomous weapons on technical and tactical fire control and firing safety are considerable. Because weapon location, orientation, and nonstandard condition data are immediately available on-board the weapon, that is the obvious place to compute the gunnery solution. Everything else follows from this decision.

By 1990, the battalion FDC should be able to manage the weapons of the battalion as separate fire units

whenever the situation requires such control. In addition to the traditional tactical fire control decisions, the processor at battalion would use a new set of rules to select units to fire. In order to present the enemy counterfire facilities with the most complex problems possible, a random firing pattern is maintained. The enemy sees fires from widely dispersed units, with no group ever repeated. Battery assignment becomes moot.

For battalion-controlled fire missions, the FDC directs 24 separate firing resources. Any weapon in range, with the right ammunition, could be selected for a mission providing that a firing pattern is not repeated. Rapid emplacement-to-fire times (less than 30 seconds) will make moving weapons readily available for mission assignment by FDC.

At battery level, the C³ system will be mostly concerned with RSOP (reconnaissance, selection, and occupation of position), resupply of weapons, and the management of ammunition and will primarily act as a battery operations center (BOC) rather than an FDC. Of course, the capability to provide tactical fire control by battery should be retained as a back-up mode for the BOC. The BOC should be prepared to control the fires of its weapons when the battalion FDC cannot do so or the communications intelligence security of that center is in doubt.

An interesting proposal has emerged regarding the relationship of the battalion FDC and the brigade fire support element (FSE). Reductions in the dimensions of hardware and the removal of technical fire control will shrink the FDC to a size compatible with an armored vehicle. It might then be capable of collocation with the FSE to improve the brigade's control of its fire support. It might also be possible to *merge* the FDC and FSE, which would result in personnel and equipment savings or an ability to duplicate the FDC/FSE at another location for redundancy. If one were starting with a blank sheet of paper and 1990 electronic gear, it is likely that such a merged facility would result. But the Army will not have the benefit of a clean start, so it remains to be seen if a graft can be successful.

A detailed fire support scheme to take maximum advantage of autonomous weapons is now being developed as part of the ESPAWS program. The implications of this Program on the efforts to improve TACFIRE are obvious and considerable. On the other hand, any major change in fire control doctrine may have implications for ESPAWS. For example, the unit FDC concept might be replaced by an *area* FDC concept. In such an arrangement, all centers are capable of directing all types of weapons, MLRS, 8-inch, ESPAWS, etc. While adding greatly to the robustness of the overall fire support system, an area concept would certainly affect the design and tactics of the individual weapons.

Communications

The current communications system could not support the tactics or fire control procedures described here. Net loading, voice/data contention, and line-of-sight limitations would not permit the redistribution of control and flexibility required to meet the anticipated threat. Fortunately, two programs already under development are expected to be available years before an autonomous howitzer could be fielded.

- The Army Data Distribution System (ADDS), a computer-based system of very large capacity, will provide both data distribution and position location to the direct support artillery. The planned capacity of ADDS appears sufficient, since the DS battalion of the nineties will require less than five percent of the brigade's total data-handling capability. The prime candidate to become ADDS is the Position Locating Reporting System (PLRS)/Joint Tactical Information Data System (JTIDS) Hybrid. The somewhat more sophisticated PACKET radio technology has also been demonstrated, but the Hybrid appears to be the choice for early deployment

of the system.

- The Single-Channel Ground/Air Radios (SINGGARS) will replace the AN/VRC-12 series and serve as the primary voice radio in the next decade. SINGGARS is highly suited to mobile operations in an electronic warfare environment and will also have a data handling capability that will back up the ADDS. But, while the two systems are operating in their primary modes, voice/data contention will be eliminated. Figure 3 displays a mix of communications equipment capable of supporting the future DS battalion.

The ADDS/SINGGARS reduces the Artillery's wire laying requirement to a minimum which will be extremely beneficial because the mobility of the force will preclude the emplacement of long lines. Headquarter's wire teams will install command post (CP) telephone lines only. Battery communications personnel will lay short lines from the BOC to the battery trains or platoon service areas. These lines are the first priority for installation to insure that ammunition transfer areas are under control while maintaining radio silence.

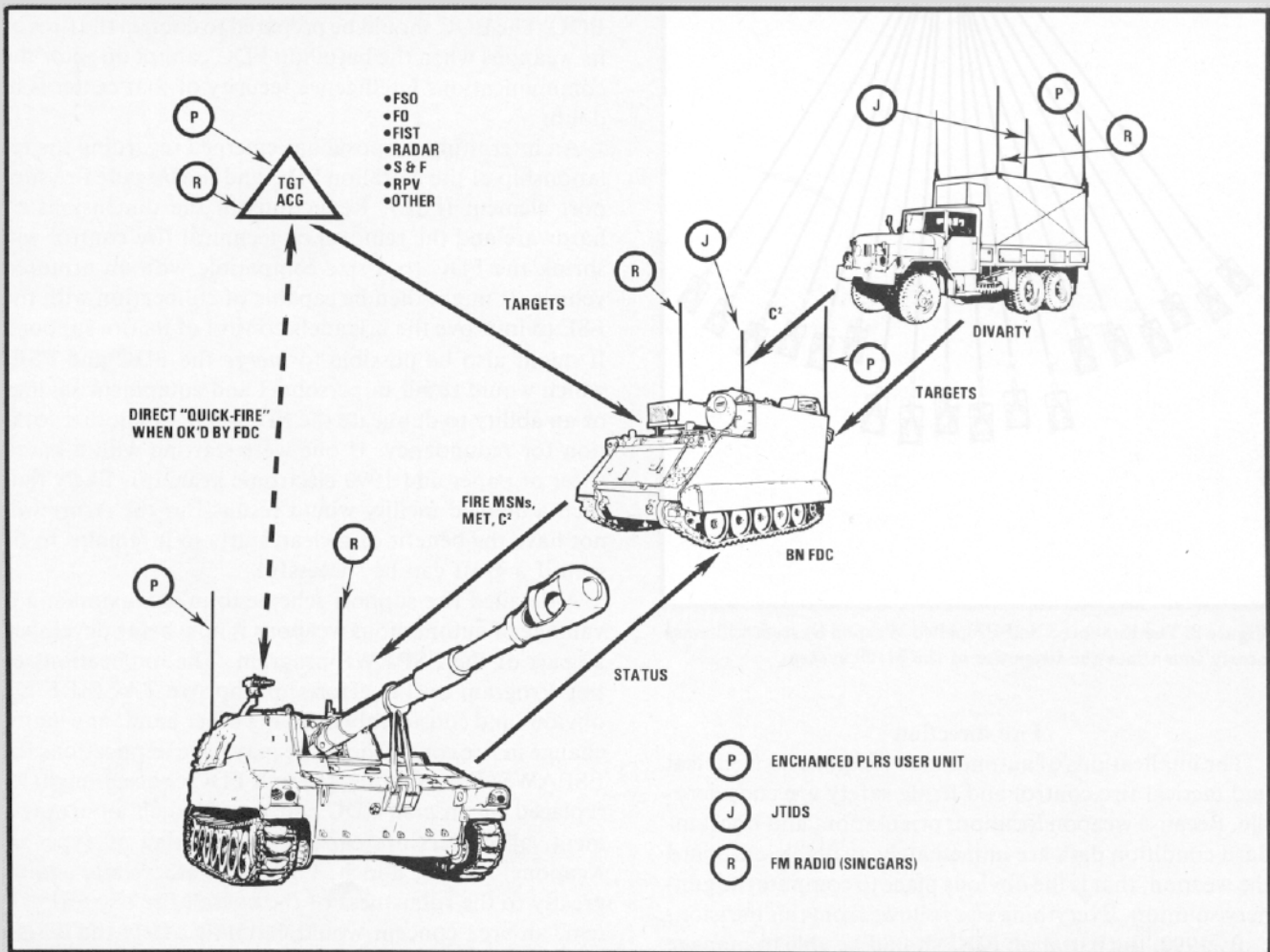


Figure 3. Communications for the future direct support battalion.

The System

Figure 4 portrays a battery slice of the proposed 1990 DS battalion. The basis of the organization is the Division '86 Objective Division. The first change made was the insertion of an autonomous howitzer. Fire control and communication systems were then modified to accommodate the weapon and the best tactics for its use. This design is intended to balance signature and vulnerability against mobility and hardness. The self-propelled howitzer has an obvious firing signature which will be offset by its hardness and agility. The BOC's/FDC's communications should be minimized by the nature of the ADDS net and it, too, will have

compensating mobility and protection. The ammunition transfer areas, however, are neither mobile nor hard; therefore, their signature must be minimized, camouflaged, and disguised. Neither firing nor radio communications will originate in these areas. Since the enemy will have sensors capable of detecting shooters, emitters, and *movers*, the final challenge in the ammunition transfer areas will be to minimize, disperse, and randomize vehicle movement to, from, and within the facility. The uninterrupted flow of ammunition will become the primary concern of commanders at battery and platoon level.

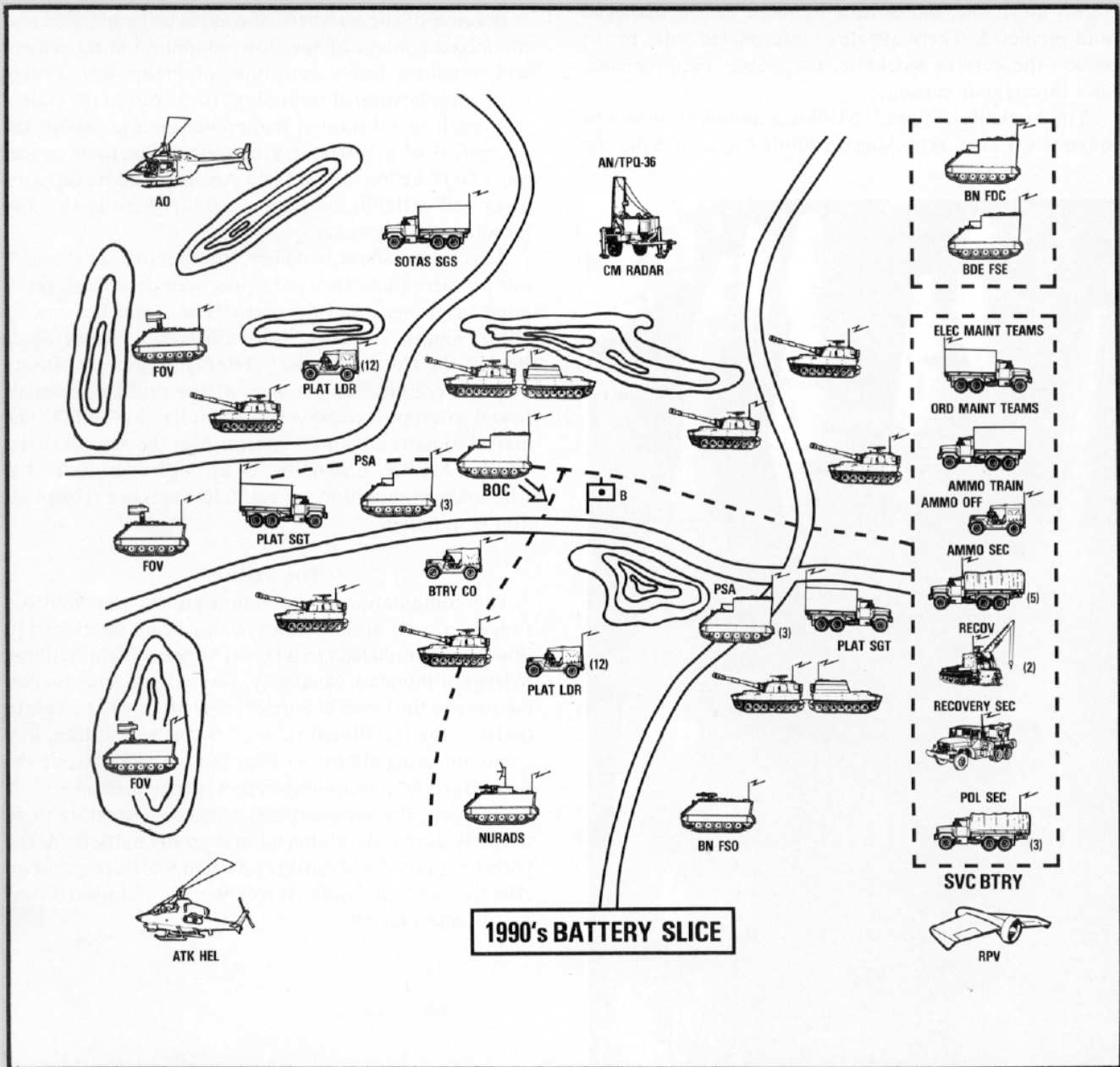


Figure 4. Battery slice of the 1990 direct support battalion.

The problem

Despite the attention of the battery chain of command, ammunition resupply will become the greatest inhibitor of effectiveness of our Field Artillery. The bottleneck that once existed in target acquisition (1940-70s), often shared by the fire control system (1960-70s), has been supplanted by the communication system (post-TACFIRE). That choke-point will move to the weapons in the 1980s (after ADDS/SINCGARS). The proper marriage of weapons, communications, and automation will then transfer it from the weapon to the ammunition system, where it may reside for a long time. A problem seems inevitable, but at least its scope can be managed and predicted. There are three interrelated sides to the issue—the current stockpile, manpower requirements, and throughput capacity.


The stockpile of "old," M107-era ammunition will be huge when new, repackaged rounds begin entering the

inventory. Unless the old stockpile is repackaged to match the new family, which is technically and economically unlikely, the ammunition system will be dealing with two very dissimilar groups of projectiles. The new stock, fully assembled, will remain in its packaging all the way to the weapon. ESPAWS handling equipment, racks, and magazines could be optimized for this packaging. However, if the requirement to fire the old family of projectiles continues to mean final assembly at the breech, then an optimized solution would not be possible. The resulting compromise may not support the firing rate which the rest of the system can generate.

Because of the numbers of rounds to be handled and the mixed content of the flow, ammunition movement will remain a heavy consumer of manpower. Fortunately, application of technology to the rest of the system will result in substantial manpower savings, about the equivalent of a battery per battalion. But these spaces must NOT be lost to the Field Artillery and its support. They will certainly be required somewhere in the ammunition supply system.

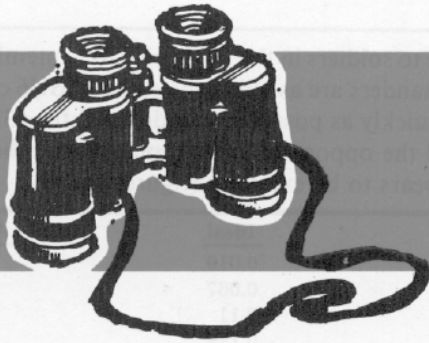
At echelons above battalion, the ammunition throughput problem that exists today has been described, simulated, exercised, and decried ("The Grim Lessons of Nifty Nugget," *ARMY*, April 1980, and "Rusty Blade Behind the Cutting Edge," *ARMY*, August 1979). An effective solution to this part of the problem must be found to support today's Field Artillery in NATO. The arrival of more advanced systems over the next 10 years, CSWS, MLRS, ESPAWS, et al, will overwhelm the wholesale ammunition system unless massive rehabilitation is initiated.

The payoff

The combination of communications, ammunition, firepower, and automation systems being developed in this decade could lead to a Direct Support Field Artillery System of immense capability, comparable and complementary to the General Support System. It will be able to perform the traditional roles of moving, shooting, and communicating almost without interruption despite the best efforts of a technologically sophisticated enemy. If we continue the necessary programs and integrate them properly during development and on the battlefield, the Direct Support Field Artillery System will be responsive, effective, and survivable. It will prevail . . . unless it runs out of ammunition. 

LTC (Ret) William W. Breen, a regular contributor to the *Journal*, lives in San Diego, CA.





View From The Blockhouse

BG Forman assumes duties as Assistant Commandant

Brigadier General Robert C. Forman assumed duties as Assistant Commandant, USAFAS on 2 July. General Forman replaced Major General Edward A. Dinges who took command of the US Army Field Artillery Center and Fort Sill on 27 June.

General Forman's most recent assignments include Chairman, Multiple Launch Rocket System (MLRS), at Redstone Arsenal, AL, and Commander, US Army Training Support Center, Fort Eustis, VA.

Conference dates set

The Senior Field Artillery Commanders Conference and initial general membership meeting of the Field Artillery Association (FAA) will be held at Fort Sill this year during the period 21-23 October.

The 1980 Fire Support Conference will take place 18-20 November.

Scheduling of events, specific times, and other administrative information will be announced via worldwide message.

The 63 CMF revision

"Your Artillery Mechanic . . . The Invisible Soldier" in the May-June 1980 issue of the *Journal* discussed what artillery mechanics were, where they were, what the commander could do to reduce current shortages of artillery mechanics, and what relief was in sight. This follow-up will address how that relief will occur, how artillery mechanics are becoming "visible," and the perspective of the overall 63 Career Management Field revision scheduled for Army-wide implementation on 1 October 1980.

The revision (change 14 to AR 611-201) is called Systems Mechanics and is designed to teach soldiers to be specialists in maintaining and repairing complex weapons and vehicles. Training under the new program will begin 1 October 1980 at the US Army Ordnance Center and School, US Army Armor Center and School, US Army Field Artillery School, and Army Training Centers.

July-August 1980

The first major change in the new program takes place at the organizational level. Soldiers at skill levels 1 (SL1) and 2 (SL2) will be trained to specialize in either armament or automotive repair. When they reach skill level 3 (SL3), they become responsible for BOTH armament and automotive repair as Systems Mechanics. For example, MOS 45D10 (formerly 13B10U6) M109/110 series turret mechanic works only on turret repair. At skill level 3, they become responsible for both turret and automotive repair. The same is true for the 63D (old 63C) except at skill level 3, they add armament repair to their chassis repair responsibility.

As the training program is planned now, the soldiers in these MOSs should, to prepare them for skill level 3 responsibilities, attend the Systems Mechanic Course for their MOS at the US Army Ordnance Center and School. Of particular interest to Field Artillery units will be the conversion of 63C to 63D. The courses are scheduled to be approximately 10 weeks long and are based on gaining additional technical skills in the current MOS as well as the crossover skills necessary to make a true Systems Mechanic, (to include advanced recovery techniques). Some leadership and managerial instruction will be included in the program of instruction. The courses are expected to be implemented on 1 October 1980.

The second major change has to do with the Wheeled Vehicle Repairman, MOS 63B. This MOS will now become two MOSs, either 63B or 63S, until skill level 3 when 63B and 63S will again become 63B. At skill levels 1 and 2, Light Wheeled Vehicle/Power Generation Mechanics will hold the 63B MOS, while Heavy Wheeled/Materials Handling Equipment Mechanics will hold the 63S MOS.

A third change impacting on self-propelled Field Artillery units is the deletion of ASI U6 now added to the 13B MOS to identify Field Artillery Weapons Mechanics. Soldiers having an ASI of U6 and working/slotted as a U6 in self-propelled units will be converted to MOS 45D. The 13BU6 spaces will be retained in towed unit TOEs. Also, a new two-week course will be initiated at Fort Sill to train personnel in the necessary skills to maintain the M198 (155-mm towed howitzer) and is planned to produce towed artillery mechanics in time frames which will support the fielding of the system.

View From The Blockhouse

In the new Mechanical Maintenance Career Management Field, two MOSs common to self-propelled artillery units (63F and 63C) have been eliminated. The deletion of the 63C MOS has resulted in creation of four systems-oriented organizational automotive maintenance MOSs (63D, self-propelled artillery; 63E, XM1 tank; 63N, M60A1/A3 tank; and 63T, improved towed vehicles/IFV/CFV) and the 63Y MOS, which is not systems oriented.

Recovery duties, currently the responsibility of the Recovery Specialist (deleted 63F MOS), will be assumed by the automotive mechanics and repairmen. These soldiers will be responsible for and receive training in recovery operations with the specific pieces of recovery equipment associated with their area of responsibility. For example, MOS 63D will operate tracked recovery vehicles in self-propelled units while 63Bs will operate wheeled recovery vehicles in towed artillery units.

According to current plans, reclassification of soldiers holding eliminated MOSs will occur in September this year, based on their unit of assignment and job he or she is working in at that time (figure 1). For example, a specialist 4 currently holding the 63C MOS and working as a tracked vehicle mechanic in a self-propelled artillery unit will automatically be awarded the 63D MOS in September. In general, this applies to all MOSs at all levels affected by the new program. More guidance will be available later this year on exceptions to the policy described.

Current MOS		Skill Levels 1 and 2 MOS		Skill Levels 3, 4, and 5 MOS	Skill Level 6
13BU6	=	45D (SP Arty)	=	63D (SP Arty)	63Z
63B	=	No change	=	No change	63Z
63C	=	63D (SP Arty)	=	63D (SP Arty)	63Z
63S	=	No change	=	63B	63Z

Figure 1. Summary of changes.

Skill qualification tests (SQTs) based on the changes will begin with the SQT administration in October 1981.

The critical point is that, even though reclassified soldiers may initially continue to perform the same duties, they will be responsible for their new MOS maintenance skills and knowledges when reassigned to another duty position and on the SQT. To assist in this transition, the US Army Ordnance Center and School is preparing exportable training in the form of correspondence lesson plans which may be tailored to meet the requirements of each soldier. Consideration will be given for skills and knowledges already acquired. As an example, a Recovery Sergeant, MOS 63F30, being reclassified into MOS 63D, Systems Mechanic, will take subcourses on Field Artillery armament and automotive repair but will not be required to complete subcourses dealing with recovery operations. Current plans call for these subcourses to be

available to soldiers in the field prior to September 1980.

Commanders are asked to make the 13BU6 change to 45D as quickly as possible. The demand for 63D will be high and the opportunity for promotion in the new 63 field appears to be excellent (figure 2).

Grade	Ideal	Achieved
E8	0.019	0.026
E7	0.067	0.08
E6	0.11	0.33
E5	0.179	0.177
E4	0.269	0.287
E3	0.34	0.301

Figure 2. Grade density percentiles.

For additional information on the Systems Mechanic Program as it impacts on Field Artillery units, call AUTOVON 639-2323 (Mr. Neher) or 639-5523 (Mr. Converse).

Communication readiness

"Steel on the target without communications is as easy as nailing jello to a tree." Based on the apparent lack of communication readiness of some units in the field today, there are many soldiers who are trying the jello-and-nail routine! For example, during a recent field survey, the following was discovered.

- In one division, 76 percent of the FM radios checked by a maintenance team did not work properly; 88 percent of the problems were cable or antenna related.

- In another division, 163 radios were randomly selected from a single brigade and 80 percent of them were inoperable. Some had not worked in months; yet most of them could have been repaired within the unit.

Several recurring problems which contributed to poor maintenance procedures included the following:

- Division artillery, brigade, and battalion Communication Electronics Staff Officers (CESOs) did not visit subordinate units.

- FADAC mechanics/repairmen were misused or improperly assigned.

- Test equipment was not available for the 31V10 Tactical Communications System Operator Mechanic—Radio Repairman.

- On-the-job and field training for communication troops was inadequate.

Field artillerymen have definite responsibilities to insure that their communication equipment is functioning properly and that resources are available to maintain assigned equipment. Personnel who should assist in meeting these responsibilities include:

- Communication Electronics Staff Officers (captains and lieutenants who are trained to keep the equipment working).

View From The Blockhouse

- Tactical Communication Chief (MOS 31V30, Supervisor and Maintenance Chief).
- Tactical Communications System Operator Mechanic—Radio Repairman (MOS 31V10).
- FADAC Repairman (MOS 31V10F7).

Besides the unit assets, the division Signal officer and the direct and general support shops also have the mission to assist and provide support. Additionally, the Communications/Electronics Department, USAFAS, can provide help. For assistance—

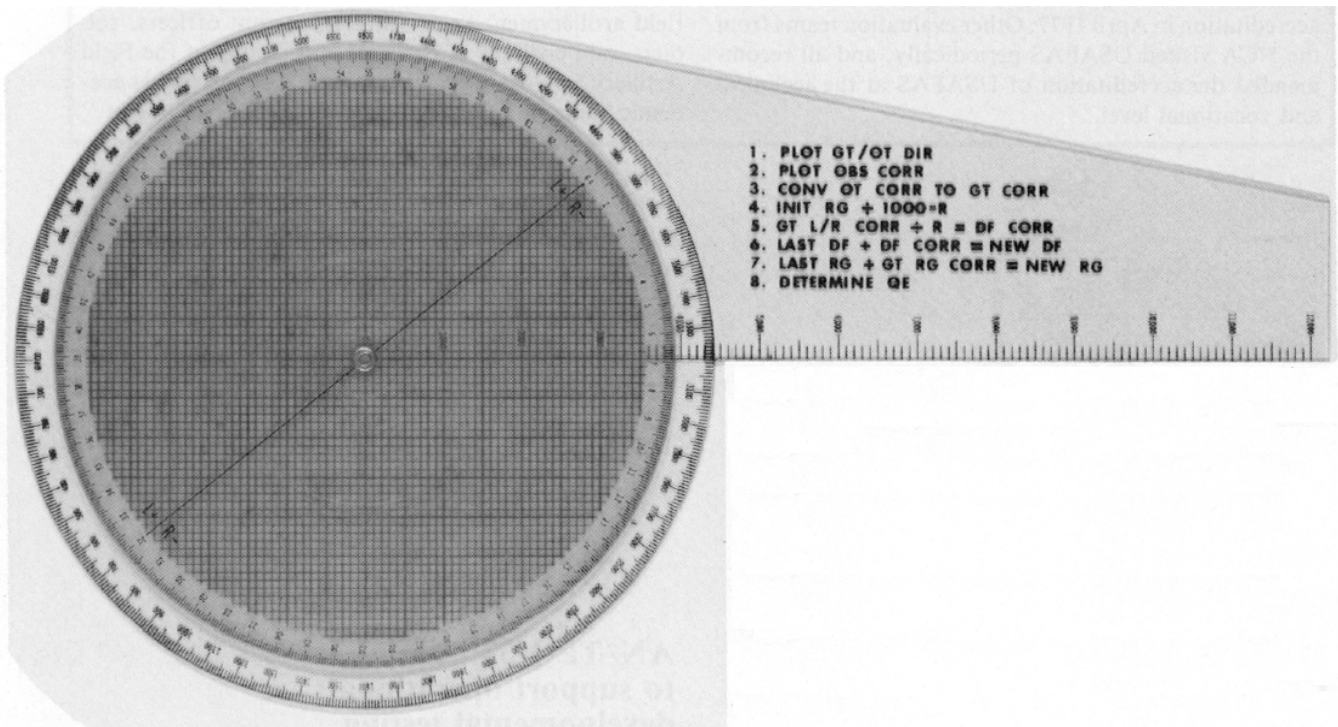
Write: Commandant
US Army Field Artillery School
ATTN: ATSF-CE
Fort Sill, OK 73503
or call: AUTOVON 639-3115.

Artillerymen are good at keeping their vehicles and artillery pieces in serviceable condition, so why not communication equipment?

If a radio doesn't work and Signal troops can't repair it, contact the division Signal officer and on up the line until you find the needed support. In most cases the equipment is still good; it is not usually old worn-out items, "black magic" electronics, sun spots, or radio waves that prevent you from communicating, but lack of command emphasis; i.e., not caring enough to learn and/or lack of support by assigned Signal personnel.

Command emphasis doesn't mean yelling at your communications chief or Signal officer to "fix it or else"—it means finding out whether you have the assets to repair and test the equipment. Also, it means knowing the capabilities of your personnel. For example, has your communications chief been to MOS school? Is his expertise only in limited areas? These things (plus 100 others), along with implementation and follow-through, are needed.

Use command emphasis to make your communications system work! (COL Karr, Dir, CED, USAFAS)



Hipshoot!

One of the most difficult tasks for a battery executive officer (XO) during a hipshoot is to determine an accurate range and azimuth of fire to the target while "bouncing down" the tank trail. Although many techniques and tools are used to determine initial data (calibrated eyeballs, pieces of string, protractors, and coordinate scales are a few) a single item (shown below) can be used to reduce the XO's required equipment.

the initial range and azimuth of the known, the XO can now lay the guns, announce deflection 3200, and determine charge and quadrant using a graphical firing table (GFT) or a tabular firing table (TFT).

Subsequent corrections may be made using the inner rotating scale in the same manner as an M10/M17 plotting board. Instructions for using the inner rotating scale may be found on page 14-9, paragraph 14-6, of FM 6-40. Requests for further information addressed to the Commandant, USAFAS, ATTN: ATSF-CT-TM-PD, Fort Sill, OK, 73503. (CPT Moore and CPT Turner, DCRDT)

USAFAS accredited

The US Army Field Artillery School was recently accredited as a member of the North Central Association of Colleges and Schools (NCA).

"Accreditation" in simple terms means that the School does what it claims to do. Students attending USAFAS will be able to transfer credits earned in some courses to other educational institutions.

US Army Training and Doctrine Command (TRADOC) Schools were directed in 1975 to seek membership in regional accrediting agencies.

USAFAS completed the first phase of the process in July 1976 when it published a comprehensive self-study, covering all aspects of the School, and submitted it to the NCA.

In January 1977 an on-site evaluation team from the NCA visited the School to review the self-study and to make recommendations on desired progress.

The School was officially accepted as a candidate for accreditation in April 1977. Other evaluation teams from the NCA visited USAFAS periodically, and all recommended the accreditation of USAFAS at the technical and vocational level.

Although USAFAS was accredited at this level because it is not a degree-granting institution, the School was judged by the same standards that other NCA accredited schools must meet. The NCA is one of the six regional accrediting agencies in the United States.

The decision on which courses will receive credit, and the amount of credit given for completion, is made by the American Council on Education (ACE).

As courses are added to the USAFAS curriculum, ACE will evaluate them to determine whether credit should be given. In addition, the entire curriculum will be re-evaluated every five years by the NCA.

Noting that "we have won the victory after a long hard fight," MG Jack N. Merritt, then Commandant, congratulated all those whose efforts made the undertaking a success. He added that, for the worldwide community of field artillerymen, "the officers, warrant officers, soldiers, and civilians of the staff and faculty at the Field Artillery School are proud to have earned this higher academic honor as a part of the TRADOC School System."



COUNTERFIRE SYSTEMS REVIEW

Target Acquisition Commanders Conference

A Target Acquisition Battery (TAB) Commanders Conference will be held at Fort Sill on 18-20 November 1980, in conjunction with the annual Fire Support Conference. Previous TAB commanders conferences have been well attended, offering an outstanding forum for interchange of ideas between the Counterfire Department and field units.

All TAB commanders are urged to make plans for attendance. Division artillery and Field Artillery brigade

tactical operations center team chiefs and Counterfire officers are also encouraged to attend. Reserve and National Guard officers in these positions are included in this invitation.

Any topics recommended for discussion should be submitted to the address below. We would also appreciate several presentations from some of you in the field. If interested, please contact LTC Nilson or MAJ Wisser (AV 639-3312/4270) at the Counterfire Department, USAFAS, or write:

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

AN/TPQ-37 training to support operational/developmental testing

The Counterfire Department (CFD) is conducting Firefinder courses on the AN/TPQ-37 artillery locating radar which will provide trained operator and organizational maintenance player personnel to support Operational/Development Test III (OT/DT III). Training includes use of the A17E11 Firefinder, the AN/TPQ-37 radar, and A17E12 operator and organizational maintenance trainer facilities.

Development Test III operator players will complete training at Fort Sill, OK, in early July and proceed to Fort Huachuca, AZ, where final engineering tests to validate production system configuration will be conducted through 17 October 1980. Operational Test III operator and organizational maintenance players will complete their training at Fort Sill by late August and proceed to Fort Hood, TX, to participate in final system testing in an operational environment. This tactical evaluation is scheduled to be completed in November this year. Shortly after completion of these three OT/DT III courses, CFD will begin Firefinder institutional training, dedicated to support next years European deployment.

FM 6-2 revision

The Counterfire Department's Survey Division requests field comments and suggested improvements on revising and updating FM 6-2. Revision of the manual is scheduled to be completed by February 1981 and published in draft by October that year.

Subjects to be included for the first time will be the Position Azimuth Determining System (PADS), the computer set TI-59 with new forms, and possibly a new infrared distance measuring device, the Hewlett-Packard 3808-A.

Standardization will also be addressed. A research project being conducted by four students in the Officers Advanced Course is looking into the idea of eliminating fourth and fifth order FA survey as separate entities and replacing them with a standardized level of survey with common specifications and common sets of equipment. Standardized field artillery survey would be used at all cannon battalions, division artilleries, target acquisition batteries, and missile units if approved. If the project is feasible, the results will greatly reduce the amount of training required by surveyors, reduce the number and types of equipment used, and eliminate much material currently included in the FM 6-2.

The Counterfire Department is vitally interested in your comments and suggestions on what should be considered in standardizing the FA survey party and what improvements can be made to the new FM 6-2. While these proposals are on the drawing board is the time to make your voice heard and you can do so by contacting:

Commandant, USAFAS
ATTN: ATSF-CF-SV (Mr. J. F. Alexander)
Fort Sill, OK 73503
AUTOVON 639-6616/2805

Status of sound ranging equipment under procurement

Sound Ranging Set, AN/TNS-10

When the Sound Ranging Set, AN/TNS-10, was type classified, a contract was let to S & W Electronics, Cherry Hill, NJ, for 36 initial sets. When this contract was filled, each Active Army sound/flash platoon of the division artillery target acquisition battery received one of its two authorized TNS-10s. In May 1978 a second contract was let to Communicology Inc., Brooklyn, NY, for 54 additional sets. (Sound platoons were scheduled to receive their second set starting in March 1980; however, the date has now slipped to September 1980.)

Radio Data Link, AN/GRA-114

On 28 June 1979 a contract for 90 AN/GRA-114s (Radio Data Link) was let to International Signal Controls & Electronics, Lancaster, PA, with delivery scheduled to begin in September 1981. The revised schedule is as follows:

Europe	15 March 1982
TRADOC	15 May 1982
Korea	15 June 1982
FORSCOM	15 July 1982

All Active Army units are scheduled to receive both of their authorized AN/GRA-114s. The Counterfire Department is continuing its effort to get additional buys to equip Reserve Component target acquisition batteries with these equipments.


Computer Set, FA, General

The Computer Set, FA, General (T1-59), with sound/flash and survey modules, is now in stock. Since funds expended on initial issue of this item will be reimbursed, the authorized allowance should be requisitioned immediately.

Hewlett Packard Calculator, HP-9825A

Because of the requirement to replace FADAC in the sound/flash platoons, the Atmospheric Sciences Laboratory at White Sands, NM, programmed the Hewlett Packard HP-9825A Calculator to process sound/flash ranging data. This program has been tested by USAFAS and found to be satisfactory; therefore, action has been initiated to procure this equipment (should be available for issue in FY81) for issue to sound/flash platoons. Additionally, a cathode ray tube (CRT) is to be procured for use with the HP-9825A. The plot will be displayed on the CRT, thus eliminating the need to compute and plot time intervals manually.

Work continues on the development of Draft TC 6-20-3, *Fire Support Operations in Brigade Size Units*. When final, it will replace the current TC 6-20-10, *FIST*, and will embody approved recommendations made by Close Support Study Group II.



After the tank, then what?

by MAJ Orville T. Stokes Jr.

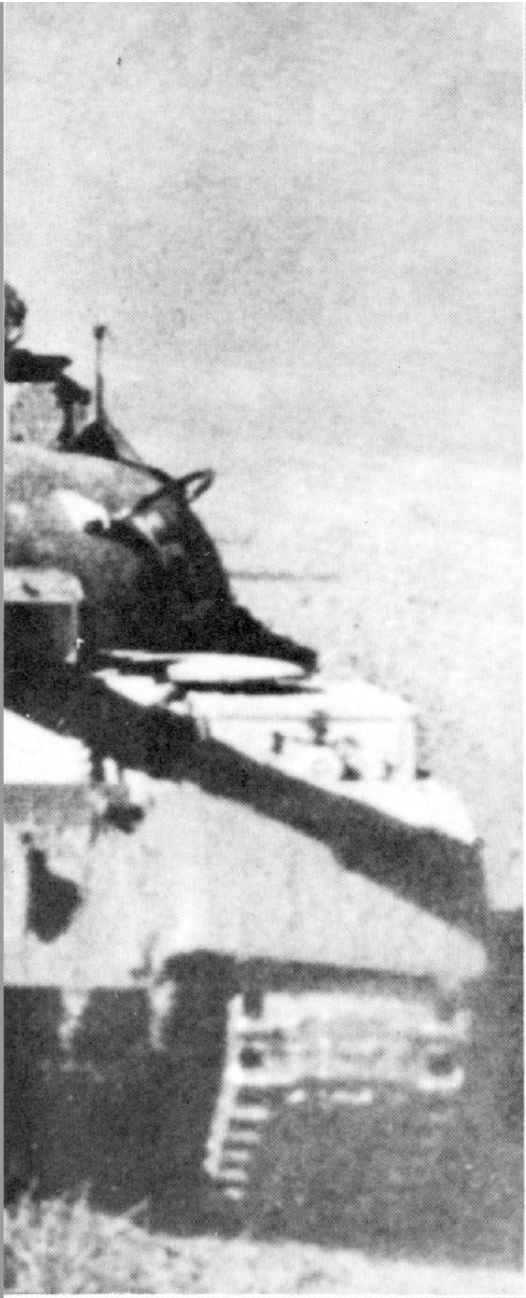
In broad terms, contemporary doctrine focuses on the use in battle of all arms: helicopters, tanks, infantry, and artillery. There is nothing new in this, but it is a lesson that each succeeding generation of commanders has to learn anew. The Middle East War of 1973 restated the doctrine in the most striking terms. It was evident that the Israelis' emphasis on armor and air forces cost them dearly at the outset of the campaign. It was only when the infantry and artillery joined in a combined arms effort that they were able to redress the balance—Drew Middleton

The defense of Europe

In the preceding paragraph, Mr. Middleton reminds us that it is easy to overlook the fundamentals necessary for successful military operations. Is the new defensive concept for Europe, the *active defense*, fundamentally sound? I think not. When employed properly, the tactics of the active defense have the potential to blunt the initial Soviet offensive, but after we've stopped their armored legions, what then? I believe the active defense is good for only one phase of the war and that we

must be prepared to shift to a tactic which gives a better chance of overall victory rather than just winning the first battle.

The active defense allows commanders to conduct offensive operations while defending, an important psychological edge. This strategy requires the enemy to be engaged far forward of the main defensive positions by a strong covering force which uses successive delay positions and *kill zones* to seriously attrit the enemy force. When the main defensive positions are reached, all available force is committed to the



enemy's destruction. Not so long ago, US forces depended on a *two-up one-back* strategy which guaranteed a strong reserve. Not so anymore. In the active defense, a division reserve may be less than one combat battalion since all combat power is forward where it can be concentrated on the enemy.

Observers have labeled the new strategy *risky*, citing the lack of a strong reserve, weak flanks, and tightly packed formations as presenting a lucrative nuclear target. In a recent article in *ARMY* magazine, MAJ Richard Sinnreich analyzed the

active defense from the standpoint of tactical maneuver. Additionally he identified several more objections when he stated:

The active defense overemphasizes firepower to the virtual disregard of tactical maneuver. In effect, the active defense seeks victory in a battle of attrition in which all the advantages lie with the numerically preponderant aggressor . . . it is a zero defects defense, but it must be executed by imperfect soldiers and commanders . . . simultaneous attacks on multiple axes might well overload, and ultimately paralyze, even a well-planned defense.

There is a good deal of truth in these observations. Even advocates of the active defense concede there is little room for tactical error using these tactics. There are, however, strong counterarguments.

A former Commander of Training and Doctrine Command, GEN William DePuy, a strong supporter of the active defense, noted that in West Germany the political and geographic tolerance for the classic defense is extremely low. Translated into military terms this means that the German Allies are committed to *defend—not delay*—since West German territory will not be conceded without a fight (like the Israelis, they are committed—it's their country). Our own options are therefore reduced since US forces share tactical

boundaries with the Germans. If they defend, we must, or risk leaving large gaps in NATO defenses. The question then is not *whether* to defend but *how*.

The active defense should give North Atlantic Treaty Organization (NATO) forces an opportunity to take advantage of their areas of qualitative superiority; e.g., target acquisition, advanced munitions, and the greater effective ranges of tank-killer systems. Our technology has given us the means to *minimize risk* but we can never eliminate it, although commanders today can "see the battlefield" better than ever before. This increased intelligence should assist commanders in positioning our limited forces, but there are other positive considerations. General DePuy pointed to the significant terrain advantages which accrue to the well selected defense; i.e., as much as 8 to 1 for dug-in infantry and 15 to 1 for tanks. He noted that this advantage decays over range and usually over time. If the defender is to maintain this advantage, he must use armored mobility to withdraw, keeping the aggressor at long range. The active defense attempts to use these terrain advantages again and again by defending from successive delay positions, and this is where it becomes a bit *sticky*, for rear boundaries preclude defending only at points where the terrain naturally favors the defender. Good terrain must be found and used, but it can't be too far back from the present national borders.

Risky or not, the active defense may in a few years be viable. Many US tank-killer weapons have on paper a 3,000-meter (3-kilometer) effective range, although, in reality, reduced visibility conditions will greatly reduce this edge. Even in the desert in the 1973 war, the Israelis found that tank engagements generally occurred under 1,000 meters. In Germany there are strong reasons to believe engagements would be closer

ranges where Soviet weapons compare with ours in lethality. A Soviet/Warsaw Pact (WP) attack would likely be timed to insure that visibility is minimal, although by the early 1980s this situation will most likely change when US forces receive all-weather sights. For the first time then, US forces will be able to take advantage of the long ranges which are built into many systems; e.g., CLGP, PGMs, TOW, and XM1, 2, and 3. All-weather sights will allow opposing forces to be engaged about 1,000 meters outside the effective range of their direct-fire weapons, a potentially decisive advantage.

In the coming decade qualitative improvements in US artillery munitions will lessen the immunity to artillery which armored formations now enjoy. Currently experts estimate that a one-hour conventional artillery bombardment will inflict only 1 percent losses to an armored unit, which is hardly worth the effort. This percentage will change however with the fielding of cannon launched guided projectiles (CLGP), a *smart* artillery shell with an 80 to 90 percent chance of destroying an armored vehicle.

The cannon launched guided projectile is not the only new advancement in artillery, the family of scatterable mines (FASCAM) is a system of artillery-delivered antipersonnel and antitank minelets, the majority of which are capable of disabling a tracked vehicle. One analyst even predicted that the introduction of CLGP and FASCAM will *slow tanks to a crawl*. Perhaps this assessment is overly optimistic since CLGP and FASCAM will only account for 4 and 9.3 percent, respectively, of an artillery battery's basic load of ammunition. Nonetheless, their introduction will certainly restrict the use of armor. Therefore, for the first time, time and technology appear to be on the side of the active defense and, in fact, may be its two greatest allies.

The Soviet perception

What about the Soviet reaction to our defense strategy? Much has been written about the active defense in the West; yet little has appeared in the Soviet press. There are several possible explanations. First, the active defense doesn't really affect Soviet tactics since, regardless of how we defend, a Soviet attack would follow highly structured, predetermined tactics. The Soviets in fact may even believe the active defense works to their advantage (NATO forces will essentially *fix* themselves where they intend to defend). Once the Soviets reach NATO's main defensive areas, weakened flanks should prove vulnerable to envelopment, the favored Soviet tactical movement. Consequently, they probably aren't concerned with NATO's stronger covering force, which they believe is not capable of slowing down their attack.

The second reason that the active defense has been ignored by the Soviets is that they have more pressing concerns. For example, soviet articles appearing in the West indicate they are still searching for solutions to problems identified in the 1973 Yom Kippur War. Although the Soviets weren't a participant, their equipment and tactics were certainly tested. The Soviet press unanimously agrees that changes must be made to protect their armored war machine from the threat posed by antitank guided missiles (ATGMs).

Crucial questions still unanswered are how much will ATGMs slow down the advance and what can be done about it. With more than 40,000 Soviet armored vehicles in Eastern Europe, these discussions understandably involve the top echelons of Soviet leadership, to include Soviet Marshall Grechko who states:

The conditioning process of perfecting the antitank

weapon has placed before science and technology a serious task in the business of tangibly raising the viability of tank troops and developing more effective means of reliably suppressing antitank defenses.

Even before the Arab-Israeli 1973 War, the Soviets recognized the potential of ATGMs. In 1972, the Soviet book *Antitank Warfare* noted that ATGMs had significantly greater range and armor penetrating power than tanks, had a high kill probability, and under operational conditions could expect to achieve a favorable kill-ratio of 4 to 1 against tanks and double that against armored personnel carriers (APCs). In 1972 this contention was still theoretical and unproven in combat; however, after the October War it was taken seriously. In a recent article in *Parameters*, LTC Wolfgang Samuel, an Air Force Research Associate at the Massachusetts Institute of Technology Center for International Studies, concluded that the Soviets apparently intend to meet the ATGM threat by using *heavy artillery* and *rocket barrages* and by depending on *resolute behavior* by tank crews. He added another sobering thought, "Tactics have a limited potential to overcome basic system deficiencies." Is the ATGM superior to the tank? Certainly not at the present time since ATGMs have limitations which allow them to be defeated. The gunner, who must either guide or control the missile to its target, is in my judgment the weak link. (The gunner can be distracted by nearly all countermeasures as proved by the Israelis in 1973, but that is no guarantee that these tactics will be effective in the next war.) With the continuing development of *smart*

munitions, the introduction of *fire-and-forget* ATGMs guided to the target by a sight picture taken the moment the projectile is fired is inevitable—probably within the next several years. This combination of fire-and-forget ATGMs, CLGPs, FASCAMs, and the direct fire means currently available should make it possible to either slow armored movement or stop it altogether.

A European war scenario

Assume that in the mid-1980s NATO and Warsaw Pact forces will begin "conventional" war in Europe. NATO covering forces meet strong resistance and are forced back to main defensive positions. Since NATO main defenses are strong, the Soviet/WP commander realizes that these positions can be taken only with a time-consuming deliberate attack; therefore, he decides to try to breach NATO defenses at weakly defended points. In the early morning hours, Soviet/WP forces attack. Indications are that electronic warfare successes allowed them to accurately pinpoint boundaries between units. After several hours, a pattern of major and minor salients becomes apparent. NATO orders all available air and artillery units to seal off the most dangerous penetrations. Soviet columns are engaged by antitank gunships and USAF A10 squadrons with success. Long-range artillery firing CLGP rounds further decrement the attacker, and all armored penetrations are eventually stopped. Credit for stopping the assault goes to the relatively new fire-and-forget ATGMs which proved to be even more lethal than anticipated. In three days Soviet losses include 65 percent of assaulting tanks, APCs, and SP artillery destroyed, with another 10 percent disabled. US and NATO forces have suffered approximately 50 percent casualties in men and equipment.

Based on this scenario, it is apparent that even armor formations supported by mechanized infantry cannot operate freely on a

high-technology, high-intensity battlefield. Artillery support for the WP divisions conducting the penetrations has also been ineffective since much of it was destroyed by antitank weapons systems. Airpower has surprisingly not played a major role either, as the *air umbrella* of both sides has proved to be deadly to both fixed wing and helicopter support systems. The fears of Marshall Grechko appear to have been realized. The Soviet offensive strategy lies in ruins on the battlefield. Movement invites destruction, with stalemate the apparent result. The NATO lines, although thin, are holding. Apparently the US strategy adopted by NATO has proved its merit. Although penetrations were made, the defense was *elastic*; it bent but didn't break. Faced with the choice of negotiating, escalating to nuclear weapons, or changing tactics and continuing with a conventional assault, a conventional attack is selected. "*Old School*" generals convince policymakers that a tactic from WWII, the *firestorm*, where massed artillery is used to totally saturate an area, will be effective against the remaining NATO defenses. The Soviet aim is destruction of 60 percent of the remaining forces with artillery alone. Tanks and APCs are used to secure each objective after the artillery barrage and hold it while the artillery displaces forward. A moderate rate of advance, leapfrog style, is believed to offer greater assurance that ATGMs and artillery will be suppressed. The Soviet decision proves to be wise since NATO forces aren't prepared for the massive artillery bombardments, and already weakened units are destroyed by artillery in piecemeal fashion. Allied artillery has the potential but not nearly enough ammunition to counter this offensive. NATO stocks of ammunition have been depleted stopping the first Soviet offensive. The Soviet advance continues, this time largely

unopposed, as US CONUS-based forces haven't arrived in sufficient numbers to greatly affect the outcome.

It has been commonly accepted for some time that US and NATO forces could only win a war in Europe if they could stop the Soviet/WP armor threat. They did stop it, and yet lost the war. Why? The inescapable conclusion of this scenario is that the Allies failed to adequately consider all the threats facing them. Just as the Israelis in 1973, NATO had miscalculated. The Soviets too had miscalculated, but they had enough available resources to implement revised tactics. Unlike the Israelis whose miscalculation came at the beginning of the war, the NATO error only became apparent at the end—much too late.

The artillery option

Artillery has been one of the most important elements in 20th century warfare. In World War I, 58 percent of the casualties were caused by artillery; in World War II, this figure varied from 78 percent in open terrain to 50 percent in dense terrain. Even in the Middle East, where tank warfare has been the norm, the use of artillery proved effective against dug-in troops and columns on the move.

All modern armies depend on artillery support. Soviet armies even have separate artillery divisions—14 of them. Although they aren't comparable on a one-to-one basis, this is nearly as many artillery divisions as the US has combat divisions in the Active Army, an indication of the value the Soviets place on artillery support. While NATO and the US enjoy qualitative superiority in several fire support areas, such as fire control, target acquisition, counterbattery fire, and the type and quality of munitions, the inescapable fact is that NATO artillery is significantly outgunned in Europe. Estimates vary. One analyst states the gap is not large, 3,400 field pieces for

the Soviets and 2,800 for NATO. Another puts the number of Soviet artillery pieces (over 100-mm) at over 18,000. General DePuy places the disparity at something less than 2.5 to 1. Although exact figures aren't all that important, the pattern is clear.

The use of all this artillery poses some interesting dilemmas for the Soviets. With the exception of GSFG Soviet divisions, most artillery is towed while nearly all assault elements are mechanized. This mobility imbalance obviously creates some problems; therefore, the Soviets are moving to plug this gap. Towed batteries are being replaced by 122-mm and 152-mm SP artillery. This conversion is rapidly taking place in the first line divisions, but will take years for the army as a whole. For the time being, it is understandable that the Soviet press expresses concern with the ability of their artillery to provide continuous fire support during an assault.

The Yom Kippur War revealed several other artillery defects. At the expense of their Soviet trained and equipped Arab allies they learned that the standard field deployment used by Soviet/WP forces since WWII has a low chance of survival. (Troops were unprotected and the linear formation was easily targeted.) Also revealed was the need for *shoot and scoot* tactics, rapidly relocating firing batteries after a specified time to avoid counterbattery fire. The Soviets expect NATO counterbattery fire within 6 to 10 minutes; many would say this is wishful thinking—that it would arrive much sooner. The point is, even this time frame poses a problem for towed batteries, which don't move out quite as fast as their SP cousins. Any vehicle in the Soviet army can pull an artillery piece if necessary, but this is mobility only in a limited sense, and there are other problems. Artillery units have limited organic communications and thus, in some cases, may depend on the supported

unit to pass on fire requests. Even when this system works, it cannot be as responsive as US and NATO fire support methods using organic communications.

Even the most recent improvements, the introduction of 122-mm and 152-mm SP artillery may not result in required artillery support. This artillery has the capability of accompanying attacking forces—a capability which will be required since the SP artillery might well be used in a direct fire support role to suppress ATGMs. The ATGM suppression mission which has vexed the Soviet hierarchy has apparently settled on the artillery. Many Soviet authors have argued that only artillery has the capability of reliably suppressing an enemy's antitank defense. A good case can be made for this argument. But why the direct fire approach? ATGM suppression is tailor-made for artillery in an indirect fire support role. When the main guns of tanks and BMPs are considered, the Soviets seem to have enough direct fire weapons without exposing their limited SP artillery to destruction by direct fire weapons. This artillery will be only 500 to 1,000 meters behind the advancing troops, where they will accomplish little and take high losses.

With all of the problems cited, why is artillery the kingpin of the scenario? Think for a moment about artillery in general and Soviet artillery in particular. Artillery is generically so lethal that it doesn't have to be extremely accurate—close is usually good enough. If there is enough artillery available to dedicate 70 to 100 tubes of artillery per kilometer in a key area (which is generally understood to be Soviet doctrine), anyone within that area would be affected. Without strong overhead cover, elements wouldn't survive. Soviet counterbattery fire plans reflect their dependence on massed fires. US planners can be selective and massive strikes are not normal procedure, but

this is not the case with Soviet artillery. A US 155-mm battery eight kilometers from Soviet guns could be on the receiving end of 290 to 330 rounds; at a range of 12 kilometers when front artillery is considered, 550 to 650 rounds; and at 16 kilometers when army artillery assets are added, 900 rounds.¹ The chances are the Soviets would elect not to waste all this ammunition on one target, but the capability is there. Soviet use of artillery is not characterized by finesse, has never been, and we shouldn't expect that to change in the future.

In the scenario, after NATO demonstrated that Soviet armor could be stopped, and the Soviets learned that modern warfare had evolved past the tank as the main player, both adversaries were left with what they had not lost or committed. For the US, it was largely a matter of what we hadn't lost, for other combat units couldn't get there in time. The Soviets, on the other hand, could divert other in-theater assets with limited delay. At this point, the Soviets would have lost many of their best units and equipment. At the front, much of the Soviet artillery would have survived. With the exception of the SP artillery supporting the penetrations, which took very high losses, US and NATO counterbattery fire had been less than the Soviets anticipated. Apparently US and NATO counterbattery fire had been limited due to the priority given to stopping Soviet/WP armor. In short, a great deal of artillery and unseasoned troops would be available for use in whatever strategy was selected. The *firestorm strategy* took advantage of what was on hand; the troops need not be very good or the artillery very mobile as long as there was enough of it. In the classic work by A. A. Sidorenko, *The Offensive, A Soviet View*, he indicated that in a nonnuclear environment the use of tactics previously successful, i.e., barrage

fire, couldn't be ruled out. Soviet tacticians haven't forgotten what was successful in their last war, nor should we. Soviet planners don't want to use this tactic; the construction of the Soviet land forces are predicated upon swift mechanized movement. However, circumstances might make what they want to do academic.

From the US standpoint, basic problems exist with this tactic. We aren't prepared either physically (from an equipment standpoint) or mentally to face massive artillery barrages. The Vietnam-tested US Army knows about rocket attacks, but much of this knowledge was obtained from covered and improved bunkers—a commodity not likely to be found during the first few weeks of a war in Europe. Only the US Marines at Khe Sanh really found out what a real artillery pounding was like and they too had their bunkers. In Vietnam, US forces grew accustomed to artillery and air superiority and they haven't had to learn to operate without them, although it is obvious that will be necessary. More important, military professionals are preoccupied by the armor threat. To appreciate the tank is necessary, for the armored offensive must be stopped. But when legitimate concern leads to disregard of equal or greater threats, it creates a dangerous situation. I believe that is happening today.

Conclusion

Any perception of the threat which concentrates on the tank and doesn't consider Soviet artillery on an equal scale is faulty. Major General Merritt, as Commandant of the US Army Field Artillery School, recently heralded what he felt was a *period of renaissance* for the Field Artillery and fire support. Although General Merritt was speaking specifically about NATO countries, his words ring equally true for our adversaries. At the same time, as a result of lessons learned in the 1973

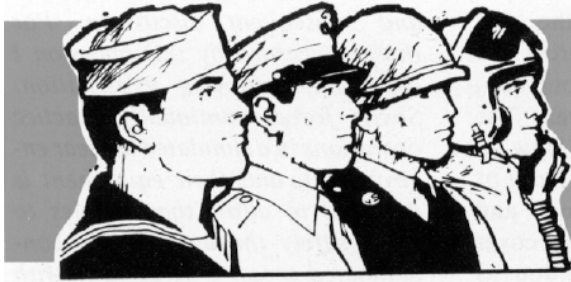
Middle East War, our forces are much more concerned about concealment than about cover. The threat, reinforced by the *How to fight* manuals, is seen as *in front of* and not *from above*. Both cover and concealment are vital; lack of cover in the long run is just as hazardous as lack of concealment initially. Emphasis on *concealment* may inhibit measures to develop overhead cover. The lead time required to field any product or system makes it imperative that we recognize the problem and act now.

Even if NATO can stop the massive Soviet/WP tank and motorized rifle armies, their artillery and reserve forces must still be reckoned with. We can't count on the many problems facing Soviet artillerymen to make our task any easier, for we are told by responsible analysts that the Soviets are taking the identification and solution of their tactical problems very seriously. Several years from now their artillery may be far better employed than it appears to be now. The Chairman of the Joint Chiefs of Staff, GEN David Jones, recently remarked that we have shown a tendency to underestimate Soviet programs—not to overestimate them. When all our technological wonders are deployed, we must guard against being lulled into a false sense of security. To again quote Major Sinnreich, who makes the point succinctly, . . . "the key question remaining unanswered by proponents of the active defense is where a successful defense will leave us when it is over." By the mid-1980s the active defense should have a credible tank-stopping capability; but it cannot succeed against the Soviet artillery option which could cause NATO to lose the war. After the tanks are stopped, what then? Let's get an answer now while time is still our ally. ☒

The reader may question the omission of nuclear play in the

scenario and subsequent discussion. For those concerned by this omission I offer the following explanation: Soviet forces continually practice operations in a simulated nuclear environment, and their equipment is designed to allow their armies to move safely through nuclear contaminated areas. I agree fully with those who state there would be strong pressure, especially within the Soviet military, to resort to nuclear weapons if stopped by NATO in a conventional conflict. But in the final analysis, I don't believe Soviet politicians (they and not military commanders will make the decision just as in our country) will decide to first use nuclear weapons, even small yield tactical nukes. They can't predict any more than I can what would happen following the initial release. There is a strong probability that the conflict couldn't be confined to tactical nukes in Europe. The Soviets would gain little by occupying an industrialized country which they couldn't exploit or use productively for years due to radiation hot spots. My crystal ball has been turned on a subject I believe has a high probability of happening, a nonnuclear war in which there are some very unpleasant surprises in store for both sides. If I am wrong and the Soviets decide to pull the nuclear trigger, someone else's crystal ball will be required to predict the outcome.—MAJ Orville T. Stokes.

MAJ Orville T. Stokes Jr. is the Security Officer, SSO Heidelberg, and is assigned to the Office, Deputy Chief of Staff for Intelligence, Headquarters, USAREUR.



With Our Comrades In Arms

Navy receives new target acquisition system

The first production Mark 23 Target Acquisition System (TAS), designed to protect US Navy ships against hostile cruise missiles, has been delivered by Hughes Aircraft Company. Under an initial \$32.5 million contract, Hughes Ground Systems Group will build seven TAS radar systems and spares, and the Navy may exercise options to buy an additional 33 systems.

Developed for the Naval Sea System Command, TAS will be installed on DD963 destroyers and high-value Navy auxiliary ships to detect antiship cruise missiles launched from submarines, surface ships, or high-altitude aircraft. The Mark 23 radar selects targets on a priority basis and relays target data to the ship's fire control systems for weapons firing.

The high-speed radar system provides time for the weapons system to conduct multiple firings at the targets with a high kill-rate probability. The Mark 23 can be fully automatic, detecting and designating in all environments including clutter and electronic jamming. It is the only fleet radar capable of fully supporting the sophisticated NATO Seasparrow surface missile system (NSSMS), and it can be expanded to designate targets for other ships' missiles and guns.

New engines for KC-135s

The Pentagon has selected the CFM International (General Electric/SNECMA) CFM56 turbofan for development as the replacement engine for the Boeing KC-135 tanker aircraft. Boeing was awarded a \$13.6 million contract for the planning, preliminary design, and developmental testing of a KC-135 aircraft re-engined with CFM56s.

It has not yet been decided whether all KC-135s will be retrofitted with new engines, but it appears to be a likely step because of the increased emphasis placed by the Carter Administration on airlift capability. The Pentagon's so-called Rapid Deployment Force could require more transport aircraft, capable of being refueled in mid-air, than are available today. This in turn would also mean the need for more tanker aircraft to refuel the air transport fleet. This latter need will be partly met by the 20 McDonnell Douglas KC-10 tanker aircraft currently being manufactured. The continued use of

Boeing B-52s, Lockheed C-141s, and Lockheed C-5As in the fleet also underlines the need for USAF tanker aircraft.

The potential importance of the CFM56 retrofit program can be seen when it is realized that the USAF Strategic Air Command controls approximately 615 KC-135s of which 128 have been transferred to the Air Reserve and Air National Guard.

The retrofit program would serve to prolong the service life of these aircraft, the first of which was delivered to the USAF as long ago as 1957.

New chemical protective mask

Initiation of an intensive effort to develop a new chemical-biological protective mask has been announced by the US Army Armament R&D Command's Chemical Systems Laboratory, Aberdeen Proving Ground.

The mask is being developed for use by all US Armed Services. When fielded, it will replace the current inventory of protective devices.

Designated the XM30, the new mask provides respiratory, eye, and face protection against chemical and biological agents. It consists of a molded elastomer facepiece with an in-turned peripheral seal and a large flexible lens bonded to the facepiece.

Canada is assuming responsibility for developing the mask's new canister, which can be worn on either cheek. The external canister can be easily attached to either side of the mask and will enable the seven or eight percent of military personnel who are left handed to use shoulder fired weapons without a special mask. The Army's current protective mask, the M17A1, has a filler in both cheeks, making it difficult to properly sight the Army's M16 rifle.

The new mask has a flexible wide-angle lens for coupling with field instruments and sighting devices on modern sophisticated weapons. Other features include a dual voice-mitter system as well as systems for drinking and providing mouth-to-mouth resuscitation. For aircraft and tank applications, where a chest-mounted canister is required, a hose assembly is provided.

The mask will be produced in small, medium, and large sizes to accommodate male and female personnel and assure a rapid donning capability. (*Army R, D&A magazine*)

BLACK HAWK to replace Huey

The Army's new utility tactical helicopter, the BLACK HAWK, is replacing the UH-1 Huey as the air carrier for combat troops in the 1980s. Plans call for over 1,100 BLACK HAWKS to be produced for the Army by 1990.



With the UH-60 BLACK HAWK's increased payload and troop carrying ability over that of the Huey, 15 BLACK HAWKS can replace 23 UH-1s in a combat support aviation company (CSAC).

CW3 Carl R. Brown, a standardization instructor pilot with the 101st Airborne Division (Air Assault), Fort Campbell, KY, says the BLACK HAWK does a lot more than the Huey. "This aircraft can carry a squad of 11 troops and a TOW vehicle. It would take three UH-1s to do that same job."

Equipped with the BLACK HAWK, a CSAC can transport up to 210 troops in one lift, and three CSACs can lift an entire rifle battalion including its 81-mm mortars, REDEYE and TOW teams, and vehicles. And, with a sprint speed of 160 knots (about 185 mph), the BLACK HAWK can do it faster.

Powered by twin T-700 turbo shaft engines, the BLACK HAWK can carry more than twice the Huey payload, in all types of weather.

Referred to as "the most mature engine ever placed in an Army aircraft," the T-700 has a modular design, where parts of the T-700 can be changed in the field without removing the entire engine. It is smaller, weighs 40 percent less, has lower fuel usage, and requires only a quarter of the maintenance of a Huey engine.

The new utility helicopter is designed to overcome combat shortcomings found in the UH-1 such as lack of power to operate in high temperatures and altitudes and vulnerability to attack by small arms fire.

Advanced features and survivability systems allow the BLACK HAWK to be the "most survivable helicopter ever built for the Army." Also, critical components are redundant or self-correcting to enable the BLACK HAWK to withstand small arms hits.

Air Defense School marks 156th anniversary

As World War I machine gunners turned their weapons skyward to defend against attacking aircraft and hastily modified 75-mm guns were called to service for anti-aircraft use, the need for schooling in anti-aircraft tactics quickly became apparent.

To meet this new threat the Army, in 1917, directed three officers to study the French Army's organization and training in anti-aircraft defense. From that study, the first American anti-aircraft school was established in France.

The US Army Air Defense School, a direct descendant of that pilot anti-aircraft school in France, recently marked its 156th anniversary.

With roots going back to 1824 when the Artillery Corps for Instruction was established at Fort Monroe, VA, the School's unique heritage can be traced through the Artillery School (1942), Anti-aircraft and Guided Missile School (1946), and finally, in 1957, the US Army Air Defense School.

Since 1824, the School has seen crude artillery weapons evolve into supersonic guided missiles. From original classroom instruction in the technical operations of a 75-mm gun, the study of air defense at Fort Bliss has grown to an educational institution that includes two brigades, six staff elements, and four academic departments. With a current enrollment of some 3,000 students, including 265 artillerymen from 14 foreign countries, the School conducts 59 courses of instruction. Training in the current family of air defense weapons include the Hawk, Nike Hercules, Chaparral, Vulcan, and Redeye.

An active partner in the research and development of air defense weapons, the Air Defense School is planning and developing changes in its academic departments to handle added training missions for four new weapons—Stinger, Patriot and Roland missile systems, and the DIVAD (Division Air Defense) gun. Instruction for the Stinger is scheduled to begin this year while training programs for the Patriot, Roland, and DIVAD gun are expected to be implemented in early 1982. (Jim Lemons)

With Our Comrades In Arms

Divisions reorganized

Department of the Army recently announced that all Active Army divisions located in CONUS will be placed under three corps headquarters, which will include the existing III and XVIII Corps at Fort Hood, TX, and Fort Bragg, NC, respectively, plus a new corps to be added in the western United States. (A delay in activation of a "western corps" is expected due to personnel and budget constraints.)

III Corps will include:

- 1st Infantry Division, Fort Riley, KS (less OPCON).
- 5th Infantry Division, Fort Polk, LA.
- 1st Cavalry Division, Fort Hood, TX.
- 2d Armored Division, Fort Hood, TX.
- 3d Armored Cavalry Regiment, Fort Bliss, TX.
- 6th Armored Cavalry Brigade, Fort Hood, TX.
- III Corps Artillery, Fort Sill, OK.
- 11th Air Defense Artillery Group, Fort Bliss, TX.
- 13th Support Command, Fort Hood, TX.

The XVIII Airborne Corps will include:

- 24th Infantry Division, Fort Stewart, GA.
- 82nd Airborne Division, Fort Bragg, NC.
- 101st Air Assault Division, Fort Campbell, KY.
- 197th Infantry Brigade, Fort Benning, GA.
- 194th Armored Brigade, Fort Knox, KY.
- XVIII Airborne Corps Artillery, Fort Bragg, NC.
- 1st Support Command, Fort Bragg, NC.
- 36th Engineer Group, Fort Benning, GA.

Although the need for a "western corps" has been recognized, the divisions that would be assigned to it will, for now, continue to report directly to US Army Forces Command, Fort McPherson, GA. These divisions are:

- 4th Infantry Division, Fort Carson, CO.
- 7th Infantry Division, Fort Ord, CA.
- 9th Infantry Division, Fort Lewis, WA.

YCH-47D helicopter tested

The 101st Airborne Division (Air Assault) recently received its first YCH-47 D-model Chinook helicopter, one of three prototypes designed and built for the Army by the Boeing Vertol Company.

The YCH-47D is at Fort Campbell as part of Development Test II which is being supervised by the US Army Aviation Development Test Activity (USAADTA) at Fort Rucker. According to CPT Alan D. Sodergren, a test pilot for USAADTA, "We're going to be carrying external loads that are typical of what the YCH-47D will be expected to transport in the field."

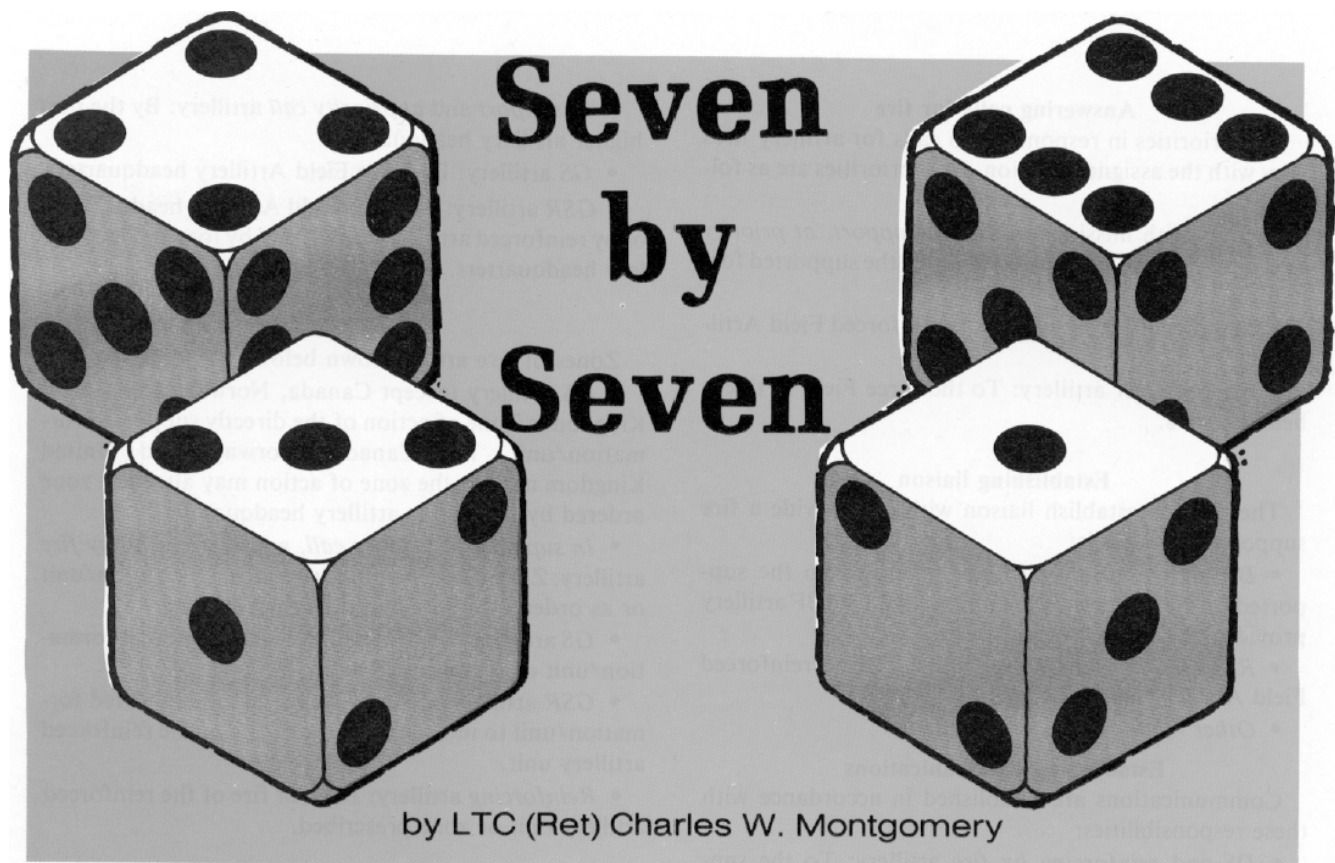
As part of the test, the helicopter will be expected to carry five loads using its unique triple-hook system which not only lifts the load but stabilizes it as well.

While at Fort Campbell the YCH-47D will carry a MILVAN trailer rig, a gama goat, a 155-mm howitzer, a large CONEX container, and a 20-mm antiaircraft gun.

The new helicopter has already lifted the new M198 howitzer which weighs about 15,000 pounds.



Members of the Boeing Roland organization check out two US Roland fire units at company facilities in Seattle, WA. These fire units are used in training US Army instructors and key personnel who will develop Army courses for its own instructors and operators. Receiving instruction are personnel from the Army Air Defense School at Fort Bliss, TX, and the Army Missile Munitions Center/School at Redstone Arsenal.



Although most artillerymen of the NATO military community often encounter differences in weapons, munitions, organizations, procedures, and languages, there are many areas which are common to all nations. This commonality is the goal of NATO standardization agreements—more commonly called STANAGs. These are records of agreement among several or all of the member nations to adopt like or similar military equipment, ammunition, supplies, and stores and also operational, logistical, and administrative procedures.

An example of this commonality is evidenced in the *seven* responsibilities inherent in each of the *seven* tactical tasks or missions used by NATO artillery. This uniformity is the focus of this article.

Background

In 1971, the Artillery Procedures Working Party, under the Army Board of the NATO Military Agency for Standardization (MAS), commenced work on a draft STANAG wherein all artillery would use four or five standard tactical missions. Due to differences in national resources and needs, however, this goal could not be achieved. Finally, it was decided to draft an *informative* type STANAG, listing all artillery tactical missions used throughout NATO. This resulted in a list of *seven* tactical missions:

- Direct support (DS).
- General support (GS).
- Reinforcing (R).
- General support—reinforcing (GSR).
- In support.
- At priority call.
- Reinforcing by fire (mutual support).

The first four tasks/missions are assigned the US Field Artillery while only the French artillery is responsible for "reinforcing by fire."

It was agreed by all nations that the STANAG of concern would show *seven* responsibilities inherent to each of the *seven* tasks. These common responsibilities are:

- Answering calls for fire (priorities).
- Establishing liaison.
- Establishing communication.
- Furnishing observers (or FISTs).
- Moving (deploying) weapons.
- Zone of fire.
- Planning fires.

With this accord, STANAG 2887, "Tactical Tasks and Responsibilities for Control of Artillery" was born. It allows each nation to better understand the tactical missions and responsibilities of the artillery of other member nations.

Answering calls for fire

The priorities in responding to calls for artillery fires vary with the assigned mission. *First* priorities are as follows:

- Units with missions of *DS*, *in support*, *at priority call*, and *reinforcing by fire* (RBF): To the supported formation/unit.
- *Reinforcing* artillery: To the reinforced Field Artillery.
- *GS* and *GSR* artillery: To the force Field Artillery headquarters.

Establishing liaison

The need to establish liaison with (or provide a fire support officer to) is:

- *DS* and *reinforcing by fire* artillery: To the supported formation or unit. Additionally, the RBF artillery provides liaison to the reinforced FA.
- *Reinforcing* and *GSR* artillery: To the reinforced Field Artillery headquarters.
- *Other missions*: No requirement.

Establishing communications

Communications are established in accordance with these responsibilities:

- *DS* and *reinforcing by fire* artillery: To the supported formation or unit.
- *Reinforcing* and *GSR* artillery: To the reinforced Field Artillery headquarters.
- *Other missions*: No requirement.

Furnishing observers/FISTs

Observers or FISTs, as appropriate, are furnished as follows:

- *DS* artillery: To maneuver companies (troops) of the directly supported formation or unit.
- *Reinforcing* artillery: To the reinforced Field Artillery, when requested.
- *GSR* artillery: To the reinforced Field Artillery, if approved by force Field Artillery headquarters.
- *Other missions*: No requirement.

Moving (deploying) weapons

Responsibilities for moving (deploying) artillery weapons are:

- *DS* (except Canada, Norway, and United Kingdom artillery) and *reinforcing by fire* artillery: By the *DS* (unit) commander or as ordered by the force Field Artillery headquarters. *DS* for Canada, Norway, and United Kingdom artillery: By the next higher artillery headquarters.
- *Reinforcing* artillery: By the reinforced Field Artillery headquarters or as ordered by the force Field Artillery headquarters.

- *In support* and *at priority call* artillery: By the next higher artillery headquarters.

- *GS* artillery: By force Field Artillery headquarters.
- *GSR* artillery: By force Field Artillery headquarters or by reinforced artillery if approved by force Field Artillery headquarters.

Zones of fire

Zones of fire are as shown below:


- *DS* artillery (except Canada, Norway, and United Kingdom): Zone of action of the directly supported formation/unit. For Canada, Norway, and United Kingdom nations the zone of action may also be a zone ordered by the higher artillery headquarters.
- *In support*, *at priority call*, and *reinforcing by fire* artillery: Zone of action of the supported formation/unit or as ordered by higher artillery headquarters.
- *GS* artillery: Zone of action of the supported formation/unit or a prescribed zone.
- *GSR* artillery: Zone of action of the supported formation/unit to include the zone of fire of the reinforced artillery unit.
- *Reinforcing* artillery: Zone of fire of the reinforced artillery unit or zone prescribed.

Planning fires

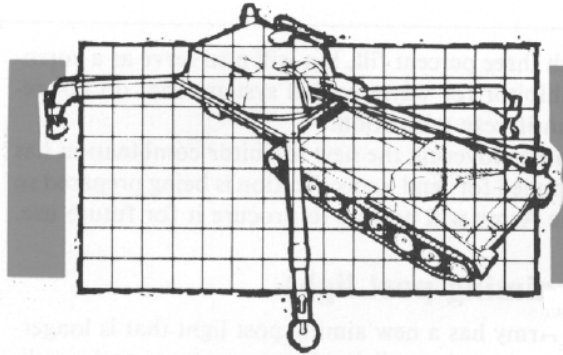
Artillery has its fires planned in accordance with its tactical task (mission) as follows:

- *DS* artillery: Develops own fire plans commensurate with the needs of the directly supported formation/unit.
- *In support* artillery: By the next higher artillery headquarters.
- *At priority call* artillery: By the formation/unit to which placed at priority call.
- *GS* artillery: By force Field Artillery headquarters.
- *GSR* artillery: By force Field Artillery headquarters or as otherwise specified.
- *Reinforcing* artillery: By the reinforced Field Artillery.
- *Reinforcing by fire* artillery: By own fire direction center and reinforced artillery unit.

Summary

This article has focused on but one example of standardization in NATO artillery procedures. It has pointed to the *seven* tactical tasks (missions) and the *seven* responsibilities for each mission. From this standard framework, NATO artillerymen have a better understanding of "How the other fellow does it." This makes working during combined operations that much easier. 

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FA Test and Development

Forge fires arsenal bonanza

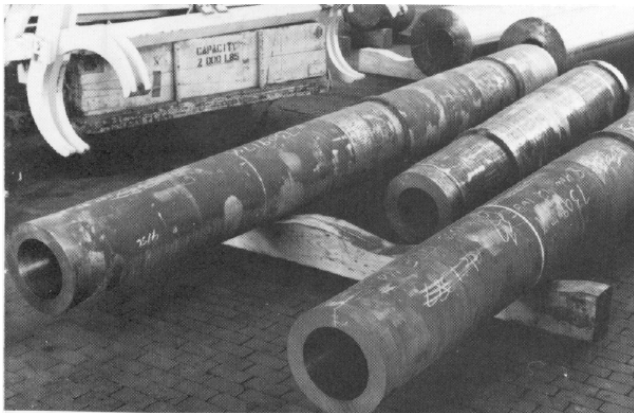
In these days of recycling everything from paper and tin cans to bottles and other containers, the idea of reclaiming waste material and reprocessing it for use in making "second-generation" goods is nothing new.

At Watervliet Arsenal, NY, however, the combined efforts of the Benet Weapons Laboratory, Product Assurance and Operations have given a new twist to the concept of recycling. Through recent efforts, these organizations have discovered cost-saving methods of recycling worn-out artillery tubes and breech rings—projects that promise to mean million-dollar payoffs for the Arsenal.

Old tubes scrapped

According to the project leader in Benet's Advanced Engineering Section, "shot-out" gun tubes, such as the now-replaced 8-inch M2A2 howitzer, have traditionally been sold to scrap dealers for remelt. The scrapped-out tubes sell for only a few cents per pound—a fraction of the value of the alloys contained in the high-quality steel used in the original tubes.

The advent of the rotary forge at Watervliet—with its ability to forge various configurations from a given volume of raw material—opened up a new idea for disposing of worn-out tubes.



Two 155-mm M185 preforms and one 105-mm M68 perform (center) await rotary forging. All three preforms were cut from scrap 8-inch M2A2 howitzers.

First step taken

The first step in testing this concept was the design of a computer system that would show potential combination of tubes that could be reformed directly from different-size "fired-out" guns returned from the field. In the case of the 8-inch M2A2, tube length and diameter showed a potential for yielding two new 105-mm M68 tubes after rotary forging.

To test the theory in practice, several scrap 8-inch M2A2 tubes were shipped to the Arsenal from depot graveyards.

Gun bores were first cleaned to remove rifling and any firing damage. Next, some minor machining was done on the outer surface and each tube was cut into three sections—two to be reformed into new tubes and the other to be discarded.

Each 8-inch M2A2 scrap tube can produce either two 105-mm M68 forgings or two 155-mm M185 forgings.

Savings add up

The potential savings from recycling scrap tubes can add up to millions of dollars. For example, a conventional 105-mm M68 forging costs about \$3,200 versus a cost of about \$1,200 for rotary forging from a scrap tube.

In another project, engineers propose to recycle 8-inch M2A2 breech rings and other small breech components to produce a breech mechanism for the M201 howitzer. With a minimum amount of machining, a scrap M2A2 ring can be made into a new ring for the M201 howitzer, at a savings of 60 percent of cost.

By recycling the M2A2 ring, the Arsenal can save both the cost of buying a new breech ring forging and the cost of start-to-finish machining—savings of almost \$5,000 per breech. With more M2A2 breeches at the Letterkenny Army Depot, PA, which are now in various stages of disassembly, the potential savings could add up to a healthy sum.

Still a third project at Watervliet Arsenal involves machining a bushing from a 12-inch piece of steel cut from the breech end of the M201 tube. By cutting step threads and machining, the former scrap piece can be reclaimed as a bushing for the recycled 8-inch M2A2 breech ring assembly, a saving of \$1,000 per unit. (Maureen Gour, PAO, Watervliet Arsenal)

FA Test and Development

Contract awarded for advanced guided projectile

The US Army has awarded Martin Marietta Aerospace a \$4 million contract for the Advanced Indirect Fire System (AIFS) program. The 24-month effort includes study of technologies associated with range extension of cannon-launched guided projectiles and development and test of lock-on-after-launch seekers.

Under the contract, Martin Marietta will develop and evaluate a prototype millimeter-wave seeker in ground and captive-flight tests in conjunction with an earlier developed infrared seeker. The seekers will be tested against a variety of military vehicle targets in several operational environments.

Both seeker concepts will be further analyzed to develop a tactical seeker design that can be packaged in a 155-mm projectile and survive cannon-launch environments. Following the conceptual design phase, critical components will then be studied for possible integration by Martin Marietta into a 155-mm projectile designed to have a range capability in excess of 20 kilometers.

The AIFS program is being managed by the US Army Armament Research and Development Command, Dover, NJ, and is jointly sponsored by the Defense Advanced Research Projects Agency.

Corrosion inhibitor

A new corrosion inhibitor that extends the useful life of vehicle antifreeze has been developed by the US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA.

The inhibitor was formulated by MERADCOM's Energy and Water Resources Laboratory, Fuels and Lubricants Division, as part of the national effort to conserve petroleum resources. Ethylene glycol, the base fluid component for all military and most commercial antifreezes, is a petroleum distillate, and extending its useful life helps to reduce crude oil consumption.

Testing of the extender was conducted in both gasoline and diesel powered vehicles. Test vehicles were selected with a coolant that retained adequate freeze protection while the corrosive protection was rated as marginal or discard. When added to the cooling systems in a three percent concentration, the extender successfully recharged the antifreeze corrosion protection for an additional year of use.

The tests also indicated that the extender is an excellent corrosion inhibitor for any water cooling systems. It proved to be especially effective in providing protection to aluminum cooling system components at

very high temperatures. Therefore, the antifreeze extender will not only extend the useful life of antifreeze an additional year for each three percent fill, but will also serve as a corrosion inhibitor for water cooled systems that do not require antifreeze protection.

A patent covering the new inhibitor combination has been applied for, and a specification is being prepared so that the Army will be able to procure it for future use.

New aiming post light

The Army has a new aiming post light that is longer-lasting and works well in all temperatures and conditions. Similar to a flashlight in that it is powered by two D-cell batteries, a light emitting diode (LED) replaces the standard "bulb" which increases battery life more than 100 times.

The new device combines two LEDs (red and green) with a three-way switch which will allow quick color change. It is lightweight and waterproof and will function at temperatures below freezing. Perhaps of greater importance, it is estimated that the light will save the government an average of \$222,497 a year!



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

International consortium formed

Martin Marietta Corporation, USA, and Diehl GmbH, Federal Republic of Germany, have formed an international consortium—PGM Systems—initially to plan co-production of the Copperhead laser-guided artillery projectile in Europe. Extensive studies by the two companies have established the need for Copperhead and its potential for economic production in Europe. During 1980, headquarters for the new organization will be in Nuremberg, Germany.

Qualified industrial partners from European NATO countries have been invited to join the consortium to participate in planning for the production and sale of the guided projectile to their respective countries. Participants will be selected on the basis of their knowledge of Copperhead and its interfaces, willingness and ability to promote the system with their respective governments, and production capabilities. Countries represented will manufacture, test, and assemble components and subsystems in proportion to the value of their respective Copperhead procurements.

It is intended that PGM Systems will act as prime contractor for planning, manufacture, and logistical support and will provide the requisite technology and manufacturing expertise for the production of Copperhead in Europe.

Having undergone successful developmental and operational testing, the Copperhead 155-mm guided projectile is now in the production phase. The guided round is fully compatible with a number of NATO howitzers, including the FH70, SP70, and 155GCT, and can be used with a variety of airborne and ground laser designators.

The consortium was formed with the conviction that guided projectiles, such as Copperhead, offer a significant advantage in combat capability for NATO forces as a deterrent against the numerical superiority of Warsaw Pact armored elements. Extensive testing and analyses of guided projectiles have demonstrated their effectiveness under European terrain and weather conditions.

Interest in guided projectiles has been expressed by a number of NATO countries, indicating a substantial market for such products. The consortium is unique in that it is proceeding in expectation of procurement approval by various governments, rather than waiting until firm European government commitments have been made.

European manufacture is planned to be fully compatible with US production and would thus meet US requirements for alternate sources for components and subsystems.

As prime contractor, PGM Systems, assisted by the various industrial participants, will submit directly to interested European NATO governments offers regarding the planning, manufacture, and logistical support of Copperhead in Europe. PGM Systems will provide technology transfer and manufacturing expertise, manufacturing licenses, engineering support, and technical, financial, and marketing analysis support. It will develop co-production and work-sharing plans. In addition, it will analyze and plan a legal entity which will contract for production orders and will support interested governments in technical analysis and operational effectiveness studies.

The planning work of PGM Systems is scheduled to be completed by the end of this year. Although the organization intends to begin production in the early 1980s, such action requires further approval by the US government.

During the planning phase, participants will:

- Provide marketing efforts.
- Support or perform tactical mission and effectiveness studies for their respective countries.
- Participate in system interface studies.
- Support tactical analyses to determine cost-effectiveness as compared with other anti-armor systems.
- Prepare work-sharing plans and conduct competitive bidding for pricing components and subsystems.
- Support PGM Systems component tests.
- Evaluate all special production facilities and their delivery schedules.
- Establish qualified sources for commodity procurements.
- Determine production lead times.

In the procurement phase, participants will supply components and subsystems as negotiated with the respective governments and will share in the logistical support phase, including troop training.

Tadeusz Kosciuszko:

Father of American Artillery Tactics

by CPT David T. Zabecki

The first major American treatise on artillery tactics, *Manoeuvres of Horse Artillery*, was written in 1800, in Paris, by Tadeusz Andrzej Bona-wentura Kosciuszko, a former brigadier general in Washington's Continental Army and the last commander of the Army of the Kingdom of Poland. The book is marvelously simple and straightforward and forms the basis for US Artillery tactics from the War of 1812 through the dawn of the Civil War. Many of today's current tactical concepts can be found within its pages.

Kosciuszko (pronounced Kawshchoosh'-ko) was born in Poland in the Palatinate of Breese in 1746. He was educated at the Jesuit College at Breese and the Royal Military School in Warsaw where he became First King's Cadet. Graduating in 1769 as a captain, he received a scholarship to study Engineering and Artillery at Mezieres, France. When he returned home in 1774, however, the First Partition of Poland had already taken place, and he found little opportunity to



apply his military skills and subsequently returned to Paris.

In 1776, he was stirred by the announcement of the American Revolution and managed to borrow sufficient money for a trip to America. He arrived in Philadelphia in August 1776 and presented himself to the Pennsylvania Committee of Defense. It was an uneasy time in America because the British were closing a land-sea pincer

on the Continental Army which had been badly beaten at the Battle of New York, and American forces were falling back across New Jersey toward Philadelphia under constant pressure from Lord Cornwallis. Meanwhile, a British fleet under Admiral Howe was positioned in the Atlantic preparing to attack Philadelphia, the seat of the Revolutionary Government.

In light of this impending disaster, Kosciuszko was asked to fortify the Delaware River where he built sea forts on Billingsport Island and positioned artillery batteries to control both the riverbanks and the waterway. After assessing the high cost of taking these forts, Admiral Howe elected to stay at sea which in turn caused the British pincer to remain open. This action allowed Washington time to regroup his forces above Trenton and mount his celebrated attack on the Hessians on Christmas night, 1776. For his efforts, Kosciuszko was commissioned by Congress on 18 October 1776 as a Colonel of Engineers and posted to the headquarters of the Northern Army at Fort Ticonderoga, where General Horatio Gates ordered him to improve the fort's defenses. Kosciuszko devised an innovative plan to fortify the surrounding hilltops with artillery and interlocking fields of fire. The key to his plan involved a battery of guns on nearby Mount Defiance. Gates approved Kosciuszko's plan but was replaced by General Philip Schuyler before the work could be started. Schuyler cancelled Gates plan and ordered Kosciuszko to strengthen the fort's existing works. When the British under General John Burgoyne attacked in June 1777, they immediately started hauling cannon to the top of Mount Defiance. The Americans abandoned Ticonderoga leaving behind critically needed supplies and artillery. Schuyler was then relieved and Gates was restored to command of the Northern Army.

The British plan called for Burgoyne to march on Albany and link up with another British force advancing up the Hudson River from New York City. To prevent this link-up, the Northern Army marched on Burgoyne's forces. Gates sent Kosciuszko ahead to find and prepare the site where the Americans could successfully block "Gentleman Johnnie's" regulars. Kosciuszko selected a location about 20 miles north of Albany near Saratoga.

Kosciuszko laced the area with redoubts and entrenchments. He placed the heaviest concentration of artillery on Beams Heights, which would cover all the avenues of approach and all the natural and artificial obstacles with fire. The Battle of Saratoga was considered the turning point of the war. While not slighting the efforts of Morgan or Benedict Arnold, Kosciuszko was a major contributor to the victory. Gates later wrote: "Let us be honest . . . the great tacticians of the campaign were the hills and forests which a young Polish engineer was skillful enough to select for my encampment." Washington

personally recommended to Congress that Kosciuszko be promoted to brigadier general, based on his effort at Saratoga. Kosciuszko declined. He was all too sensitive to the resentment among American officers of the often politically inspired promotions of foreign officers.

His next assignment, in March 1778, was to fortify an uninhabited patch of wilderness on the Hudson River, known as West Point. Washington called it "the key to America." Control of the area and the river at that point was considered essential to keeping the British forces in New York City contained. Rather than a conventional 18th century fort, Kosciuszko set up the type of defensive system that he had wanted to establish at Ticonderoga. He laid out a network of interlocking forts and batteries whose fields of fire could cover each other, the river, and the approach to the south of West Point. He also designed and built the massive 60-ton chain that was used to block the river. In the fall of 1779, the British massed for an assault on West Point; but, after their reconnaissance revealed the nature and extent of the defenses, they thought better of it.

In his final assignment of the war, Kosciuszko was posted to the Southern Army as Chief Engineer in August 1780. As a means of increasing American mobility in the wilderness areas of the Carolinas, he designed and built a fleet of wagons with detachable wheels and axles that could rapidly convert into flat-bottom boats capable of carrying men, guns, horses, and equipment over the inland waterways. This innovation freed General Nathanael Greene's forces from dependence on existing roads and bridges and was the first major application of mobile riverine warfare in North America. On 14 November 1782, Kosciuszko led an attack against a British foraging party on James Island, SC. This brief skirmish is considered the last military action of the Revolutionary War.

Kosciuszko returned north with Greene in the spring of 1783. At Newburgh, NY, he participated in the founding of the Society of the Cincinnati. On 13 October 1783, Congress made him a brigadier general and awarded him 500 acres of public land, which he was entitled to as an officer. On 4 December 1783, Washington invited him to be present at Fraunce's Tavern in New York City where he delivered his farewell address to the principal officers of his army. With the exception of Lafayette and Steuben, Kosciuszko was the only other foreign officer invited.

Kosciuszko left New York for France and then Poland in July 1784. After four years in rural retirement, he accepted a commission as a major general in the tiny 50,000-man Polish Army. During the spring of 1792, he successfully led a resistance to a Russian invasion for three months, until the Polish King succumbed to Russian intrigue. Kosciuszko resigned his commission and

went to France. The penalty for the resistance was the Second Partition of Poland in 1793.

Kosciuszko intended to return to America; but, at the urging of Polish nationalists, he returned to Poland in March 1794, was invested with the emergency powers of a benevolent dictator, and declared a national uprising against the Russians. There followed a series of stunning victories for the Poles. But in October 1794, Kosciuszko's tiny force of 7,000 was overwhelmed by a combined Russian-Prussian force at the Battle of Maciejowice. He was severely wounded and captured by the Russians. Russia, Prussia, and Austria participated in the Third Partition of Poland in 1795, and Poland disappeared from the map for the next 123 years.

Kosciuszko remained in a Russian prison for two years and, upon his release in 1797, returned to the United States to a hero's welcome. Congress awarded him \$15,000 in back pay for his eight years of service in the Continental Army. He left America for the last time in 1798 and returned to France. Before he left, Kosciuszko established a will, with Thomas Jefferson as executor, directing the use of all his American assets to free and educate Black slaves. The funds from the sale of his 500 acres were used to establish the Colored School at Newark, NJ, one of the first educational institutions for Blacks in America.

Kosciuszko retired in France; but, in 1800, he was requested to perform one more military service for his adopted country. The United States Military Philosophical Society, through US envoy General William R. Davie, requested that Kosciuszko develop a manual of tactics for horse artillery. The resulting *Manoeuvres of Horse Artillery* was published in New York in 1808. Fort Sill's Morris Swett Library has one of the very few remaining copies of the book. In the introduction, Kosciuszko wrote, "The whole science of Field Artillery consists in knowing how to perform the following manoeuvres with the utmost facility, precision, and promptitude:

- 1) To march in advance and in order of battle.
- 2) To retreat in good order and in the same form.
- 3) To march in column, advancing or retreating.
- 4) To fire upon the enemy while advancing.
- 5) To fire upon the enemy while retreating.
- 6) To form front in any direction.
- 7) To fire upon the enemy in flank, on either the right or left."

These seven functions should be to American Field Artillerymen what Roger's standing orders to his Rangers are to American Infantrymen. Specified or implied in these functions are the time-honored artillery

missions of shoot, move, communicate, and acquire targets.

Kosciuszko further elaborates on the importance of communication in his discussion of the duties of the battery's second lieutenant: ". . . it is his duty to communicate the captain's orders to the commanding officer of each half battery and to the first gunner or commander officer of every piece in case of the words being imperfectly heard or understood, so that the duties of this officer are essential to the preservation of order throughout."

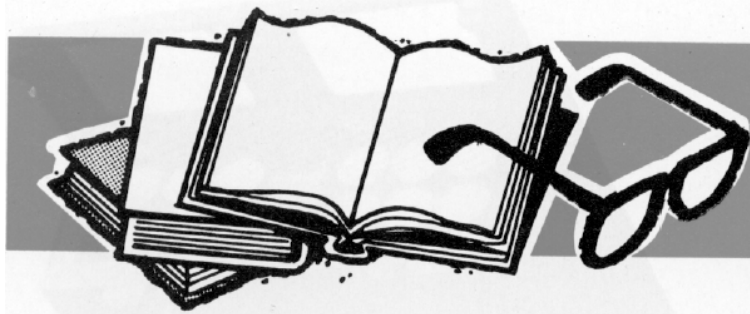
Kosciuszko started with his seven basic maneuver concepts and expanded them into 30 specific maneuvers which he described in detail. The roots of many modern tactical concepts can be found here. Maneuver 19, for example, deals with the notions of split-battery operations and displacement by echelons: "The battery marching in retreat in battle array to fire by half batteries, continuing the retreat." He was also an early advocate of combined arms operations: "Flying or horse artillery when in battle is placed on the flanks, and opposite to the flanks of the enemy, always choosing the most elevated positions, in order to direct a diagonal fire on the enemy's lines. It is also used against cavalry by being covered with its own cavalry; then, when at a proper distance, the cavalry opens to the right and left and unmasks the artillery which has placed itself in battery ready to open the fire the moment it is unmasked. This movement should be made with great rapidity, so that the enemy may be ignorant of the end in view and unable to prevent its effect when it is discovered."

Kosciuszko died in Soleure, Switzerland in 1817. At the request of the Swiss, his heart was buried in Switzerland. His body was returned to Krakow, Poland, where it was interred in the royal crypt at Wawel Castle among the Polish kings. As an interesting side note, Kosciuszko's name was attached to another military action more than 100 years after his death. In 1919-1920, the newly reborn nation of Poland found itself in a war for its survival with its historic enemy, Russia. The backbone of the Polish Air Force in that war was a volunteer squadron of American Pilots; they called themselves the Kosciuszko Squadron.

Tadeusz Kosciuszko was the first major foreign volunteer to the American cause. He was a military hero of two countries; an early champion of universal human rights; the father of American Artillery tactics; and, according to Thomas Jefferson, ". . . as pure a son of liberty as I have ever known . . ."



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Redleg Review

INFANTRY WEAPONS OF THE WORLD, by Christopher F. Foss and T. J. Gander, Charles Scribner's Sons, New York, 1979, 136 pages, \$12.50.

In a compact format the authors have presented a concise yet extensive outline of the close-in fighting weapons of the world's military forces. This second edition gives a thumbnail description of each weapon, its general characteristics and frequently a brief history of materiel development. Most weapons are illustrated by a good photograph but, regrettably, not all. The scope of weapons covered is wide and appropriate for today's surrogate wars fought with materiel which ranges from World War II leftovers to the latest in technology. Properly included are such veterans as the British BREN and Enfield, the German MP40, and the US Springfield. Recent developments are highlighted, including trials to determine a new NATO small-caliber round and the development of the Soviet AKS-74 5.45-mm rifle. Several weapons, not formally adopted by any armed force, but having military potential, are included. The Ruger Mini-14, in use with many police forces, and the Hughes Lockless Light Machine Gun, firing a plastic cased round, are examples considered as likely candidates for military use.

The book arbitrarily limits itself to mortars of 60 millimeters or less and excludes heavy recoilless and antitank missile systems. These larger weapons are covered in companion volumes from the same publisher. A noteworthy feature in this edition is inclusion of those characteristics by which different national origins can be determined. This is useful, considering many widely built arms, such as the Soviet PPSH and AK series, produced throughout the world. Not intended as an encyclopedia to rival such works as W.H.B. Smith's *Small Arms of the World*, this compact, concise volume will be of interest to anyone looking for a handy, up-to-date quick reference.

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VICTORY AT HIGH TIDE, by COL (Ret) Robert D. Heintz, The Nautical and Aviation Publishing Company of America, Annapolis, MD, 315 pages, \$16.95.

"I also predict that large-scale amphibious operations . . . will never occur again."—Omar N. Bradley, 19 October 1949.

So begins *Victory at High Tide*, COL Robert D. Heintz's well-written account of the September 1950 Inchon-Seoul campaign. In this fast-paced book, Colonel Heintz provides excellent coverage of the operation that shifted United Nations forces from the defensive to the offensive during the initial phase of the Korean War. This would never have occurred without the understanding and support of amphibious warfare by General Douglas MacArthur.

A Navy planning officer summarized the Inchon operation by stating, "We drew up a list of every natural and geographic handicap—and Inchon had them all."

Victory at High Tide is the story of the men who overcame those obstacles and by doing so defeated the entire North Korean Army. Colonel Heintz traces the operation from political maneuvering by the Joint Chiefs of Staff to the Marine riflemen in action on the streets of Seoul. His transitions from strategic to tactical discussions are logical and easily understood.

To quote the author "It is a story of strategic prescience and unflinching nerve on the part of a high commander, of professional resourcefulness and expertise in the forces which were his instrument. Above all, it is the account of a triumph which could have been achieved only by a maritime power, more particularly by a 20th century American maritime power."

Victory at High Tide offers a welcome addition to any military library.

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F-111, by Bill Gunston, Charles Scribner's Sons, New York, 1978, 112 pages, \$9.95.

In 1960 the Air Force needed a replacement for the F-105, and the Navy needed a new aircraft for fleet air defense. Secretary of Defense Robert McNamara insisted that the airplanes needed by both services had missions in common and, despite protests by the military, ruled that a single tactical fighter, the TFX, would be built to meet the requirements of both. Design proposals by General Dynamics and Boeing were evaluated, with the military strongly recommending the Boeing design—only to be shocked later when Mr. McNamara awarded the contract to General Dynamics.

The controversial TFX project nearly failed in the early stages of development because the Navy version had to operate from carrier decks. Fortunately, this was solved by Congress in 1968 when funds for the Navy version were denied and it was dropped from the program.

As development of the Air Force version (the F-111) progressed, one major problem remained unsolved—weight and drag had increased but engine thrust had remained constant. Gone were the options of maneuvering the aircraft as a fighter and using short runways. Instead, the F-111 would have to rely on its good points—high speed, outstanding radar, "navaids," penetration aids, and the ability to make first-pass attacks on blind targets.

By the time the F-111 reached operational status, it was thought to be equal, or superior, to any attack airplane in existence. Then, in Vietnam, it proved to the world that it could not only perform its mission, but it could perform it and survive. Today, F-111 pilots are nearly unanimous in their praise.

The book, *F-111*, tells of the aircraft's controversial origin, grudging acceptance, and final success. The aircraft represents great achievement in technology, and Bill Gunston tells its story in a highly interesting and unbiased manner.

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

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