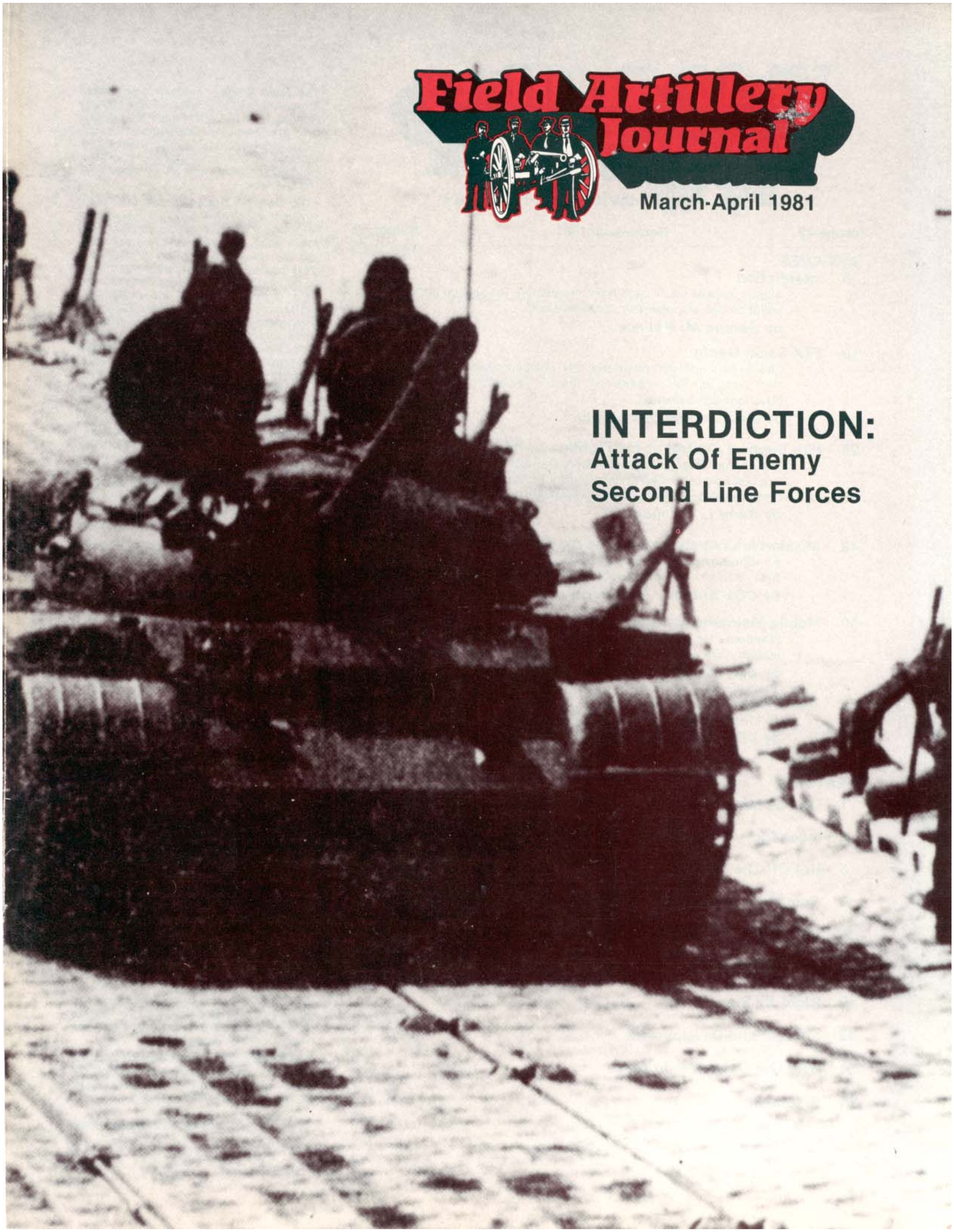
Field Artillery Journal

March-April 1981



INTERDICTION:
Attack Of Enemy Second Line Forces

Field Artillery Journal

the journal of fire support

Volume 49 **March-April 1981** **Number 2**

ARTICLES

FEATURES

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PURPOSE (as stated in the first *Field Artillery Journal in 1911): "To publish a journal for disseminating professional knowledge and furnishing information as to the field artillery's progress, development, and best use in campaign; to cultivate, with the other arms, a common understanding of the power and limitations of each; to foster a feeling of interdependence among the different arms and of hearty cooperation by all; and to promote understanding between the regular and militia forces by a closer bond; all of which objects are worthy and contribute to the good of our country."*

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On the Move

by MG Edward A. Dinges

All of us are aware of the current shortage of Field Artillery captains which has resulted in many 03 billets, including battery command, being filled by officers in the grade of lieutenant. The resulting ripple effect is felt throughout the chain of command, so that in many units, junior battery grade positions go unmanned.

Under these circumstances it may be tempting to ease the burden by withdrawing FIST chiefs from their parent headquarters battery and attaching them to firing batteries to carry out additional duties. Here we think of supply and maintenance tasks as "professional development" for Field Artillery lieutenants. Doubtless these jobs have some training value, but certainly they are not more important than the opportunity for these young officers to begin building the core of knowledge necessary to perform their primary duties.

For the past several years the Army has followed the central theme of "train the way we will fight," and I believe our FIST chiefs epitomize that challenge. Indeed, there is a full time training requirement for each FIST chief in "his company" if he is to:

•Maintain team proficiency.

•"Sell the Field Artillery" to maneuver commanders and insure that fire support is integrated into normal daily maneuver unit training.

•Assist in mortar training.

•Train all soldiers in the company to call for fire.

•Become an indispensable member of the ground gaining team.

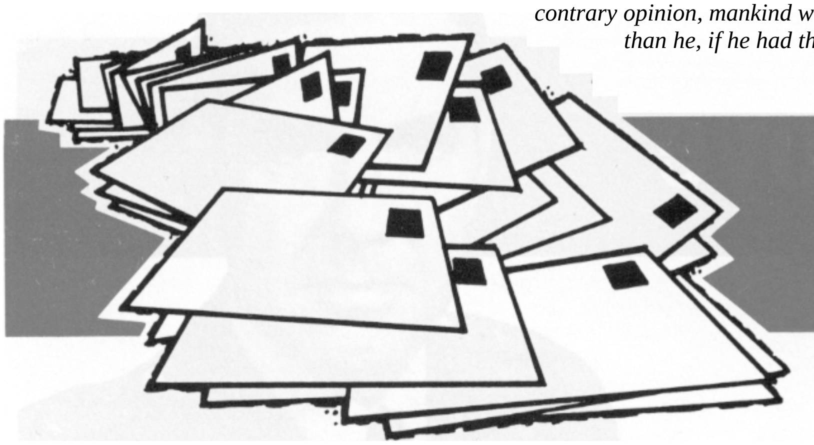
While emphasizing the importance of developing effective and experienced fire planners at all levels (to include the company/troop), I should also note the requirement for Field Artillery lieutenants to be able to "shoot" has by no means disappeared. On the contrary, since he remains the "eyes" of the Field Artillery, and should be the most qualified observer on the battlefield, we have designed the formal course of instruction at the School to insure that he maintains proficiency in "shooting" skills.

Now I know that TC 6-20-10 states the FIST chief is the company fire support coordinator (FSCOORD), and so he is. But he must also become and remain a proficient shooter, both to train his platoon observers, and to conduct observed fire himself—as he will have to do invariably in armor units, and frequently even in infantry units. To emphasize this dual responsibility, our new TC 6-20-3, Fire Support Operations in Brigade Size Units, will include as a specific duty of the FIST chief, "Call for/adjust/direct fire support."

In many respects, for example, in acquiring leadership and management skills—the professional growth of Field Artillery officers parallels that of other combat arms. But Redlegs have always been presented an additional challenge: to integrate fire support with maneuver on the battlefield.

Our FIST chiefs are the critical first response to this challenge, and we must give them the opportunity and support to meet it.

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



Incoming

letters to the editor

Miniature Long Tom

With reference to the passing of the "Long Tom" from active service in the US Army as described in the November-December 1980 *Field Artillery Journal,* I would like to point out the following:

•The "Long Tom" has not left the army—the nomenclature has been changed to howitzer, medium, towed, 155-mm, M198. Any doubting Thomas need only compare the ballistics data.

•At the same time, the weapon weight was reduced from 30,100 pounds to approximately 16,000 pounds, and a speed shift for 6400-mil traverse was incorporated.

Credit for engineering and fabrication of the first prototypes should again be given to personnel at Rock Island Arsenal where artillery design and manufacturing experience was maintained until the latest round of reorganizations.

Michael Nerdahl
Operations Research Analyst
Maintenance Directorate
Headquarters, ARRCOM
Rock Island, IL

Extended command lauded

As an FY80 year group battalion commander, I read with special interest LTC Jerry Harrison's article, "Reflection on Extended Command," *Field Artillery Journal,* November-December 1980). I found solace in his experiences and surety in his advice that have helped underwrite my own game plan.

I was particularly impressed by his advocating increased utilization and development of the staff by maximizing delegation and decentralization. The longer term command tour affords both the opportunity and obligation to allow both staffs and young commanders more latitude to plan and execute mission tasks and functional programs in a time environment that can promote more action, thoroughness, and continuity of their efforts. It will permit an increased tolerance and learning climate for freedom to fail and recover that until now was usually minimal, lethal, or non-existent.

Lieutenant Colonel Harrison addressed most of the anxiety issues experienced during the first year and presented a most plausible forecast of the next year and a half. He may have coined the maxim for this extended tenure in saying "It is not what happens to you that is important; rather what you do with what happens to you."

The ability and will to take the heat as well as the bows from a variety of disassociated actions, events, and circumstances now creates a sustainment acid test of our command philosophy, leadership styles, managerial techniques, and personal and physical staying power.

The comments and perceptions of a "normal command tour" as cited in the preface of the article will be reformed by the results of the tenure of the new generation of commanders.

Isaac F. Bonifay Jr.
LTC, FA
Commander
2d Bn, 18th FA
Fort Sill, OK

USAR education tips

Course/subcourse listings, YES! Catalogs, NO!

The November-December 1980 *Field Artillery Journal* reported that copies of the DA PAM 351-20 series Army Correspondence Course Catalogs are available on request from the Army Institute for Professional Development. Unfortunately, copies of the pamphlet are only available through the DA Publications Center in Baltimore, Maryland. However, the US Army Field Artillery School can provide soldiers with a complete listing of Field Artillery courses and subcourses. These are available by writing:

Commandant
US Army Field Artillery School
ATTN: ATSF-CT-RC
Fort Sill, Oklahoma 73503

Although the Field Artillery School cannot provide prospective students with actual correspondence subcourses, these are available by submitting an enrollment application to the:

Army Institute for
Professional Development
US Army Training Support Center
Newport News, VA 23628

The Institute offers correspondence subcourses, developed by the Field Artillery School, covering most Field Artillery jobs. These include a newly developed series of subcourses on fire direction skills.

Field Artillery soldiers who have questions about the Army Correspondence Course Program can call the Field Artillery Team at the Army Institute for Professional Development (IPD), AUTOVON 927-4575. IPD's normal duty hours are 0800-1645 (EST). After duty hours, call Code-a-phone AUTOVON 927-3085 or commercial (804) 878-3085.

Paul B. Minton Jr.
LTC, FA
Director, IPD
US Army Training Support
Center
Fort Eustis, VA

Tactical operations center for 105-mm direct support battalion

Compact, mobile, and efficient best describe the tactical operations center (TOC) organization developed by the 1st Battalion, 119th Field Artillery, Michigan Army National Guard.

When mobility became the key word in field artillery tactics for towed direct support (DS) battalions, the 119th FA faced the problem of how to remove cumbersome equipment and continue to function in a streamlined and efficient manner. First, it was decided to do away with the tents and use the TOE authorized 2½-ton vehicle (with trailer) and M880 5/4-ton truck for the TOC. To achieve ample head room, bows were added to both the 2½-ton truck and the trailer and covered with canvas. Permanent chart tables were installed across the front end, and work tables were constructed along both sides fo the fire direction computers (figure 1). Four AN/VRC-46 radios were installed to handle the three battalion and the division artillery fire nets. Thus, the truck was converted into an exclusive battalion fire direction center (FDC).

The trailer was converted into a combined S2/S3 work area by installing a modular folding desk/cabinet on one side and a permanent map board with book cases on the other. A fold-up ramp was installed between the trailer and truck to provide a continuous path and work area. Lights (AC and DC) were permanently installed in both the truck and trailer areas, and three AN/VRC-46 radios were mounted in the observation post/fire direction 5/4-ton truck and remoted into the trailer to handle the battalion command/fire direction net and the brigade and division command nets.

A TOC SOP was developed listing priorities for initial occupation and displacement and assigning section personnel various key tasks. Under most conditions, the observation post/fire direction section was able to occupy a new position and become operational within 15 minutes and displace within 10 minutes after notice.

Section equipment was stored under the table areas and off-loading was kept to the bare minimum. RC-292 antennas were erected only when time permitted; instead, a home-made telescoping antenna mast was attached to the 2½-ton truck and used during initial position setup. Additionally, cigarette lighter mounts were installed to supply power for the TI-59 hand-held calculator which was used almost exclusively for firing computations. (The battalion has never been issued FADAC and is not programmed to receive it.)

To provide for an echelon movement capability, the 5/4-ton truck carried the minimum amount of FDC equipment to maintain control of the battalion. In fact, there were times when this smaller vehicle and its personnel were responsible for computing and firing both battalion and division artillery time-on-target missions while the main vehicle, the 2½-ton truck with trailer, was on the advance party movement.

Members of the 119th FA believe that the layout and organization of the TOC developed by them is very realistic and functional for today's combat tactical environment. We strongly invite constructive criticism from other direct support artillery units. Comments may be submitted to Operations and Training Officer, 1st Battalion, 119th Field Artillery, 300 Elvin Court, Lansing, MI 48913, ATTN: MSG Timothy D. Maynard.

Timothy D. Maynard
MSG, MIARNG
1st Bn, 119th FA
Lansing, MI

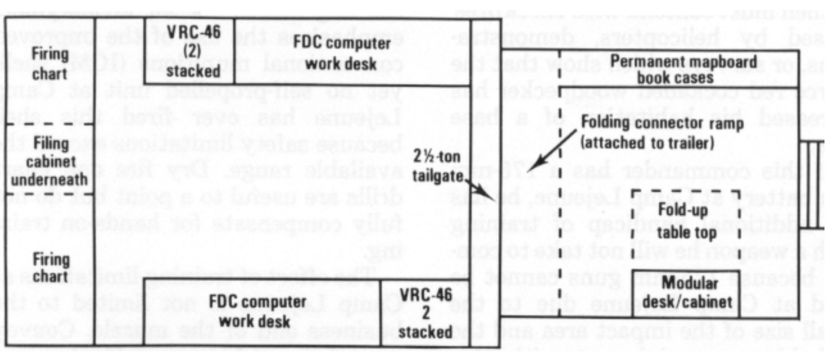


Figure 1. Tactical operations center layout in 2½-ton vehicle (not to scale).

IFV vs MICV

On page 28 of the September-October 1980 *Journal,* you show a picture of an XM723 Mechanized Infantry Combat Vehicle (MICV), but in the text you make reference to the Infantry Fighting Vehicle (IFV). I'm concerned that this may lead readers to believe these vehicles are identical, which is not the case.

The MICV is defunct while the IFV is currently being tested for fielding. The IFV has two configurations: one is as an infantry vehicle (M2) the other is as a cavalry vehicle (M3).

CPT W. C. Garrison
TCADD
USAFAS
Fort Sill, OK

Should any of our readers have the same concern, this letter will hopefully clear the air. —Ed.

TACFIRE photo error

Having spent over three years trying to educate and inform artillerists and the Army in general about TACFIRE, I congratulate you on the information provided in the January-February 1981 *FA Journal*.

Lest my time as a trainer of TACFIRE operators and maintainers go to waste, I feel it is my duty to point out that the picture on page 27 is not a "TACFIRE console" but a Battery Computer Unit, the heart of the Battery Computer System (BCS) which is mentioned in the article which accompanies the picture.

It is also interesting to note that on page 27 the article states that the Reserve Components will not receive TACFIRE; yet the picture on page 47 which accompanies the article about the displacement of a national guard tactical operation center is a TACFIRE shelter under camouflage.

Mr. Cathcart and Captain Clark wrote fine articles. Thanks for keeping those in the field as up-to-date as possible.

Daniel M. Ferezan
MAJ, FA
Executive Officer
2d Bn, 27th FA
Fort Sill, OK

Your comments concerning the photograph of the Battery Computer Unit are correct—our cutline was in error. The photograph on page 47, however, was intended to depict a "typical" operations center in field position, not a setup for TACFIRE—Ed.

Training our SP artillery

The Marine Corps currently fields three types of self-propelled artillery weapons. These are the M109A1 155-mm howitzer, the M110A1 8-inch howitzer, and the M107 175-mm gun. Only two batteries of the latter are currently in use and are slated for replacement when charge 8 and the rocket-assisted projectile (RAP) round becomes available for the 8-inch howitzers.

All of these units are currently divided evenly between Twentynine Palms, CA (less one platoon of 8-inch in Okinawa) and Camp Lejeune, NC. Until 1978 all of these assets were located in the 1st and 2d Field Artillery Groups. In that year these groups were dissolved and their assets joined to the 1st and 2d Marine Divisions. At Twentynine Palms these units were formed into the 4th Battalion, 11th Marines, comprising all three types of artillery weapons. At Camp Lejeune two battalions, the 4th (155) and 5th (8-inch/175) Battalions of the 10th Marines were formed.

General support artillery under current doctrine is supposed to provide deep support fires to neutralize the adversaries' second echelon forces. In addition, all general support weapons are now or will in the foreseeable future be capable of delivering nuclear warheads. General support weapons will be used, with either conventional or nuclear ordnance, to engage enemy forces at the maximum distance at which targets can be acquired. With the current developments in target acquisition, this means that gaining and firing on targets in the 20,000- to 30,000-meter range is not only feasible but likely.

The training for this type of combat requires extensive range areas. At Twentynine Palms this is certainly no problem. The vastness of its ranges are well known throughout the Corps. The self-propelled weapons assigned there have little or no difficulty in preparing or conducting long range training. It is those units currently stationed at Camp Lejeune which chronically suffer a lack of adequate training areas.

There are three impact areas aboard Camp Lejeune. Only one (G-10) is currently suitable for large caliber weapons. The other two lack sufficient space and observation to deliver large caliber artillery fire into them on a consistent basis. Of the 33 established gun positions at Camp Lejeune, only 6 can be used by large caliber self-propelled units. All but one of these six positions is located in or immediately adjacent to an established landing zone with its concurrent problems involving helicopters and other uses; e.g., parachute drop demonstrations. The maximum range available from any of these positions to the center of the impact area does not exceed 11,000 meters. Additional severe limitations are imposed by blast focus restrictions which are imposed to curtail the sound waves generated by explosives from spreading out into the surrounding civilian community. Large caliber weapons by virtue of their greater explosive content cause a louder explosion and hence are the first units restricted from firing when atmospheric conditions cause windows to rattle and community complaints to be called into base headquarters.

If these restrictions were not severe enough by themselves, Camp Lejeune is also the home of the red cockaded woodpecker, an endangered species. Each area inhabited by this bird is heavily restricted in both type and amount of training which can be conducted therein or in the immediate vicinity. The discovery of new areas of habitation is even further restricting those areas available for training of self-propelled weapons.

The consequence of these restrictions is that a battery commander of an 8-inch or 175-mm battery, if he can get a position (there are 15 active duty batteries of all calibers as well as other division units competing for the positions) will take his battery to a position where he can drop his spades in essentially the same holes he has used several times before. He will then contact range control to see if blast focus is high enough for him to conduct firing operations. If it is, he then must contend with checkfires caused by helicopters, demonstrations, or surveys which show that the scarce red cockaded woodpecker has increased his habitation of a base area.

If this commander has a 175-mm gun battery at Camp Lejeune, he has the additional handicap of training with a weapon he will not take to combat because 175-mm guns cannot be fired at Camp Lejeune due to the small size of the impact area and the probable errors inherent with this weapon. Consequently, this unit must keep half of its carriages configured for the 8-inch howitzer tube to achieve any live fire training at all. In the event of armed conflict, a delay would be incurred while these carriages were refitted with the 175-mm guns, which are our only weapons capable of outranging the Soviet D130 gun.

Those units at Camp Lejeune comprising the 5th Battalion, 10th Marines, participate in only two deployments outside the Lejeune area a year. Those are the regimental field firing exercises conducted at Fort Bragg, NC, each spring and fall. Although Fort Bragg is much larger and better suited for self-propelled weapon training, it also suffers several training disadvantages. First of all it is an Army training facility, and Army units, therefore, have priority on its use. Although their range personnel are always most helpful, in any substantial scheduling conflict the Marines still get last priority.

Second, the expense and logistics effort required to move the self-propelled weapons to Fort Bragg and support them (spare parts, POL, repairs, etc.) is enormous. Each howitzer must be mounted on a civilian contracted transporter (approximate cost one way $1,000) for the trip. During the exercise, the unit is supported out of temporary deployment stocks, which also must be transported to the site. At the end of the exercise, the unit returns to Camp Lejeune (transportation cost $1,000 per howitzer again).

No 8-inch or 175-mm unit has deployed outside of the Camp Lejeune-Fort Bragg area since 1976; consequently, there are few gun positions at either place which someone from that unit has not occupied or used before.

Current doctrine at Fort Sill, OK, training school for all artillerymen, emphasizes the use of the improved conventional munitions (ICM) shell; yet no self-propelled unit at Camp Lejeune has ever fired this shell because safety limitations exceed the available range. Dry fire and chart drills are useful to a point but do not fully compensate for hands-on training.

The effect of training limitations at Camp Lejeune is not limited to the business end of the muzzle. Convoy procedures at Lejeune suffer because self-propelled weapons are limited to established tank trails which are in general unsuitable for wheeled traffic. Therefore, when a tracked vehicle unit moves out to occupy a gun position, the guns go one way and the trucks, including ammunition and jeeps, go another. It is difficult, if not impossible, to properly rehearse and train for ambush, air defense, convoy interval, hasty emplacement, and reconnaissance when the guns and other battery elements are separated by several kilometers.

There are several options available to increase the training proficiency and ability of the 8-inch and 175-mm units now at Camp Lejeune:

•**Relocate these units to Twenty-nine Palms.** The 155-mm self-propelled howitzers should remain at Camp Lejeune to facilitate armor/mechanized training and to support those NATO deployments in which they already participate. The collocation of all 8-inch and 175-mm batteries at Twentynine Palms would resolve many of the aforementioned problems. Additionally, it has the benefits of increased maintenance capabilities through its closer location to the depot at Barstow, reduced training deployment expenses, and (due to a wider variety of gun positions) enhanced training realities and readiness.

The units at Twentynine Palms would have to be organized so as to be able to support all divisions while still conducting the majority of their training at Twentynine Palms—perhaps a fourth battalion for the 1st and 2d Divisions composed of three 155-mm self-propelled batteries and a general support artillery battalion composed of four 8-inch and two 175-mm batteries.

Training interface with direct support artillery units could still be achieved by putting general support weapons by platoon or battery into the combined arms exercises conducted at Twentynine Palms. This would, in fact, be an increase over the current contact between maneuver units and general support artillery which is negligible due to the limited maneuver space at Camp Lejeune.

The initial expense of this arrangement in movement of men and materials would be significant, but the long-term improvement in the state of training for heavy caliber general support artillery would be substantially increased. This option, although yielding the best training possibilities, would reduce operational readiness of east coast units by splitting them from their organic heavy caliber general support artillery.

•**Increase and vary the deployment schedule of the Camp Lejeune units.** Instead of two deployments a year to Fort Bragg, substitute or preferably add a deployment to Vieques, PR; Fort Pickett, VA; Fort Drum, NY; or Twentynine Palms. This could be achieved at a reduced cost by transporting the personnel to Twentynine Palms and allowing them to use the equipment of units already stationed there. Variety is the spice of life in training management and would improve readiness and morale.

This option in the long term would cost more because of increased transportation cna deployment expenses, but should yield a beneficial increase in combat readiness. An even more beneficial training effect could be achieved by alternating the training area selected for the deployment.

•**Increase those areas and times available to these units at Camp Lejeune.** This could be achieved through raising the blast focus minimums, opening areas currently closed due to endangered species' habitats and proximity to housing areas, and allow firing over the ammunition storage area, a restriction which currently denies one-third of the base from use as a firing point.

This option would be certain to increase public relations problems as a result of increased noise levels and encroachment on an endangered species. This option would also leave unresolved those problems associated with convoy movement and control.

In an era of tight budgets, it is imperative that we receive maximum benefits for our training expenditures. The limitations of range and maneuver at Camp Lejeune on large caliber self-propelled artillery leaves open the question of value. There can be a better solution.

Capt Wayne E. Krout
HQ Btry, 5th BN
10th Marines
Camp Lejeune, NC

Although this letter appeared in the MARINE CORPS GAZETTE, *Captain Krout's thoughts are deserving of another look, particularly to the Marine officers and men who serve in artilery units.—Ed.*

Submunitions technique has been perfected

The article ("The New Artillery") by Patrick F. Rogers in the November-December 1980 *Journal* tends to confuse the reader in a few areas. Mr. Rogers indicates that the M483A1 contains "88 antipersonnel fragmentation submunitions" and further states that hollow charge bomblets can be used once the submunitions technique is perfected. The 88 submunitions in the M483A1 are dual purpose, including a shaped-charge and fragments in each of the 88 munitions, providing significant armor penetration plus antipersonnel fragmentation. Over one million M483As have been produced to date. The technique of submunitions has been perfected.

Artillery-delivered mines are deployable with 155-mm M718 and M741 projectiles delivering antitank mines and 155-mm M692 and M731 projectiles deploying antipersonnel mines. The projectiles have been standardized and are in production. Mixed volleys of antiarmor and antipersonnel mines can be fired in any weather, day or night, with the latter preventing efforts to countermeasure the antitank mines or clear a path.

It is important that the reader recognize that antiarmor ICM and artillery-delivered antitank and antipersonnel mines are here today. Their capabilities, together with others included in the article, will have a tremendous synergistic effect and may well have the impact on ground warfare which Mr. Rogers projects.

Martin B. Chase
Selected Armament Division
Armament Systems
Directorate
Dover, New Jersey

Reunion

B Battery, 373d Field Artillery Battalion Association—30 April-3 May, Fort Jackson, SC. Contact Frank G. Andros, P.O. Box 55, Hyde Park, NY 12538. All former 100th Division members welcome.

Personal weapons for artillery units

As an artilleryman, I find that current weapons used for personal defense in the field artillery battalion do not meet the needs of the soldier, since the M16A1/M203 was not designed to be used while handling projectiles, powder, and fuzes. Slung on the shoulder or back it continually slips off and it is difficult to get into action. Placing individual weapons on, in, or near the piece requires time to retrieve and generates a continued danger of loss or damage. Here it might be better if artillery units were armed with submachineguns (SMGs) and M79 grenade launchers configured for magazine feed or double-barreled.

Comments about loss of firepower and range by going to SMGs and M79s are countered by the fact that the section and battery retain all their machineguns and other weapons organic to the unit. (There would probably be very few times that long range rifle/machinegun fire would be used against a battery without the howitzers being used to return fire.) Use of the SMG would greatly increase the ammunition capacity of the battery due to smaller rounds in the same volume. The US Armed Forces are presently conducting tests at Eglin AFB, FL, to determine the feasibility of a 9-mm pistol to replace the M1911A1 caliber .45 ACP as the standard sidearm. There are numerous 9-mm SMGs (Ingram, Uzi, Beretta, Sterling, etc.) that could adequately fill the needs of artillery units presently in production which use box magazines and have an excellent rate of fire.

The M16A1/M203 could still be issued to FIST personnel, since those individuals will be with maneuver units. Fire support teams at battalion and brigade headquarters could carry the SMG, since it would better fit their needs. By converting artillery units to SMG/M79 weapons, small arms ammunition would be reduced to pistol/SMG rounds, LMG rounds, HMG rounds, 40-mm grenades, and LAWs.

As an alternative to the SMG, the M231 firing port weapon or M577 carbine could be issued, thus keeping a common caliber with the maneuver units. Soldiers could still use the modified M79 with the short 5.56-mm weapons as needed. Regardless of which decision is made, a smaller, lighter, less cumbersome weapon is needed to replace the M16A1/M203 in artillery units.

Larry A. Altersitz
CPT, FA PAARNG
Defense Investigative Service
Industrial Security
Field Office Pittsburgh
Pittsburgh, PA

There are many circumstances which seem to indicate that a unique or different weapon is more suited for the task than the one at hand. A submachinegun or M79 vice the M16A1/M203 for the artilleryman is a case-in-point. Looking at any combination of weapons, one soon finds that trying to handle projectiles, powder, and fuzes while trying to get your individual weapon into action is difficult at best. The providing of timely fires to support the maneuver commander must always be foremost to the artilleryman. This may well mean protecting the battery position from isolated ground attack while still delivering fires. It is at times like these that the range of a rifle is needed. Where to place our individual weapons, whatever model, so that they are readily accessible when needed will depend on the situation. How the 4th Infantry Division solved this problem was illustrated in the July-August 1980 JOURNAL. *—Ed.*

New terminology

Although the concepts of "integrated battlefield" and "extended battlefield" are now used throughout the US Army Training and Doctrine Command (TRADOC) community, they do not accurately describe the battlefield in its torality. A need exists, therefore, to tie these two concepts into one overall descriptive term. As such, when talking about the total battlefield, the term "airland battle" will be used.

Further, since our combat developers need a term to use as a conceptual basis for the development of requirements, the term "air-land battle of the 1990s" will be used

Donn A. Starry
GEN, USA
Commanding General
US Army Training and
Doctrine Command
Fort Monroe, VA

Hot off the Hotline

1. **Question:** Reference computation of sight using range changeover: FM 6-40, dated December 1978, page 4-19, shows that range changeover is computed by using the range division value read from the C scale on the GFT. TEC Lesson 250-061-6310F explains that the range under the line on the range scale is used for rough division.

Answer: *FM 6-40, paragraph 4-13g(2), is correct. You use the C scale for rough division with ranges over the range changeover point. The TEC lesson will be updated to show the correction information.*

2. **Question:** When will the new GFTs incorporating the ICM scales for the M110A2 be fielded?

Answer: *M110A2 GFTs will be made incorporating the M509 ICM scale as the projectile becomes available (other information on availability dates is classified).*

3. **Question:** What is the national stock number for ordering mass fire distribution templates?

Answer: *Mass fire distribution templates are not mass produced. Change 1, FM 6-40, paragraph 12-8, explains how each unit can make them locally.*

4. **Question:** In a direct support battalion, based on modern battlefield concepts, to what extent is wire communications utilized other than for internal battery communications?

Answer: *By doctrine, a direct support battalion is required to run external wire lines to the supported brigade headquarters to give access to the division multichannel telephone switching network as well* *as the brigade and maneuver battalion fire support officers. Additionally, a line either directly or through a collocated field artillery battery to a countermortar radar section is required. In the future, there will also be the requirement to have lines to a remotely piloted vehicle section, MET (FAMAS) section, etc., that are attached for control of their intelligence assets to the direct support battalion. While ideally doctrine calls for the installation of these external wire lines, it is recognized that expected rapid displacements and large distances between units may make the use of wire communications both difficult and limited. The installation of the circuits mentioned above will be dependent on the tactical situation, time, personnel, and resources available. Wire continues to be the preferred means of communications, and priorities of circuit installations must be established that best allow for a reduction in radio subscribers for a significant period of time. For a more detailed description of wire communications required for a direct support battalion see FM 11-50, Combat Communications Within the Division.*

5. **Question:** Reference the article about the hand-held calculator, TI-59 (November-December 1980 *FA Journal*, "View From The Blockhouse"): I have called the US Training Support Center at Fort Eustis and they were unable to provide information on how to obtain these TEC lessons. In the article, there was no phone number, no reference, or no instructions on how to obtain these lessons. Since we've converted to this calculator, these lessons would be very helpful.

Answer: *The TI-59 lessons listed in the November-December 1980* ***FA Journal*** *are video cassette tapes. Requests for dubbing these lessons are now honored through Training Aids Service Center (TASC) channels. The Fort Sill TASC will dub the tapes on blank ¾-inch cassettes provided by the requester.*

6. **Question:** I have an ARTEP scheduled in April and am required to meet with evaluators in advance to lay down the ground rules. When will the revised ARTEP 6-365 be released—particularly the nuclear tasks portion? If it is not released by April, would it be possible to get a draft copy so that I can intelligently discuss the ground rules?

Answer: *The revised ARTEP will not be distributed until the latter part of FY81. ARTEP 6-365, dated 29 September 1979, is valid until superseded.*

7. **Question:** There is an indirect fire trainer at the School which is used in the Officers Basic and Advanced Courses, which I believe is made somewhere in Europe. I need information concerning this indirect fire trainer, such as exact nomenclature, size, cost, components, and literature (FMs, TMs, etc.)

Answer: *Four indirect fire trainers are currently under consideration. Two of these, Invertron and Marconi, have been evaluated at Fort Sill and bids are due to be let in March 1981. Basis for issue will be four for the US Army Field Artillery School and two per division artillery. The trainer can train 30 students with only 1 instructor required. A building 25x47x10 feet, fully air conditioned, is necessary. The Training Aids Service Center at each installation will hand receipt the equipment to the user. The civilian contractor will perform the necessary maintenance for two years and will teach military personnel how to use the equipment. (Point of contact at Fort Sill is MAJ Daly, DTD, AUTOVON 639-1481.)*

8. **Question:** Is there anything on the drawing board to replace the 13F Soldier's Manuals that we are now using since the task numbers and subjects do not match up with the Sergeant's Manual?

Answer: *The School's Directorate of Training Developments is in the process of rewriting the Soldier's Manual for MOS 13F.*

9. **Question:** I would like to know who in the Department of the Army now has proponency for illuminations.

Answer: *No proponent exists now, but the Field Artillery School will initiate the necessary action to assign a proponent and update doctrine pertaining to battlefield illumination since the existing doctrine in FM 20-60 (written in 1977 by the now nonexistent Combat Developments Command) is badly out of date.*

10. **Question:** I've been assigned to the Department of Military Science, Longwood College, for six months, and it is difficult for me to stay current on Field Artillery as fast as it is changing. I subscribe to the *FA Journal* but my question is "What do you recommend in the way of correspondence courses or any other source to aid me in knowing what is happening in the Field Artillery?

Answer: *The* ***FA Journal*** *is probably the best source to keep up with the day-to-day happenings in the Field Artillery. Another source is the* MONTHLY LIST OF INSTRUCTIONAL MATERIAL, *a publication listing all the new instructional material of the Field Artillery School. We have added your college to the mailing list for this publication and will also send you a copy of the new* CATALOG OF INSTRUCTIONAL MATERIAL *when it is published. You may use this catalog to select subcourses you wish to complete (enrollment procedures are explained in Part II). If additional assistance is needed, please contact Commandant, USAFAS, ATTN: ATSF-CT-TD, Fort Sill, OK 73503.*

Commanders Update

LTC(P) George F. Kraus Jr.
Field Artillery School Brigade

LTC Daniel Bartholomew
2d Battalion, 6th Field Artillery

LTC Robert J. Davis
3d Battalion, 16th Field Artillery

LTC Robert B. MacGruder
1st Battalion, 21st Field Artillery

LTC Larry E. Stunkard
2d Battalion, 37th Field Artillery

LTC William D. Smith
1st Battalion, 39th Field Artillery

LTC Robert Beddingfield
1st Battalion, 40th Field Artillery

Interdiction

by George M. Malleck

Consider for a moment that you are in the tactical command post of a US division in Western Europe and war has suddenly been declared. The division is deployed and has been able to withstand the initial assault of Soviet forces. First echelon regiments of lead Soviet divisions have been stopped, and the US division commander is now reviewing the situation. The cost of stopping the lead regiments has been tremendous. The enemy second echelon regiments are now entering the brigade battle. What can be done—what could have been done—to counter the Soviet ability to inject new combat power into this situation?

One area which indicates potential for great tactical benefit is interdiction which is presently defined as denying the enemy unrestricted use of terrain. An article in the January-February 1980 issue of the *Field Artillery Journal,* written by BG (now MG) Edward A. Dinges and MAJ Richard H. Sinnreich noted that interdiction today is much more: *Interdiction is a process intended to influence the flow of combat power into the battle*.

Corps interdiction is aimed at enemy forces beyond the division's area of influence. Operating over an area which is 30 to 100 kilometers from the forward line of troops (FLOT), corps presently has Lance missile fire and Air Force assets to exercise its interdiction and influence when and with whom the divisions fight. Corps will have the critical choice of where to orient its target acquisition assets and how to prioritize its subsequent attack of targets.

Interdiction at corps level is to deter the flow of enemy combat power by attacking moving formations, as well as the facilities which can accommodate and support their movement. Division interdiction is to influence where and when we fight those enemy forces handed off by corps.

In division fire support operations, interdiction is the firing in time or space at enemy formations in conjunction with the commander's scheme of maneuver. In short, guidance is received on how the commander plans to fight the battle and what arrangement of enemy forces is necessary to accommodate his plan; then interdiction is planned accordingly. Obviously, corps interdiction and target acquisition efforts will affect division plans; thus the two are tied closely together.

The division is the largest US Army organization that trains and fights as a team and it is here that interdiction can have the greatest impact on tactical operations. The efforts required to integrate division staff operations for interdiction are an important aspect of our tactical operations. Since little guidance is presently available on how this should be done, this article will consider division interdiction and how we can do it today.

Our ability to see the battlefield, combined with new and improved weapon systems, has dramatically altered the ability of the commander to project his combat power which in turn has given us the capability to seek out and attack second echelon forces. Since the attack of these forces is the center of our interdiction efforts, we must first understand what these forces are and how they operate.

The threat

It should come as no surprise that a discussion of the threat is based on the tactics of our principal adversary, the Warsaw Pact forces, who employ doctrine developed by the Soviets. Thus, a knowledge of their "techniques" is vital if interdiction is to be effective.

To insure the momentum of offensive combat operations and provide for contingencies, Soviet attack formations are "echeloned." This arrangement generally consists of a first and second echelon and a reserve as shown in figure 1. It is this "echelonment" technique which constitutes the need for interdiction.

The first echelon carries a preponderance of the enemy force which may vary from one-half to two-thirds. It includes tank support as well as most of the artillery and has the objective of the parent unit.

The second echelon, with no exact equivalent in United States Army doctrine, is used to maintain the momentum of the attack, particularly on the main axis. In a sense, it is prepared to deliver the decisive blow. The Soviet commander plans for second echelon commitment in his initial attack order where he assigns a tentative employment line and designates artillery and other support. The second echelon is initially tasked to reach the same objective as the first echelon, should this assistance be required. As the battle develops, modifications to the planned employment of the second echelon can be made.

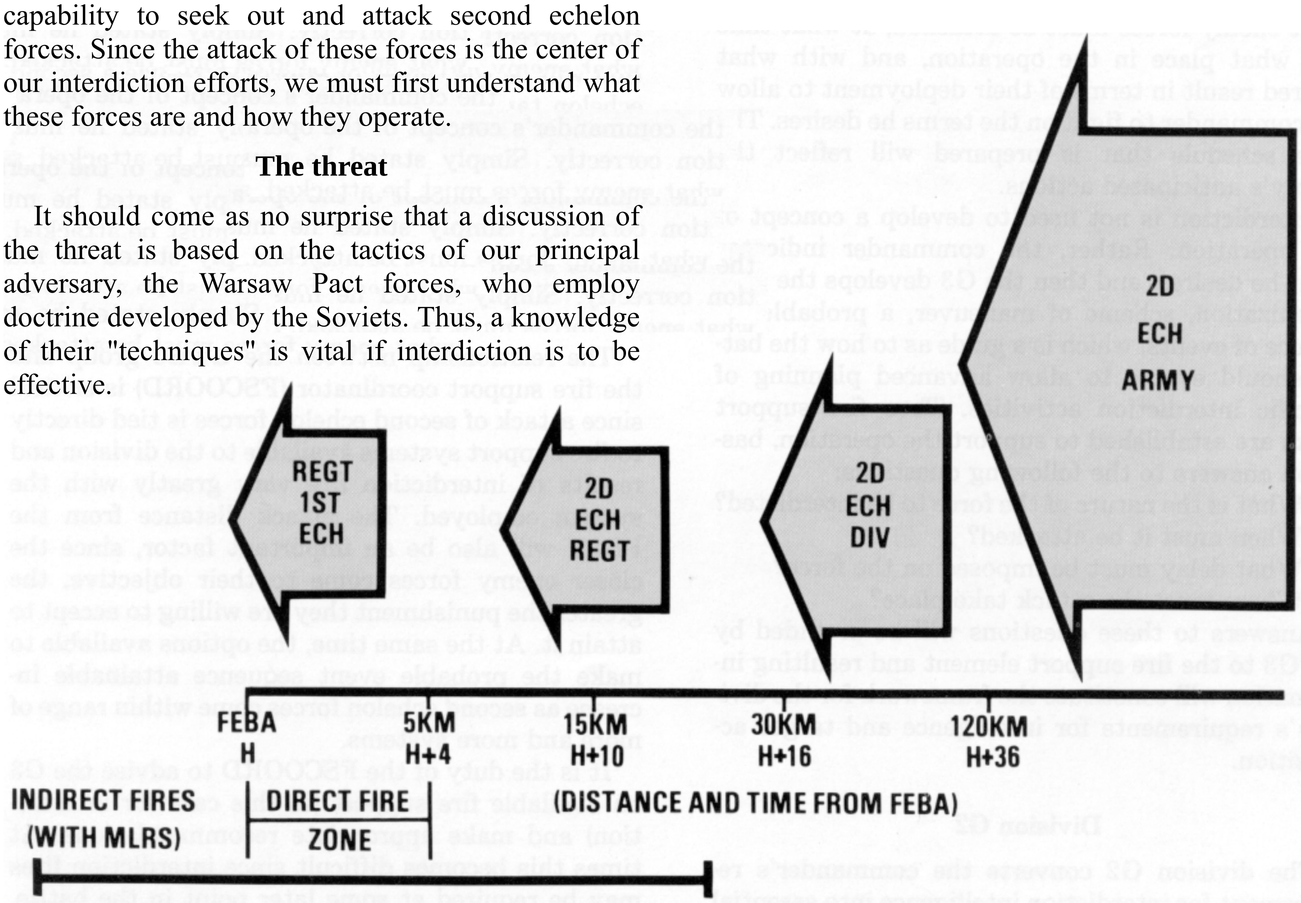


Figure 1.

The second echelon may be employed not only to exploit first echelon success but also in a variety of other missions; therefore, it may be considered as a multipurpose force, ready for rapid commitment.

Division commander

How then does the division commander and his staff approach the problem presented by this force? The interdiction effort begins with the concept of the operation which is the commander's description of how he sees the battle being fought. It is on this basis that interdiction plans and orders are issued.

Division G3

The division G3 is the interdiction planner, and as such is responsible for determining certain key interdiction related requirements on the basis of the scheme of maneuver and commander's guidance; e.g., when, where, and what forces must be struck to achieve the desired result?

Using the G2's templating the route analysis, the G3 must develop an oriented "probable" sequence of events which reflects what will have to occur for the commander's concept of the operation to function correctly. Simply stated he must determine what enemy forces must be attacked, at what time and what place in the operation, and with what desired result in terms of their deployment to allow the commander to fight on the terms he desires. The time schedule that is prepared will reflect the enemy's anticipated actions.

Interdiction is not used to develop a concept of the operation. Rather, the commander indicates what he desires, and then the G3 develops the task organization, scheme of maneuver, a probable sequence of events, which is a guide as to how the battle should evolve to allow advanced planning of specific interdiction activities. Then fire support tasks are established to support the operation, based on answers to the following questions:

- What is the nature of the force to be interdicted?
- When must it be attacked?
- What delay must be imposed on the force?
- Where must the attack take place?

Answers to these questions will be provided by the G3 to the fire support element and resulting information will constitute the framework for the division's requirements for intelligence and target acquisition.

Division G2

The division G2 converts the commander's requirement for interdiction intelligence into essential elements of information (EEI) and other intelligence requirements (OIR) for the commander's approval. This information is the basis for establishing intelligence-collection priorities, allocating collection resources, and assigning collection tasks. Here, second echelon forces are of particular importance since these elements—the regiments of the first echelon divisions—form the enemy commander's primary means of influencing the battle and, because they are deployed in depth, cannot be observed by forces in contact.

Event templating by the G2 assists the commander in assessing enemy intentions by keeping him informed of key events, indicative of enemy intentions. Doctrinal templates also assist in determining the size enemy force which an avenue of approach may accommodate.

In close coordination with the G2, the division engineer must conduct a survey of those routes capable of accommodating deployment of enemy forces. This analysis is of special importance to the interdiction planner since interdiction is primarily concerned with moving forces, the routes they can take, and the facilities which support their movement.

Another asset available to the G2 is the Combat Electronic Warfare and Intelligence Battalion (CEWI). The CEWI's intelligence production section will be the center of efforts to realize a second echelon targeting scheme. Not only must this section correlate all intelligence information from organic division sources, but it must also insure that information from "above", i.e., corps and higher, is quickly analyzed, processed, and made available through the G2 for G3 planning.

Fire support coordinator

The relationship between the G2/G3 group and the fire support coordinator (FSCOORD) is critical since attack of second echelon forces is tied directly to fire support systems available to the division and results of interdiction fire vary greatly with the system employed. The attack distance from the FLOT will also be an important factor, since the closer enemy forces come to their objective, the greater the punishment they are willing to accept to attain it. At the same time, the options available to make the probable event sequence attainable increase as second echelon forces come within range of more and more systems.

It is the duty of the FSCOORD to advise the G3 on available fire support (in this case for interdiction) and make appropriate recommendations. At times this becomes difficult since interdiction fires may be required at some later point in the battle, when contending with attrition and positioning problems.

As such, the FSCOORD establishes fire support elements (FSEs) at both the division tactical and main command posts. Additionally, he will coordinate the activities of all the fire support system operators. Since assets from the Air Force and division artillery will constitute the division's principal interdiction weapons, the FSCOORD will work closely with the air liaison officer (ALO) at the division main and the division artillery tactical operations centers. This will include the requirement to keep both systems informed of interdiction planning guidance and, at the same time, insure that the G3's requirements for interdiction fires are processed in a timely fashion.

The FSCOORD includes interdiction planning in the fire support portion of plans and orders. (In the staff estimate process, undertaken before the actual writing of such plans, he provided the fire support information necessary to determine which options could be pursued.)

Fire support element

The relationship between the G3 and fire support element insofar as interdiction, rests on the fire support tasks generated by the probable sequence of events.

If predictive planning has been successful, the FSE will have requested groups and/or series of targets from division artillery which adequately cover the target area. Units to fire such targets, if within range of division artillery, will already have firing data, and the air liaison officer may already know the nature of his targets, the geographic area, and the number of sorties and type of ordnance required. The FSE would then be mainly concerned with insuring that targeted second echelon units be attacked in accordance with the probable events sequence.

Since we are dealing with moving forces which may not be where initially predicted, these actions may still not result in the desired effect on the targeted force. The integration of all possible intelligence sources are required to insure that attack of targets is accomplished when and where required. Here, pilots returning from strikes may provide this information. Once a target is struck, we must determine whether the required delay, detour, or damage was inflicted so that a restrike may be accomplished if necessary.

Interdiction planning involves the selection and firing of interdiction targets in reaction to new intelligence data which could force changes to the interdiction plan. For example, if a targeted regiment is in a defile or will be soon, the FSE must react accordingly. Also, the G3 must know the success or failure of the interdiction effort in order to consider any requirement for changes to the scheme of maneuver. (G2 is responsible for this aspect of interdiction planning.) It may be necessary to use tactical air (TACAIR) or attack helicopters to attack second echelon forces, but the use of attack helicopters in this respect raises a number of questions, not the least of which is survivability.

If it becomes apparent that a restrike is required, the FSE at the tactical command post (since it manages immediate actions) will have a number of options. Any decision will be based on the location of the enemy force (which still may be advancing), available systems, and response time. The G2 then must inform the FSE whether an immediate restrike is required or the targeted unit should be rescheduled. If rescheduling is required, the targeted unit will be passed to division artillery for attack, sent to the corps FSE for possible Lance attack, or sent as immediate request to the air support operations center at corps.

It is particularly important for the division main FSE to have a close association with the corps FSE which is particularly important since corps hands off succeeding enemy echelons to division. This coordination provides valuable targeting information to the division and allows corps to prioritize its own requirements to hold selected enemy formations from their timetables for varying periods of time.

On an integrated battlefield, nuclear weapons will greatly enhance the interdiction capabilities of both division and corps, particularly in regard to range capabilities and target servicing. Should these weapons come into play they will provide the division commander with specific targeting alternatives to engage second echelon forces.

Division artillery

In defensive operations, division artillery weapons are positioned in depth to provide fire from 60 to 75 percent their range forward of the FLOT depending on the tactical situation and configuration of the frontlines. Addition of the Multiple Launch Rocket System (MLRS) will provide a capability to attack targets to a range of approximately 25 kilometers.

The ability of the division artillery to accomplish interdiction schedules of fire will depend largely on the organization for combat. For example, a more highly centralized organization allows the division artillery fire planner more firing options in the preparation of schedules. However, when second echelon forces come within range, the division will already be heavily engaged with the first echelon in the brigade battle. The demands for close support fires, augmentive reinforcing fires, counterfire, and suppression of enemy air defense (SEAD) will probably exceed available resources. Nevertheless, consideration must be given to the interdiction effort.

There are times when the use of available fire support on behalf of the division commander's plan carries a benefit for the whole division. An example might be the firing of a division counter-preparation using direct support battalions. The conditions under which this special consideration is made must be carefully weighed by the maneuver commander. Direct support of covering force (CF) battalions is now provided during active defense operations and, if interdiction fires are required in this phase of the operation, the only available artillery to perform the mission may possibly be those CF direct support battalions, general support/general support reinforcing artillery supporting the covering force, and main battle area artillery in forward supplementary positions. It may be that interdiction of second echelon forces will be timed to occur in conjunction with the main battle area fight. In this case more general support/general support reinforcing artillery, responsive to division artillery, may be available. If necessary, the division commander can use the assignment of nonstandard missions.

Division artillery performs detailed fire planning to execute the field artillery portion of the division interdiction plan and, supports the division by attacking targets within range and munitions capabilities. The division artillery prepares fire schedules in conjunction with the exchange of information with the FSE and identifies the units to fire, informing them of the munition to deliver and time sequence (according to normal scheduling formats). Close association with the FSE enables the division artillery to respond to changes as plans are developed.

Once the battle has begun, interdiction efforts will be focused on developing the tactical situation. With plans unfolding as expected, the interdiction of second echelon forces might take place with little more than the adjustment of schedules to a given timetable—the probable sequence of events. Many unforeseen problems however could arise which must be allowed for; therefore, interdiction also involves the development of fires to support immediate requirements. Just as the division commander directs his maneuver brigades as the situation warrants, the division artillery must be prepared to execute short notice fire support requirements identified by the FSE. Additionally, division artillery may seek additional support from reinforcing artillery through the FSE.

Air Force

Presently, the only arm available for the interdiction of second echelon forces at extended ranges is the Air Force. Through its close air support arrangements, the Air Force can provide air reconnaissance and also preplanned and immediate airstrikes which may be used for interdiction. The Air Force can strike much deeper than artillery (often providing after-strike intelligence in the form of the pilots' own reports), but its lack of immediate responsiveness because of air battle requirements and other demands may make it unavailable at critical times. Therefore, coordination and careful planning between corps, division, and the Air Force is essential.

Other systems

Electronic warfare, which is an element of combat power, should be employed in accordance with the concept of the operation to disrupt key command and control nets of first and second echelon units, provide deception, and assist in denying the enemy flexibility by reducing his fire support and disrupting critical resupply.

Electronic warfare planning, which is under the control of the G3, should include electronic countermeasures as part of the interdiction plan and should be coordinated in the FSE in the same manner as the artillery.

Naval gunfire, allied support, or other means may be available for interdiction and should be coordinated with the FSE to insure that they are employed where required.

Sample problem

How do all these considerations function on the battlefield? Let us consider a hypothetical division problem in the 3d Armored Division's portion of the 5th Corps sector.

The 5th Corps is opposed by two threat armies, and the 3d Armored Division might be required to deal with any combination of their forces (figure 2). (For purposes of this discussion, we will assume that the division is opposed by four enemy divisions, three in the Army first echelon and one in the second.)

Based on intelligence information, an analysis of the area of operations, battle reports, and other information, the G2 is able to estimate the probable

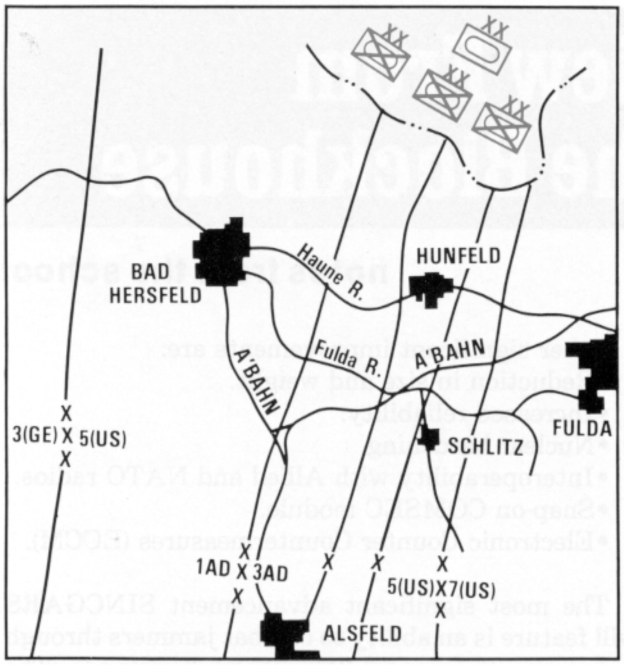


Figure 2.

course of enemy deployment for the next five to nine hours. The division commander, through his G3, develops the concept of counterattacking, after feinting what appears to be an exposed flank (figure 3).

The G3, assisted by the G2, detrmines that, once the enemy moves against what it believes is a faltering 3d Armored Division, four hours will be required to counterattack and destroy first echelon regiments. The G3 indicates to the FSCOORD at

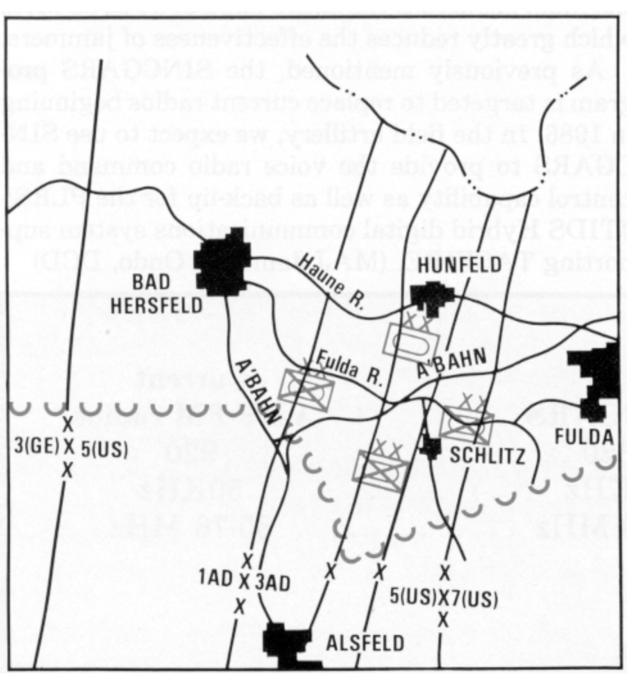


Figure 3.

the division main FSE the requirement for a preparation to support the counterattack and the need to interdict three second echelon regiments. The commander requires that these three regiments be held out of action—fixed beyond the brigade battle—for a period of four hours once the counterattack begins.

As part of an analysis of the area, the division engineer has developed a list of possible routes into the division area for battalion size forces. Division artillery has surveyed 14 of these routes which are located in area formerly held by the division. By templating enemy forces, the G2 has focused requirements for target acquisition and intelligence gathering efforts on likely routes into the area. Requirements will be placed by the G2 on organic target acquisition systems, and requests will be made to corps and the Air Force for further assistance. The FSE will apportion target requirements and coordinate time of attack based on the probable sequence of events and available firing systems.

As the time for the counterattack approaches, enemy forces are attacked in accordance with the probable sequence of events. Where required, Air Force attacks on targeted enemy columns are undertaken and restrike requirements are determined based on the effectiveness of the initial strike.

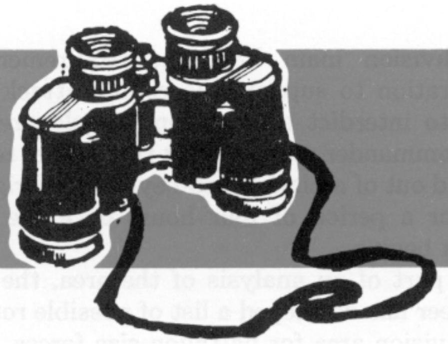
FSE

The importance of the division's interdiction effort and the FSE's role cannot be overemphasized. While the integration of fire and maneuver remains the responsibility of the G3, the FSE must assist him through planning and coordination of complicated firing and attack sequences.

A critical task for the FSE is to insure that interdiction by fire is always kept a viable option for the commander. This is done through the maintenance of target lists, scheduling of fires for interdiction requirements, and providing planning information to division artillery and all the other supporting agencies.

Interdiction can now be more than simply attacking terrain. However, since our resources are so scarce, we must concentrate on targets which present the greatest threat to the force. A reasoned approach to support the commander's plans can assist dramatically in altering the odds in our favor.

George M. Malleck, formerly assigned to the Tactics, Combined Arms and Doctrine Department, USAFAS, is now serving with the State Department.



View From The Blockhouse

notes from the school

TM 9-2350-303-10 fielded

The US Army Armament Materiel Readiness Command recently informed the Weapons Department, US Army Field Artillery School, that the operator's manual for the M109A2 155-mm self-propelled howitzer (TM 9-2350-303-10, dated 22 September 1980) is being fielded. Units with established pin-point requirements should receive the quantity indicated on DA Form 12-37 from the St. Louis AG Publications Center. If additional copies are needed, individual units should follow the established unit procedures for requesting other technical manuals.

SINCGARS—the hopping radio

SINCGARS (Single Channel Ground and Airborne Radio Subsystem) is the new family of combat radios designed for the expected battlefield of the 1990s. Beginning in 1986, SINCGARS will replace the current very high frequency-frequency modulated (VHF-FM) radios used throughout the Army. Additionally, versions of SINCGARS radios will replace the familiar manpack AN/PRC-77, vehicular AN/VRC-46, and aircraft AN/ARC-114 radios, among others.

SINCGARS will offer a number of distinct improvements over the current systems and will have more than twice the number of usable channels (figure 1) because of a narrower channel width and higher available frequency band.

Other significant improvements are:

- •Reduction in size and weight.
- •Increased reliability.
- •Nuclear hardening.
- •Interoperability with Allied and NATO radios.
- •Snap-on COMSEC module.
- •Electronic Counter Countermeasures (ECCM).

The most significant advancement SINCGARS will feature is an ability to combat jammers through a process known as "frequency hopping." (The Soviets have a known capability to effectively jam US command control and fire direction nets.) In a SINCGARS "frequency hopping" net, all radios automatically change frequencies very rapidly. Netted radios are synchronized so that they "hop" together up and down the frequency band in a way that appears to be totally random. For example, in one instant all radios are set at 45 megahertz (MHz); seconds later all the radios are at 74.25 MHz, then at 63.6 MHz, etc. This "hopping" is extremely rapid, giving the appearance of having "smeared" the radio net across the entire band of 30 to 88 MHz which greatly reduces the effectiveness of jammers.

As previously mentioned, the SINCGARS program is targeted to replace current radios beginning in 1986. In the field artillery, we expect to use SINCGARS to provide the voice radio command and control capability as well as back-up for the PLRS/JTIDS Hybrid digital communications system supporting TACFIRE. (MAJ James L. Ondo, DCD)

	SINCGARS	Current VHF-FM radios
Number of channels	2320	920
Channel spacing	25KHz	50KHz
Frequency band	30-88 MHz	30-76 MHz

Figure 1.

COUNTERFIRE SYSTEMS REVIEW

TI-59 survey forms

Recent comments from the field indicate that some problems still exist in using Fort Sill Test Forms 611-11 and 611-13 with Computer Set, FA General/Missile.

For example, Fort Sill Form 611-11 (Test), Zone-to-Zone Transformation, shows in step 10 under the "Display" column that the number displayed is the true azimuth of grid Zone A. This is confusing since the true azimuths for Zones A and B are the same (only the grid azimuths change in this procedure). The number displayed on the calculator is actually the difference between the true azimuth and 6400 mils; i.e., 6400 minus true azimuth. Since the true azimuth is not necessary in the solution of the problem, the "Display" block for step 10 should be ignored. When using the Computer Set, FA Missile and its printer, the printout will display two *grid azimuths*. The first grid azimuth is erroneous and should be ignored. The second grid azimuth is the grid azimuth of Zone B and is the one that should be used.

Fort Sill Form 611-13 (Test), Traverse Adjustment, was discussed on page 21 of the November-December 1980 *Journal*. An error in the programming sequence causes an erroneous "azimuth of radial error" to be displayed when the azimuth occurs in the fourth quadrant. The error results from the internal use of the tangent function to compute a bearing. Since the tangent is negative in the fourth quadrant, the resulting bearing is also negative. The calculator adds this negative bearing to 0 degrees, resulting in a "negative azimuth." To covert this to a positive azimuth, 360 degrees must be added. Using the calculator, this is accomplished by recalling memory register 10 and adding the two numbers. Because 6400 mils is stored in memory register 10 and the azimuth in degrees is added to this, an erroneous azimuth of radial error is produced. This error was corrected in the aforementioned *Journal* article by adding "360 STO 10" to the "Enter" column in step 7, thus eliminating this problem. When program 02 is recalled to continue the adjustment, 6400 mils is restored in register 10 when the "A" key is pressed to initiate the program.

Surveyors worldwide are reminded that, until new forms are distributed by Department of the Army, the test forms must be locally reproduced and corrected as changes occur. The changes mentioned here are incorporated in the October 1980 edition of these forms. Request for these forms, as well as any questions or comments, should be addressed to:

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-SV
Fort Sill, OK 73503
AUTOVON: 639-1198
Commercial: 1-405-351-1198

FALOP change

Due to changes since publication of the November-December 1980 *Journal,* the Field Artillery School no longer uses the acronym FALOP (Forward Area Limited Observation Program). The US Army Intelligence Center and School is the proponent for FALOP as well as all Army general meteorology (met) and tactical weather requirements except those relating to artillery meteorology. The artillery meteorology section will take a limited surface observation in the future to support the anticipated needs of new artillery target acquisition systems and weaponry. Surface weather observations taken by artillery met personnel will use the same NATO code Supplementary Surface Weather Report (SUPREP) used by intelligence personnel when preparing a Forward Area Limited Surface Observation.

For further information on the Forward Area Limited Observation Program contact:

Commander
US Army Intelligence Center and School
ATTN: ATSI-CD-CS (Mr. R. Cundy)
Fort Huachuca, AZ 85613
AUTOVON 879-5155

For information on surface weather observations by field artillery meteorology sections contact:

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

Hand-held calculator applications in radar operations

Increased sophistication of the hand-held calculator even in inexpensive models has made it possible to perform a myriad of complicated calculations quickly and accurately. For example, with the proper formula, a target acquisition radar technician can use a scientific function calculator to compute not only simple problems, such as mean-point-of-impact (MPI) and high-burst registration, but also those more complex, such as three-point resection. One can also calculate weapons location as a back-up to the computer on the AN/MPQ-4A radar.

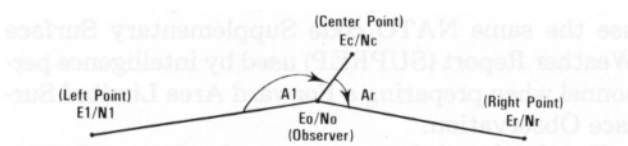
To emplace a radar without a surveyed point, the radar technician must rely on a hasty survey technique, usually map spotting and/or three-point *graphic* resection; unfortunately, neither of these provides a high degree of accuracy. However, using the same field data required for a graphic resection, the radar technician can use a calculator and the following formulas to compute his location.

These formulas are designed for use on a nonprogrammable calculator; however, along with all other formulas for three-point resections, these will not work when all four points (left, right, center, and observer) can be circumscribed by a circle. This limitation can be avoided by following either of these conditions:

1) Choose a center point closer to the observer than the left or right point.

2) Choose points such that the sum of the horizontal angles, Al + Ar, is greater than 3300 mils.

Three-point resection



The coordinates of the aiming points should be taken from trig lists, if possible. If not, they should be measured very carefully from the map. Assign the coordinate values as follows:

Ec = easting coordinate of center point.
Nc = northing coordinate of center point.
El = easting coordinate of left point.
Nl = northing coordinate of left point.
Er = easting coordinate of right point.
Nr = northing coordinate of right point.

The horizontal angles should be measured with an M2 aiming circle, or similar instrument. However, the radar telescope and azimuth counter could be used if nothing else is available. For best results, the angle measured should be between 800 and 2400 mils. Assign the values of the angles measured as follows:

Al = horizontal angle from left point to center point.
Ar = horizontal angle from center point to right point.

Since most calculators do not deal in mils, Al and Ar should be converted to degrees by the following: mils × 0.05625 = degrees.

Once the field data is complete, the coordinates of the left and right points should be referenced to the center point coordinates by performing the following calculations:

$$DEl = El - Ec \qquad DEr = Er - Ec$$
$$DNl = Nl - Nc \qquad DNr = Nr - Nc$$

Most calculators do not contain the cotangent function. The cotangents of the horizontal angles, Al and Ar, required for the calculations can be calculated by performing the following:

$$Ctl = \text{Tan}\,(90° - Al)$$
$$Ctr = \text{Tan}\,(90° - Ar)$$

Using the values calculated above while observing the plus and minus signs carefully, perform the following computations:

$$M = \frac{(Del \times Ctl) + (DEr \times Ctr) + DNl - DNr}{(DNl \times Ctl) + (DNr \times Ctr) + DEr - DEl}$$

$$DNo = \frac{(DEl \times M) + (DEl \times Ctl) - (DNl \times M \times Ctl) + DNl}{M^2 + 1}$$

$$DEo = M \times DNo$$

The values DEo and DNo represent the observer's coordinates with respect to the center point coordinates. Therefore, the observer's location can be determined by performing the following calculations:

Observer easting (Eo) = Ec + DEo
Observer northing (No) = Nc + DNo

The value M represents the tangent of the azimuth angle from the observer to the center point. If trig list data is used for the aiming point coordinates, the following calculation will give an accurate orienting azimuth: Azimuth from observer to center point (AZo)=Inv Tan (M) or Inv Tan (M) + 180. (Convert AZo from degrees to mils by the following: degrees ÷ 0.05625 = mils.) Inv Tan (M) is the inverse of the tangent function, or the angle whose tangent is the value equal to M. A map check should be made of the azimuth's value to insure that the back-azimuth is not used. (You may be 3200 mils out, if you don't check it.)

Weapons location

In a situation where the computer on the AN/MPQ-4A radar malfunctions and cannot be repaired immediately, the radar technician can still employ a calculator to compute weapons locations using the data from the range and azimuth dials. The formula below is an improvement over the formula used in the radar computer in that ground ranges are calculated rather than approximated using slant ranges. Therefore, the results from the calculator will be more accurate than the results from a perfectly aligned radar computer using the same data. Thus, the calculator can also be used to check the accuracy of the radar computer by plugging in arbitrary data.

Assign the values of the data preset into the radar computer as follows:

Er = Radar easting coordinate.
Nr = Radar northing coordinate.
Hr = Radar height.
Hw = Weapon height.
el = Lower beam elevation angle
b = beam separation angle.

Once a round is detected, assign the values of the observed data as follows:

Rl = range to lower beam intercept
azl = azimuth to lower beam intercept.
Ru = range to upper beam intercept.
azu = azimuth to upper beam intercept.
Dt = time interval.

The range and azimuth handwheels can be used to strobe both the lower beam and the upper beam intercepts. However, if the delta range and delta azimuth handwheels are used to strobe the upper beam intercept, then the following equations should be used to calculate Ru and azu:

DR = reading on delta range dial.
Daz = reading on delta azimuth dial.
Ru = Rl – DR
azu = Azl – Daz

After converting all angles to degrees, perform the following computations in sequence:

$$El = Rl \times \cos(el) \times \sin(azl)$$
$$Nl = Rl \times \cos(el) \times \cos(azl)$$
$$Hl = Rl \times \sin(el) + Hr$$
$$Eu = Ru \times \cos(el + b) \times \sin(azu)$$
$$Nu = Ru \times \cos(el + b) \times \cos(azu)$$
$$Hu = Ru \times \sin(el + b) + Hr$$

$$\text{For Dt greater than } 0: Y = \frac{Hu - Hl}{9.806 \times (Dt)^2} + 0.5$$

$$Z = \sqrt{Y^2 + \frac{Hl - Hw}{4.903 \times (Dt)^2}} - Y$$

$$\text{For Dt} = 0: Z = \frac{Hl - Hw}{Hu - Hl}$$

Once the computations above are complete, the location of the weapon can be determined by performing the following calculations:

Weapon easting (Ew)=(El–Eu)×Z+El+Er
Weapon northing (Nw)=(Nl–Nu)×Z+Nl+Nr

If the weapons height needs to be corrected, substitute the new value of Hw into the equation for Z and recompute Z, Ew, and Nw only. The other values will not change.

Programmable calculator

These formulas for three-point resection and weapons location have been designed for use on a simple scientific calculator. However, they are even more effective when used with a programmable calculator such as the Texas Instruments TI-59. Both formulas have been effectively programmed and recorded on a single magnetic card for a TI-59. Copies of these programs may be obtained by contacting:

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-R
Fort Sill, OK 73503
AUTOVON: 639-4925/4982
Commercial: 1-405-351-4925/4982

(WO1 Thomas Boomhower, CFD)

AN/MPQ-4A being replaced

Replacement of the AN/MPQ-4A radars with the AN/TPQ-36 and AN/TPQ-37 Firefinder Systems will begin this summer. As such, one item of the AN/MPQ-4A system has become an early casualty due to fiscal constraints and upcoming Firefinder deployment. The S-143A Electrical Equipment Shelter (NSN 5410-00-936-8720) for AN/MPQ-4A is no longer available in the supply system, and there are no future plans for further procurement. Therefore, it is recommended that units currently short this shelter should consider dropping the item from their MTOE and substitute another type shelter deemed appropriate for mission requirements.

FTX Sankt Georg

by MAJ George Demetriou

Perhaps the most pressing question facing the Field Artillery today is one of survivability. This subject has been addressed several times in the past year; e.g., the Field Artillery School has published a review on the subject, the Army Materiel Systems Analysis Agency (AMSAA) had made several computer runs (*FA Journal,* September-October 1980), and it has been the prime topic of discussion at several officers professional development sessions throughout US Army, Europe.

One of the key issues in survivability is how often a battery should move, and to this there are no simple answers. The frequency of moves cannot be isolated from the interrelated activities of the battalion. It is affected by, and in turn, affects the time available for fire missions, the accuracy achievable in the gunnery problem, communications-distance factors and resupply.

Field training exercise

A unique opportunity to examine these vital issues presented itself in September of last year during Field Training Exercise (FTX) Sankt Georg, an autonomous component of the NATO Autumn Forge exercise series. The exercise was sponsored

by III (GE) Korps to train German national, territorial, and allied combined arms forces in a free play, free maneuver, multiservice exercise. Here, the United States was represented by the 3d Brigade, 8th Infantry Division (Mechanized), supported by the 1st Battalion, 83d FA "Golden Dragons." (The 3d Bde fought on the ORANGE side as part of the 12th Panzer Division—the first time a US unit has been controlled by the German Army.)

The exercise was conducted in the Vogelsberg area southwest of Fulda, an extremely realistic setting in reference to a possible conflict in Western Europe (only 30 miles separated the participants from the inter-German border). Tactical missions included were:

- •Movement to contact.
- •Meeting engagement.
- •Hasty attack.
- •Defensive operations.
- •Delay.
- •Counterattack.

The movement and gunnery data of the US artillery were recorded with the hope of gaining better insight to the survivability question as well as other relevant topics.

Frequency of moves

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Frequency of moves

Throughout the four-day exercise, US firing batteries averaged 3.6 moves per day, wherein displacements occurred only when necessary to keep pace with the maneuver elements (except for the one or two times that controllers simulated counterfire on each battery). While conducting these "minimum essential" moves, the battalion lost 17 percent of its firing time; i.e., at any given instant, 83 percent (an acceptable figure to most) of the battalion's firing capability was in position.

According to the US Army Field Artillery School's review on survivability, one of the key parameters in movement is to coordinate moves with requirements for support of the maneuver force so that at least two-thirds of the available artillery is prepared to fire at all times. The validity of the two-thirds rule depends on how much artillery is available; e.g. two-thirds of four or five batteries may be adequate to support a brigade, whereas two-thirds of two or three batteries probably would not be adequate. The percentage of firing time mentioned above is an average based on three batteries in position (regardless of operational readiness rate) equaling 100 percent. To say a unit maintains an acceptable 83 percent firing capability does not tell the whole story. An 83-percent average may consist of a block of time where only one battery is in position to fire and, depending on the tactical situation, that most likely is unacceptable. As such, let's look at the firing capability in a different way:

Number of batteries in position	Percent of exercise time
3	52
2 (only)	42
1 (only)	6

One can see that the two-thirds rule was violated only 6 percent of the time as a result of the tactical situation. The most disturbing aspect of these figures is that almost half the time (48 percent) *no more than* two batteries were available to fire. Remember that this data was achieved with a minimum number of moves. If you add an equal number of moves per day for survivability and consider a 90 to 95 percent operational readiness rate, you are in the realm of 60 percent of your firing capability. As such, the *minimum adequate support for a maneuver brigade needs to be redefined in absolute terms*.

Fire missions

A total of 353 missions were fired from 34 positions during the 75-hour exercise, or an average of 10.4 fire missions from each position. Most were fired during daylight when the fire support team (FIST) could easily acquire targets and the number of missions fired from specific positions varied from none to 34. Over 95 percent of the missions were fire for effect (FFE) as opposed to adjust fire (AF) which was not unique to Sankt Georg, but has been the norm in all exercises in which the 8th Infantry Division has recently participated. The FISTs persist in using fire for effect because all rounds "hit" the target as they do in dry exercises. Realistically, no unit is going to shoot that well. FM 6-30 advises that at least a one-round adjustment should be fired when registration corrections are not available. Allowing the FIST to fire for effect at will is counterproductive since the FIST must consider the gunnery problem when calling for fire. By firing for

Sankt Georg

effect on each mission, the FIST will mislead maneuver elements in what they can expect. Additionally, the fire direction center (FDC) capability will be inflated in that fire for effect missions require less time to complete than adjust fire missions. Until the FA Community develops a realistic artillery engagement system (Dr. Stein's technique described in the September-October 1980 *Journal* is a step toward this goal), commanders must be sensitive as to how the FIST trains during dry exercises. The thought of fire for effect on each mission leads to the next parameter worth examining.

The Gunnery problem

To provide timely and accurate fires, we must have accurate meteorological (met), and muzzle velocity data.

•Met data, the easiest to obtain, was expeditiously passed to firing batteries in the form of met messages every four hours during the exercise. Due to the fast pace of the battle, it was difficult at times to free personnel to manually compute or enter the met data into FADAC; however, there were sufficient lulls in activity to allow FDCs to remain relatively current with met messages. Since Sankt Georg was a dry exercise the met messages were fabricated by the controllers. Had the entire division been deployed, it is questionable whether one met station, with a 20-kilometer validity radius on gently rolling terrain, could have provided valid met messages to all batteries of a division artillery. Additionally, met messages more than two hours old lose their validity during day/night transitions or during frontal passages. The total requirement may very well be for six to eight met messages per 24-hour period. Given the mobility and reliability of current equipment, met data may not always be available when needed.

•Obtaining muzzle velocity data was a bit more complicated. Currently, there are two methods of obtaining the muzzle velocity: registration (discussed in detail later) and calibration. Batteries were required to fire three to four different charges from each position. The full range of charges fired was charge 4 white bag to charge 8 (RAP) rocket on. In order to be fully prepared, a battery would need velocity errors (VEs) for six charges: 4 green bag, 5 green bag, 6 white bag, 7 white bag, 8 white bag, and 8 (RAP) rocket on. The training ammunition is simply not available to accomplish this; the chance of calibrating once hostilities commence is slim to none. A solution to this problem, however, is on the horizon through use of the M90 chronograph (velocimeter). The M90 will allow us to obtain VEs as we shoot fire missions but, until fielded, commanders must be prepared to fight the battle without all the VEs they should have.

• Perhaps the biggest challenge was survey since 34 positions were occupied during the 75-hour exercise. (Remember, this was with virtually no moves for survivability.) Throw in a reasonable number of survivability moves and we're in the ballpark of 20 positions per battalion per day. Some of these will be short moves to alternate positions to which the battery commander can easily extend control by means of hasty survey, but with flank batteries 11 to 15 kilometers apart, two survey parties (even with distance measuring equipment) will be hard pressed to keep up. The bottom line is that the survey conducted before the shooting starts is the bulk of what you'll have to work with. Survey parties will definitely be able to do *some* of the work and battery advance parties can help fill in the gaps with hasty survey, but if the war is begun from ground zero, units will be required to occupy unsurveyed positions at one time or another. In a defensive posture such as USAREUR is in today, presurveyed positions are an absolute must; offensive operations and out of sector missions pose the greatest challenge. The 8th Infantry Division Artillery has an excellent reference on real world survey planning and execution dated 16 September 80 which interested units can obtain on request.

Registration

Registering during the battle is going to be tough. Here, a surveyed registration point would be nice, but unless you've planned ahead you probably won't have one. (Don't forget to coordinate for an observer in the proper position if it's going to be a precision registration.) A high-burst or mean-point-of-impact registration may be out of the question since the frontline trace won't hold still long enough for you to put in a target area base. The best bet appears to be a radar registration; however, the radar must be on common control with the battery center, the offset piece, and if you're going to transfer, the rest of the battalion.

Sankt Georg brought out two problems regarding registrations. First, it was difficult to detrmine which charge should be registered. As mentioned earlier, units were required to shoot three to four charges from each position in order to satisfy the needs of various maneuver elements. The first solution that surfaces is to register the three to four charges; however, that leads right into the second problem—time. Due to the dry nature of the exercise, it was virtually impossible to realistically simulate registrations, but it came through loud and clear that opportunities to register were scarce, particularly for more than one charge. A reasonable estimate of the minimum time needed from the start of initial coordination to computation of registration data would be 30 minutes. While the registration is being conducted, the remainder of the battery must be able to respond to on call fire missions and it should be clear by now, that by the time you register the third or fourth charge and compute all the data, it's going to be time to move. What have you accomplished? You've given the enemy additional opportunities to locate the battery and you have divided the attention and energies of your FDC.

Communications

The relation of communications to survivability is clear—in order to survive, we must prevent location by enemy radio direction finding equipment. However, avoiding detection through modification of current communications practices appears to have very little to offer, simply because timely communications are the heart of direct support artillery. In order to mass fires, there must be a constant exchange of information between battalion and battery FDCs and, as units move more frequently to increase survivability, communication requirements also increase.

During Sankt Georg, four techniques for avoiding detection were examined:

- Radios on low power.
- Directional antennas.
- Couriers.
- Wire.

The wide spread of batteries and the 10 to 15 kilometers per day movement of maneuver elements virtually eliminated opportunity to use low power (often even high power capabilities were taxed).

Directional antennas proved to have limited usefulness since the tactical operations center (TOC) and firing batteries were in the center of the battlefield and thus were required to communicate forward, laterally, and to the rear. Additionally, the FIST on the frontline had to communicate primarily to the rear and sometimes laterally and their use of directional antennas was limited by constant movement. (A directional antenna from the battalion TOC to division artillery is about the only possibility.)

During the initial movement to contact, the brigade imposed radio silence on all elements until contact was made. Firing batteries had to move from staging areas to initial positions and, when contact was made, the TOC had no positive confirmation that the plan was properly executed nor was sufficient information available to mass fires. The utility of couriers was limited to routine, recurring reports.

The focal point of field artillery communications is the battalion TOC. Doctrine acknowledges that there is no single approved method of how to configure the direct support field artillery battalion TOC or where to locate it since much depends on how the maneuver brigade fights the battle; i.e., utilization of main and tactical command posts. The primary concern then should be wire communications.

The field artillery battalion commander must choose between wire to the batteries or wire to the brigade fire support officer. Only rarely will he have both. Except for initial positions, wire to the firing batteries is going to be extremely difficult with current MTOE authorizations. With an 11 to 15 kilometer spread of firing batteries and frequent moves, wire teams simply cannot keep up. The 1-83d FA chose to locate their TOC two to three kilometers from the brigade main CP (the FSO jumped between the main and tactical CPs) and their wire teams did an excellent job of establishing and maintaining wire communications. The disadvantage to this is that, at times, the TOC ends up 15 to 20 kilometers to the rear of the batteries and FM communication suffers due to distance and terrain factors. Brigade commanders and S3s must understand that the way they fight the battle impacts on FA command and control. If the brigade FSO can operate from a TAC command post, the FA TOC can have wire to him, experience little problem with FM communication to the batteries, and have frequent opportunities to lay wire to at least one battery.

Another significant problem caused by the lack of wire is the overload of the battalion command net. With five batteries (commanders and battalion operation centers (BOCs) and four fire support officers on the same net, it is difficult to get a transmission. The 1-83d FA experimented with a separate net for FSO traffic. This works fine for internal FSO planning; however, the TOC only has two radios (battalion and division artillery command/fire direction nets) and cannot monitor a fire support net nor can BOCs which need frontline trace and fire support coordination measure information as much as the battalion tactical operation center. A possible source for a third radio is to remote from the battalion S3's vehicle.

Displacement times

One of the key factors in analyzing the trade-off between mission capability and survivability moves is the firing time lost when a battery accomplishes a move. (Previously, I discussed the percentage of time lost to make both minimum essential and survivability moves; now let us look at specific displacement times in relation to the distances involved.) It has already been stated that the exercise area is a representative sample of the terrain US forces would have to fight on in a European conflict. When battery moves are planned, the distance mentioned is the straight-line distance. In estimating movement time, we actually need the road distance between positions. Data from Sankt Georg showed that a useful rule of thumb is

ROAD DISTANCE = 150%
STRAIGHT LINE DISTANCE

Knowing the applicable march rate, we can now compute movement time. Right? Wrong!! Let's look at the first three moves made by A Battery:

Road distance (km)	Time out of action (hrs:min)
7	1:00
8	2:15
7	1:30

Keep in mind that these moves were made by the same battery on the same day under daylight conditions. The times could have been somewhat better had avoiding maneuver damage not have been a consideration; however, there is still something missing! Sankt Georg showed that the primary contribution to time out of action was the time spent getting in an out of position. I have categorized the moves made as follows:

- •I —Open field position to open field.
- •II —Open field to treeline or vice versa.
- •III—Treeline to treeline.

As you go down the list, it takes longer to conduct a move of the same distance, and as such, we have something else to consider. If we are going to move every three to four hours, perhaps we should stay out of the trees to optimize firing time.

Moving one kilometer to an alternate for survivability is a viable possibility. Some have professed the ability to do this in 20 minutes making it extremely worthwhile. Let's examine the two shortest moves:

Type move	Road distance (km)	Time out of action (hrs:min)
II	1.3	0:25
III	0.5	0:30

Again, these were made during daylight and although no Type I moves of approximately one kilometer were made, the data indicates that 20 minutes for such a move is an attainable standard.

Resupply

Resupply may very well be the biggest single problem facing us. All the fire missions we've talked about will stop if we don't get the bullets to the guns. Sankt Georg showed that we must streamline firing battery operations to operate lean and mean and be ready to move as quickly as possible. Here, one battery commander utilized his battery trains (mess and supply) extremely well during the exercise—they never set up in the battery position; rather, they occupied a town nearest the position and were given a time to have the meal ready. At meal time, a messenger came to lead the mess truck with mermites to the battery position. In almost all cases, the battery moved at least once while the meal was being prepared, but meal preparation was never disrupted. When the meal was finished, the trains were relocated to what was then the nearest town.

Resupply of ammunition also presented a challenge. Although during the exercise live or "real" ammunition was not used. A Freight Automated System for Traffic Management (FAST) with ammunition representatives was established and, in order to be resupplied, the player unit had to report to the FAST with properly completed DA Form 581 and the appropriate vehicles. At the FAST, DA Form 581 was authenticated and vehicles held to simulate loading. When released, the vehicles could deliver to the batteries where the authenticated DA Form 581 had to be handed to the FDC controller before the ammunition count could be updated; vehicles were then held to simulate off loading.

The major problem encountered was locating the batteries. Ammunition truck drivers never went to the same place twice; in fact, batteries often moved after resupply vehicles were dispatched from the FAST. Possible solutions include putting a radio in ammunition vehicles (requires an MTOE change) or transloading at a predetermined point on a set schedule with a battery ammunition representative meeting the battalion representative. Petroleum, oil, and lubricant (POL) resupply faces a similar situation. To quote the 83d's after action report: "The Service Battery is extremely lean and yet has the most demanding mission in the battalion. Moreover, it does not have sufficient communications to exercise proper command and control over its assets, nor to effect the coordination with widely separated batteries."

Areas for pursuit

Any survival philosophy adopted must first satisfy mission accomplishment. Adequate direct support for a maneuver brigade is in the realm of 15 to 18 howitzers (sufficient firepower) from at least 3 different locations (to insure adquate battlefield coverage) 100 percent of the time. A 3-battery, 18-howitzer direct support battalion cannot provide such support by itself. Depending on the number of moves, a DS battalion can provide adequate support 60 to 80 percent of the time. A solution is to provide two reinforcing batteries to each DS battalion; each of the five batteries could then move six to eight times per day, and the brigade would get adequate FA support 100 percent of the time. The problem with this is it would virtually wipe out the general support and general support reinforcing units which corps and division commanders need to weight the battle and perform the counterfire mission.

Perhaps the answer is in the 8-howitzer battery, soon to be fielded in Europe. Since each battery will have two FDCs, the battalion could feasibly operate as six 4-gun mini-batteries. Each could move six to eight times per day and the battalion could still maintain 16 howitzers ready to fire 100 percent of the time.

The frequency of movement question remains a vital issue. An Army Materiel Systems Analysis Agency study conducted in 1979 showed that batteries needed to move 15 to 22 times per day to insure survivability. Perhaps computers can move batteries 20 times a day, but soldiers can't. In fact, the Division Reorganization Study (DRS) indicated batteries are presently capable of making three to four moves per day for a sustained period of two to three days before part of the system broke down.

In light of this, a movement philosophy based on moving for survivability only when engaged by counterfire appears to be the most feasible at this time; however, given the present Warsaw Pact capability to locate NATO artillery units, 19 hours and 34 missions from the same position is sheer suicide. Commanders must consider development of a general guideline on time and missions from one position to help trigger a quick move to an alternate position.

Given the present limits on moves, our energies must be directed to alternate means of enhancing survivability. Areas such as avoiding detection, dispersing, hardening, and defending against ground and air attack must be further developed. FTX Sankt Georg was an eye opener; it brought all these areas into perspective in a realistic operational environment. If the lessons learned there can serve as an impetus to pursue the entire spectrum of alternatives, we can truly call Sankt Georg a very worthwhile exercise.

MAJ George Demetriou is the S3 of the 1st Battalion, 2d Field Artillery, Baumholder, Germany.

REDLEG NEWSLETTER

Active soldiers assigned to Reserve Components

More than 450 Active Army soldiers-were assigned to National Guard and Army Reserve units in the last quarter of 1980 as part of the Full-Time Manning Program (FTM).

The first 452 individuals to be assigned to Reserve Component units this fiscal year join an additional 1,070 fellow soldiers already assigned to Reserve Component units.

Additionally, more than 3,500 National Guard members and Reservists are expected to join Active Army soldiers to strengthen the Reserve Components by more than 5,000 before the end of FY81.

The Full-Time Manning Program, which has already assigned 1,000 Active Army and nearly 2,100 full-time Reserve Component soldiers in Reserve Component units, began in October 1979.

When the program is completed in 1987, more than 10,000 soldiers from both Active and Reserve Components are expected to be on duty at local Guard and Reserve units throughout the country.

Drill sergeants needed

Drill sergeants are a select group of noncommissioned officers responsible for developing discipline, motivation, morale, esprit de corps, and professionalism in recruit trainees. As such, they teach the skills necessary for recruits to become valuable members of today's Army. Since the drill sergeant is the primary representative of the Army during the formative weeks of a soldier's training, it is essential that only the best qualified professional soldiers be assigned these duties.

Selection is based on individual qualifications and the demonstrated potential to be appointed to positions of increasing responsibility. Volunteers must be in grades E5 through E7 if male; E4 through E7 if female. Personnel may volunteer regardless of military occupational specialty (MOS).

Noncommissioned officers selected for drill sergeant duty are among the most highly qualified when considered for promotion, schooling, and assignments when compared with their contemporaries. Department of the Army selection boards for schools and promotion are instructed to consider drill sergeant experience and the manner of performance of that duty.

Volunteer applications are submitted through command channels on DA Form 4187, following procedure 3-34, DA Pamphlet 600-8, and must include the following:

•DA Form 705 (Army Physical Fitness Evaluation Score Card) showing successful completion of the Basic Physical Fitness Test (BFPT) within the last six months.

•Statement from medical officer that the applicant does not have a history of emotional instability.

•Copy of DA Forms 2 and 2-1.

•Three training centers listed in order of preference.

All male personnel in grade E5 must meet the following additional qualifications:

•Minimum of four years service.

•Successful completion of Primary/Basic Noncommissioned Officers Course or Platoon Leaders Class.

•Recommendation for drill sergeant duty by a commander in the grade of lieutenant colonel or above.

Soldiers selected for drill sergeant duty will receive two years stabilization at an Army Training Center with the option to request 12 additional months. Additionally, they receive:

•Special duty assignment (SDA) pay.

•Supplemental issue of uniforms which are laundered free.

•Authorization to wear the distinctive drill sergeant hat and badge.

•Pride of accomplishment of a difficult and demanding job.

There is a continuing need for highly qualified personnel to serve in these vital duties at Army Training Centers. For more information, soldiers may contact their local military personnel office or their career branch.

Defense Officer Personnel Management Act

The Defense Officer Personnel Management Act (DOPMA), the most comprehensive revision of the Officer Personnel Management System (OPMS) since the Officer Personnel Act of 1947, was passed by the Congress on 21 November last year. DOPMA provisions having the strongest impact on the Army are listed below in the left column while current provisions are shown on the right:

Promotion

DOPMA	Current
Dual (RA and AUS) promotion systems will be coalesced into a single active duty list.	Essentially, two systems are managed-RA and AUS.
Minimum time in grade (TIG) set for "due course" officers as follows: Promotion to 1LT - 18 months. Promotion to CPT - 2 years. Promotion to MAJ - 3 years. Promotion to LTC - 3 years. Promotion to COL - 3 years.	TIG requirements not formally established.
Expected time in service (TIS) and promotion opportunity for field grade promotions is expected to be in line with current trend. May have to adjust points by six months to accommodate changes in grade tables.	TIS for field grade promotions: **Rank / TIS / Opportunity** 04 / 10± 1 / 80% 05 / 16±1 / 70% 06 / 22±1 / 50%
DOPMA continues to allow the Army to provide promotion selection boards instructions about service skill needs. OPMS can be supported.	Promotion selection boards instructed about specialty requirements.
Army will decentralize promotion of first lieutenant and Captain to field. Promotion selection board still required for promotion to captain.	Promotion to first lieutenant decentralized to field commanders.

Tenure for Officers with Regular appointments

DOPMA	Current
Colonel, 30 years. Lieutenant colonel, 28 years. Majors twice nonselect for promotion to lieutenant colonel may be selectively continued to 24 years and captains twice nonselect for promotion to major may be selectively continued to 20 years. First lieutenants twice nonselect for captain must be involuntarily separated from the service. These tenure provisions apply only to regular officers. If the Army would not implement the all regular force concept, those nonregular officers could not remain on active duty beyond 20 years.	Colonel —30 years. Lieutenant Colonel —28 years Major —21 years. Captain —14 years. First Lieutenant —7 years.
DOPMA requires those officers who are promoted to grades above major to serve in those grades three years prior to voluntary separation. Special provisions are made for hardship cases.	Army policy requires officers promoted to grades above major to serve two years in that grade prior to voluntary separation. Not stated in law.

All Regular Force

DOPMA	Current
DOPMA authorizes Secretary of the Army to establish all regular officer force at the eleventh year TIS point. Authorized size of RA officer strength increased to 63,000.	Active Army Officer Corps composed of RA and OTRA component officers. Authorized RA officer strength is 49,500.

Field Grade Officer Distribution

DOPMA		Current	
Grade	**DOPMA End Strength**	**Current Grade**	**Planned FY80 End Strength**
06	3,764 (+ 3.8)*	06	3,627
05	9,387 (– 5.8)	05	9,963
04	14,156 (– 2.6)	04	14,529
TOTAL	27,307 (– 2. 9)	TOTAL	28,129

* Percent Difference from planned FY80 end strength.

Army will have two years to make transition to DOPMA ceilings. Overall reductions in field grade officer strength may require adjustment to promotion points for those grades.

Constructive Credit

DOPMA	Current
DOPMA establishes uniform, general, constructive credit provisions for all services. Rules will be refined by DOD directive. Impact most on AMEDD and JAG Corps personnel. By policy, Army has been moving in direction of DOPMA provisions	Constructive credit for prior service, experience, and education is according to prerogative of individual service.

Pay for Involuntary Separation

DOPMA	Current
Maximum pay for involuntary separation is $30,000.	Maximum pay for involuntary separation is $15,000.

Army advantages to be accrued by DOPMA are as follows:

•The single promotion system will eliminate the perception of inequity between RA and OTRA officers serving on active duty.

•Provides for more efficient officer personnel management which accommodates career progression.

•Establishes the foundation for all regular officer force.

•Supports the Army Officer Personnel Management System and promotion according to specialty needs.

•Provides constructive credit rules which will improve Army accession of highly educated and technical trained personnel, particularly those who possess medical skills.

DOPMA will be effective 15 September 1981.

PX privileges doubled

Army exchange privileges for members of the Army National Guard and the Army Reserve have been doubled. Members now can earn one day of PX privileges for each four-hour drill. That means four days of PX privileges for a two-day drill weekend, instead of only two.

Dependents of Reserve Component members may use the PX, but they must be accompanied by their sponsor. Unit members must present their red Reserve Component identification card and Leave and Earning Statement when using the PX. Only Reserve Component unit members may use the PX privileges; Individual Ready Reserve members are not eligible.

Issuance of DD Forms 214/220

Information listed below outlines guidance for issuance of DD Form 214 and DD Form 220 to members of the Reserve Components (Army National Guard of the United States and US Army Reserve).

Members of the Reserve Components on initial active duty for training receive a DD Form 214 (Certificate of Release or Discharge from Active Duty) when separated:

•After 90 continuous days of initial active duty for training.

•After completing initial active duty for training as indicated by award of an MOS (even if on duty less than 90 days).

Members of the Reserve Components receive a DD Form 214, as an exception, regardless of time served, when separated.

•For physical disability under the provisions of AR 635-40 (Physical Evaluation for Retention, Retirement, or Separation). Note: Separation under the provisions of paragraph 5-7, AR 635-200 (Enlisted Separations) is not a physical disability separation.

•From a special active duty training program tour. (These are tours for projects relating to Reserve Component programs that require Reserve Component expertise. Example: unit conversions to new weapons systems. Army National Guard of the US Alternate Training, US Army Reserve Split Training, and other forms of established/recurring initial active duty training programs are not special tours.

AR 635-5 (Separation Documents) is the implementing regulation for the Army use of the DD Form 214. Instructions contained in the regulation take precedence over guidance in other Army publications.

Reserve Component personnel receive a DD Form 220 (Active Duty Report) when completing basic training under the Army National Guard of the US Alternate Training or US Army Reserve Split Training programs or when completing basic training under the Civilian Acquired Skills Program. Paragraph 2-13 of AR 635-5 outlines special instructions for the preparation of this form.

Army Linguist Program

A recent announcement by the US Army Military Personnel Center indicates the Army is currently in need of enlisted soldiers who are qualified in several languages to include Chinese-Mandarin, Czech, Polish, Arabic, and Turkish.

The Army Linguist Program is largely voluntary, although some soldiers could be selected for linguist duty if Army requirements cannot be filled. To qualify for language training, individuals:

•Should not be on overseas assignment orders.

•Must have a score of 89 or higher on the Defense Language Aptitude Test (DLAT).

Soldiers who are selected for training are sent to the Defense Language Institute (DLI) Foreign Language Center, Monterey, CA, where basic course lengths range from 24 to 46 weeks depending on the language to be taught.

The Defense Language Institute provides instruction in 50 different languages divided into four language groups: Romanic-Germanic, Asian, Slavic, and Middle East-Southern Europe. The Institute is equipped with the latest in audio visual training aids, closed circuit television and laboratory facilities.

Defense Language Institute graduates are awarded the Additional Skill Identifier "L" and are subsequently assigned to one of 5,000 linguists positions worldwide. Normal initial duty tours on completion of training are for a minimum of 12 months.

Other languages for which linguist opportunities are available include Russian, Japanese, Dutch, Greek, Flemish, Swedish, Spanish-American, French, Chinese-Cantonese, Arabic-Saudi, Spanish-Castilian, Hungarian, Korean, Arabic-Egyptian, Persian-Farsi, Persian-Afghan, Serbo-Croatian, and Danish. Other positions are open for Finnish, Portuguese-Brazilian, Tagalog, Indonesian, and Portuguese-European linguists.

Enlisted soldiers interested in language training should check with their local military personnel offices for additional information. Requests for language training should be forwarded to US Army Military Personnel Center, ATTN: DAPC-EPT-S, 2461 Eisenhower Ave., Alexandria, VA, 22331.

NCO Development Program

The Army Chief of Staff recently approved the establishment of an Army-wide Noncommissioned Officers Development Program (NCODP). The objective of the program is to increase combat effectiveness of the Total Army by strengthening the NCO Corps in leadership, professional skill development, training, counseling, care of the soldier, military conduct, and discipline.

The NCODP will be a unit commander's program, conducted primarily under noncommissioned officers when appropriate. It is at the unit level where potential noncommissioned officers are selected, where their most significant training is accomplished, and where their performance counts most in the Army's mission. Therefore, commanders will be responsible for creating, implementing, and guiding noncommissioned officer development programs within their units and organizations based on individual requirements and available resources.

The NCODP will contain training tasks, duties, and responsibilities which enhance unit combat readiness. The unit NCODP will be supported by a Department of the Army program which will develop initiatives to strengthen those Army-wide programs providing support to the NCODP such as Enlisted Personnel Management System, Army Training Literature Program, Army Continuing Education Program, and the Quality of Life Program.

To assist commanders in NCODP development and execution, each major command will establish a Noncommissioned Officer Development Advisory Council chaired by the command sergeant major. Members will include senior noncommissioned officers from the command. The Sergeant Major of the Army has been charged with overall responsibility for the program.

Senior Rater Profile Reports

Army officers who served as a senior rater for a minimum of five other officers during FY80 have been provided their first senior rater profile report. The report is part of the new officers' evaluation reporting system (OERS) and provides a way to track and maintain the rating history of each senior rater. Selection boards and career managers will now know an officer's rating tendency, along with other information when they evaluate the officer's performance for promotion, command, and service school actions. The profile shows how the senior rater has evaluated officers of the same grade.

The Senior Rater Profile Report was sent to those qualifying officers who met last year's cutoff date of 18 September 1980. It will be produced annually for Army officers at the end of each fiscal year. Another copy of the report goes into the officer's performance file.

Senior raters of other military branches and Department of Defense civilians who serve as senior raters may request a copy of their profile reports by writing to Commander, US Army Military Personnel Center, ATTN: DAPC-POE, 200 Stovall Street, Alexandria, VA 22332. Personnel requesting their report should include full name and social security number.

Army-wide First Sergeants Course established at Fort Bliss

The Army Chief of Staff recently approved a Training and Doctrine Command proposal to institute an Army-wide First Sergeants Course at Fort Bliss, TX. The course is currently being developed by the Directorate of Training Developments, US Army Air Defense School, and will be conducted under the auspices of the US Army Sergeants Major Academy. The new course, offered to all branches and military occupational specialties, is directed toward E7s and E8s without prior first sergeant experience who are programmed for first sergeant assignments.

Until permanent facilities can be constructed, the course will accommodate a reduced student load of 60 per class with 5 classes per year. The pilot First Sergeants Course is scheduled to begin in October 1981. (Air Defense Newslettr)

Guard application for SMA Course

Applications are now being accepted from Army National Guard master sergeants and sergeants major for attendance at the Sergeants Major Academy resident course which begins next July 27.

Applications, which should be forwarded to the ARNG Military Education Branch, ARNG Operating Activity Center, Edgewood Area, Aberdeen Proving Ground, MD, 21010, by 6 April 1981, will be limited to high school graduates with less than 24 years of service.

Commanders should insure that applications are submitted only by Guardsmen who can leave their job or school assignment for the necessary 22 weeks to complete the course.

Applications should include an up-to-date military photograph, a recent physical examination report, a copy of the applicant's 201 field file, and a 250-word essay written by the applicant on why he or she wants to attend the SMA course.

Fire Support Control

by Barry L. Reichard

A strong national defense capability depends on the ability of the US Army to respond to any type of threat in any theater of the world. One of the most demanding missions is fighting against a mechanized threat where greatly increased mobility and lethality combined with the possibility of fighting outnumbered will result in an intensity of battle never experienced on previous battlefields. The Yom Kippur War was a sample of the kind of intensity of battle that can occur on the modern mechanized battlefield.

The objective of the US Army, however, remains unchanged—to win the land battle. Doing this on the modern battlefield, especially when outnumbered, will require the skillful orchestration of combined arms teams to concentrate combat power where and when it is needed most. On this dynamic battlefield, where command communication lines may be cut off intermittently, the battle must be fought and combat power must be applied by captains and their companies, batteries, or troops under the general direction and control of brigade and battalion commanders, while the higher levels of command focus on concentrating the forces at the right time and place. Since a principal component of combat power is the firepower provided by the fire support system, the ability to plan, coordinate, and execute fire support at the fighting level must be a critical concern for US Army research, development, and acquisition.

The HELBAT series

The Human Engineering Laboratory Battalion Artillery Test (HELBAT) exercises have provided a baseline understanding of field artillery fire support system operations as well as cursory evaluations of promising new concepts for improving the system, especially in terms of responsiveness. Although HELBAT has evolved into a joint US Army Training and Doctrine Command (TRADOC) and Materiel Development and Readiness Command (DARCOM) field test-bed series for evaluating artillery operational concepts and materiel, the program began in August 1969 with the goal of measuring the system error (sources and magnitudes) in an operational artillery battalion. The results of HELBAT 1 indicated that more than one-half of the system error (round impact relative to target location) was target location error (TLE) arising from the forward observer; i.e., locating himself geographically on a map and locating a target with respect to his position.

The advent of practical laser rangefinders (LRFs) provided the opportunity to reduce the target location error, and a second test, HELBAT 2, was conducted in February 1971 to evaluate this technology opportunity and some attendant operational concepts. The FO location could be determined quite accurately by using a tripod-mounted LRF to determine the range to (at least) two identifiable map reference points and a simple resectioning survey technique to locate the FO with respect to these points. Alternately without reference to a map, the FO location could be determined by simultaneously ranging to two commonly observable objects, such as illumination flares or hovering helicopters, from both the gun and FO positions. (Knowledge of the ranges and one included angle permits the determination of the FO position relative to the guns.) Using these techniques and the tripod-mounted LRF with angle scales to locate targets, it was demonstrated in HELBAT 2 that the FO target location error could be reduced from an average value of 400 meters to less than 25 meters.

Having demonstrated that the TLE for stationary targets could be reduced to approximately the same value as the precision of the gun-ammunition system (at about 10-km gun-to-target range), the HELBAT team investigated the capability to engage moving targets in HELBAT 3 (April 1972) and HELBAT 4 (October 1973). While the attack of moving targets with any unguided indirect fire support means is a rather controversial subject, it must be recognized that stationary targets will probably become more and more a rarity in the modern mechanized threat, especially in the close support area. Moreover, with the increased intensity of battle, traditionally stationary targets such as artillery batteries may become fleeting targets (e.g., shoot-and-scoot multiple rocket launchers). The moving-target accuracy finally demonstrated in HELBAT 4 should be viewed in terms of delivering area-fire munitions (antiarmor submunitions or mine-carrying cargo rounds) in the vicinity of moving target complexes or perhaps more importantly in terms of delivering munitions into a sufficiently small "basket" to permit the effective use of fire-and-forget seekers—*not* in terms of trying to destroy a single moving tank with existing high-explosive projectiles.

The closed-loop fire control technique that was developed to permit the engagement of moving targets with indirect artillery fire uses the tripod-mounted LRF for accuracy and the automatic transmission and processing of data to attain the needed responsiveness. The LRF is mounted on a viscous-damped tripod to permit smooth tracking of moving targets. The tripod is fitted with shaft-angle encoders such that azimuth and vertical angles as well as range data can be automatically transmitted to the fire direction center (through modulation demodulation equipment (MODEM) and wire line in HELBATs 4 and 5 and by the Digital Message Device (DMD) and standard radios in HELBATs 6 and 7. Upon receiving second lasing (ideally 15 to 20 seconds after the first lasing for the HELBAT experiments) a fire direction center computer can calculate and intercept point using a predicted gun system load-and-lay time and some prediction scheme (a straight-line predict algorithm appears to be adequate as well as most practicable). The gun orders for that intercept point are transmitted to the guns via a data line (HELBATs 4 to 6) and shown on gun displays. Considering projectile time of flight (TOF), the computer issues a "fire" command (if the gun crew has signaled ready status) that is timed so that the round and target will arrive at the

at the Fighting Level

intercept point simultaneously. No voice communications are used once the mission has begun.

To close the loop, the FO lases the round impact point, which provides "did hit" data that the FDC computer can use to ballistically correct the next set of gun orders. (Inert photo flash rounds are used to simulate HE bursts in HELBATs.) The FO also lases the target (manned, armor-clad turretless M103 tanks) again to update the computer on the target position. The computer calculates a new intercept point, and a second round is fired. This process is repeated until the *computer* calls for fire for effect (FFE) based on stored FFE criteria. With this closed-loop technique, the FO becomes a data sensor; after the mission has been approved and assigned (tactical fire direction), the battery FDC computer automatically controls (technical fire direction) the mission with maximum responsiveness while the battery fire direction officer (FDO) monitors the course of the moving target (connected lasing points) and the individual round impacts on the computer driven x-y plotter, with the option of intervening at any time with a digitizer.

The bottom line of figure 1 summarizes the performance of the closed-loop technical fire control system. The TLE for moving targets (intercept point relative to target at time of round impact) is reduced to 80 meters or one-fifth the conventional TLE for stationary targets. This improvement is driven primarily by the response time, which for the closed-loop, automatic data-link system is about 1.8 minutes. Without the automatic data link, as is the case for the hand-held LRF data entries, the response time suffers (7.5 minutes), and the moving target TLE grows to 400 meters, making effective engagement impossible. The stationary target TLE with hand-held LRFs, which will soon be issued to platoon FOs, is also perhaps larger than expected, 180 meters mean radial error (MRE). Without a tripod and angle scales, azimuth and vertical angle to the target must be determined separately using binoculars, compass, map references, and judgment. Aside from the moving target considerations, it is important to note that the closed-loop technique with a tripod-mounted LRF and automatic data links provides the following stationary target engagement benefits: first-round responsiveness of one minute (compared to three for a conventional system) and FFE in 2.4 minutes with a system FFE accuracy of about 40 meters (compared to 14 minutes and 100 meters for conventional).

The purpose of HELBAT 5 (June 1975) was to refine the closed-loop system hardware, software, and techniques. Multiple concurrent fire missions were demonstrated with the HELBAT fire direction computer and, to investigate fire control performance, an error measurement system was fabricated and mounted on the guns to permit, for the first time, the monitoring of operational laying (aiming) errors during active fire missions without interruptions. This system showed that gun laying errors (in HELBAT 5 and other tests) were on the order of 2 mils (6400-mil circle) instead of less than 1 mil as previously thought. As an example of HELBAT materiel development spin offs, the error measurement system is now being fabricated as a gun crew training aid. Of greater significance, HELBAT highlighted the need for a fire direction computer at the battery level; further, the system feasibility of such a computer was demonstrated adequately in HELBAT 4 to permit initiation of the formal Battery Computer System (BCS) program at the engineering development stage, normally the second step in the Army system development process.

In HELBAT 6 (September 1976), the following developmental field artillery systems were incorporated in the exercise: TACFIRE, AN/TPQ-36 Firefinder countermortar radar, and the AN/TVQ-2 Ground Laser Locator Designator (GLLD). The feasibility of integrating the HELBAT battery FDC computer with TACFIRE was demonstrated; even with only one battery loading the battalion TACFIRE set, the stationary-target responsiveness advantage of direct FO to battery FDC operations was clearly indicated. Additionally, actual TACFIRE Digital Message Devices were used in HELBAT 6; therefore, for the first time the closed-loop system employed a realistic radio data link between the FO and FDC. Maximum effectiveness of the

Delivery method	System delivery error (CEP)	Target location error* (MRE in meters)		Adjusting rounds (stationary target)		Average response time (minutes)		
		Stationary target	Moving target	Number rounds	Last round (MRE—meters)	First round	FFE	First round (moving target)
Conventional	Plus 1 percent of range or plus 150 meters at 15 kilometers	390	700	4 to 8	100	3	14	13
Hand-held laser rangefinder		180	400	4	85	2.5	5.0	7.5
Laser rangefinder on tracking mount with automatic data link		25	80	2	40	1.0	2.4	1.8

*FO to target range: 1.5 kilometers for conventional and hand-held laser rangefinder; 2.5 kilometers for laser rangefinder on tracking mount.

Figure 1. Performance summary to fire missions.

Firefinder radar was demonstrated by incorporating this system as a substitute for the FO in the closed-loop HELBAT system. The radar was used to detect actual incoming artillery and mortar rounds, locate firing units, and track outgoing artillery counterfire to provide "did hit" adjust-fire corrections similar to the FO lasing and locating fall of shot. Using the tripod-mounted GLLD, a laser rangefinder as well as a designator, cannon-launched guided projectile (CLGP) missions (where laser designation of the target is required for the guidance leg of the flight) were simulated. It was shown that the closed-loop, automatic data-link technique was even more responsive than the totally preplanned manual missions, where gun orders to preplanned intercept "footprints" are calculated and tabulated beforehand.

Priorities generated by the Field Artillery School led to the following objective areas for the March 1979 HELBAT 7: integration of new close-support target acquisition equipment, BCS and HELBAT computer evaluation firing battery automation, Copperhead (cannon-launched guided projectile) and HELLFIRE (helicopter-launched antitank missile) procedures, and fire support team (FIST) vehicle and operations concept evaluation. The major "players" (equipments) in HELBAT 7 are pictured in figure 2, and HELBAT 7 mission types are depicted in figure 3.

Both the developmental Army Remotely Piloted Vehicle (RPV) (with daylight TV system and on-board LRF) and an experimental moving target indicator (MTI) radar system called ASTAR (Army surveillance and target acquisition radar), a computer controlled system using the AN/PPS-5 radar were integrated into the HELBAT closed-loop system through modified DMDs with new electronic interfaces (RS-232). All HELBAT 7 DMDs also had two other critical modifications:

•Automatic polar-to-grid conversion to simplify target location and round impact data and to reduce the chance of enemy discovery of the FO position.

•A time tag capability to better classify messages on the modern, volatile battlefield and to insure the validity of moving target data messages despite possible unknown time delays.

The use of actual DMDs in HELBAT 6 resulted in a degradation in the closed-loop moving target capability since there was a variable unknown time delay caused by the wait for the FO to push the transmit button on the DMD. Primarily because of the time tag modification, moving target accuracy equivalent to the (fully automated) HELBAT 5 level of performance was

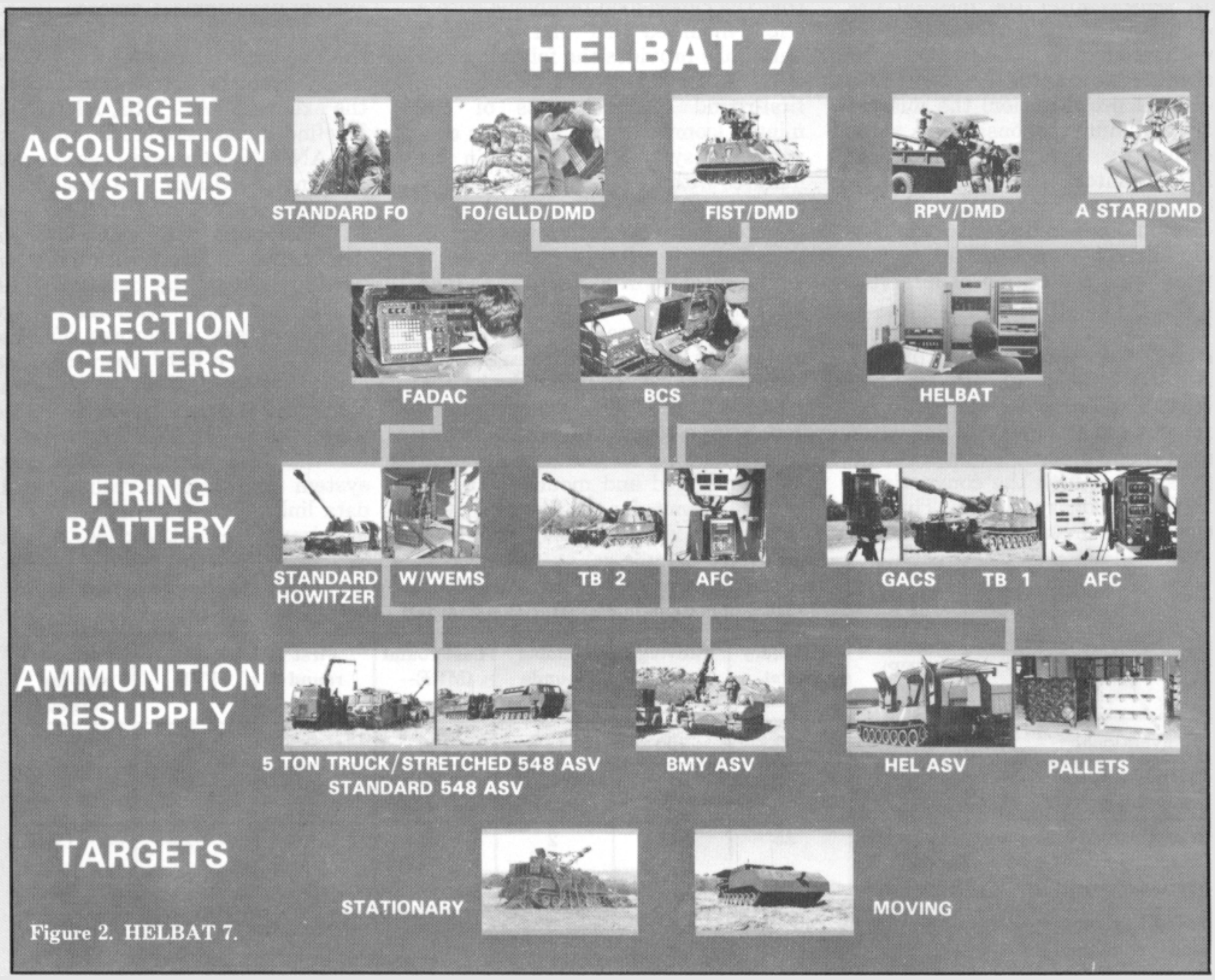


Figure 2. HELBAT 7.

demonstrated in HELBAT 7. This is especially noteworthy in that overall mission response times were longer in HELBAT 7; longer loading and laying times are required for 155-mm self-propelled howitzers than for the 105-mm towed howitzers previously used, and longer gun-to-target ranges (10 to 15 kilometers compared to 4 to 5 kilometers in previous HELBATs) resulted in longer projectile flight times. Accuracy with the RPV (close to its ground station) approached that of FOs equipped with LRFs; the RPV TLE for both stationary and moving targets was slightly less than 90 meters. The resultant error with the closed-loop MTI radar system was considerably worse than that of LRF-equipped FOs, but major problem areas have been identified and can be corrected for follow-on experiments.

Operational Test II of the BCS engineering development models included participation in HELBAT 7 to evaluate the BCS moving-target capability and compare the BCS to the HELBAT test-bed computer (now a PDP 11/34). Although the HELBAT 4 computer (CDC 469) served retrospectively as the advanced development model of the BCS, major functional differences evolved (primarily due to cost considerations) during engineering development of the BCS, as shown in figure 4. A key concern is that, without graphics (auto plotting), autonomous battery level responsiveness will be seriously degraded. Because of hardware and software problems with the BCS prototype, the complete HELBAT 7 evaluation of BCS could not be accomplished; however, enough data was collected to identify some software errors which are now being corrected by the BCS contractor.

New howitzer fire control and ammunition resupply concepts were evaluated in the HELBAT 7 firing battery, which included two standard M109A1 howitzers and Howitzer Test Beds 1 and 2. The standard fire control sights in Howitzer Test Bed 1 (HTB 1) were modified so that they could be automatically leveled and servo-driven to the commanded gun-order values. The level of automation was selectable up to fully automatic where the gun was slewed and elevated as commanded by the FDC computer. Once the special off-carriage reference device was surveyed in, the initial laying (orientation on a known azimuth) could be done automatically after HTB 1 was driven into position. HTB 2 employed a first-of-a-kind penduous, single gyro system that was designed to provide totally on-board gun pointing and positioning (local self-survey). After gun orders were manually inserted through a series of thumb wheel switches, laying was accomplished by normal slewing and elevating mechanisms until "commanded" and "set" azimuth and elevation displays matched. The "set" displays indicated the real-time bearing and elevation at all times. For the first time the M109A1 howitzers, as well as HTBs 1 and 2, used on-board radio links to the battery FDC so that hardware feasibility of dispersed battery and "gun-and-run" concepts could be investigated. HTB 1 incorporated a fully automatic data link and, through a full-duplex radio system, ballistic and aiming error data could be automatically fed back to the FDC. HTB 2 and the standard howitzers were equipped with simple data displays linked to the on-board radios (figure 3). Since this was the first time that 155-mm self-propelled howitzers were used in moving target

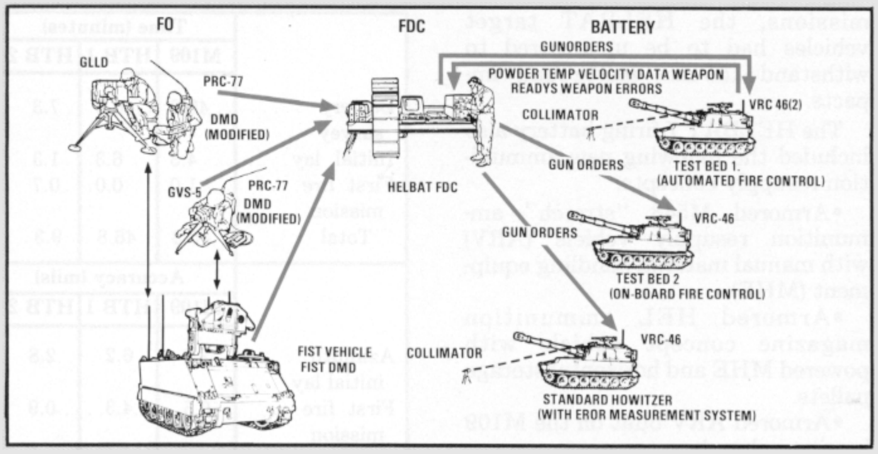


Figure 3. HELBAT 7 missions.

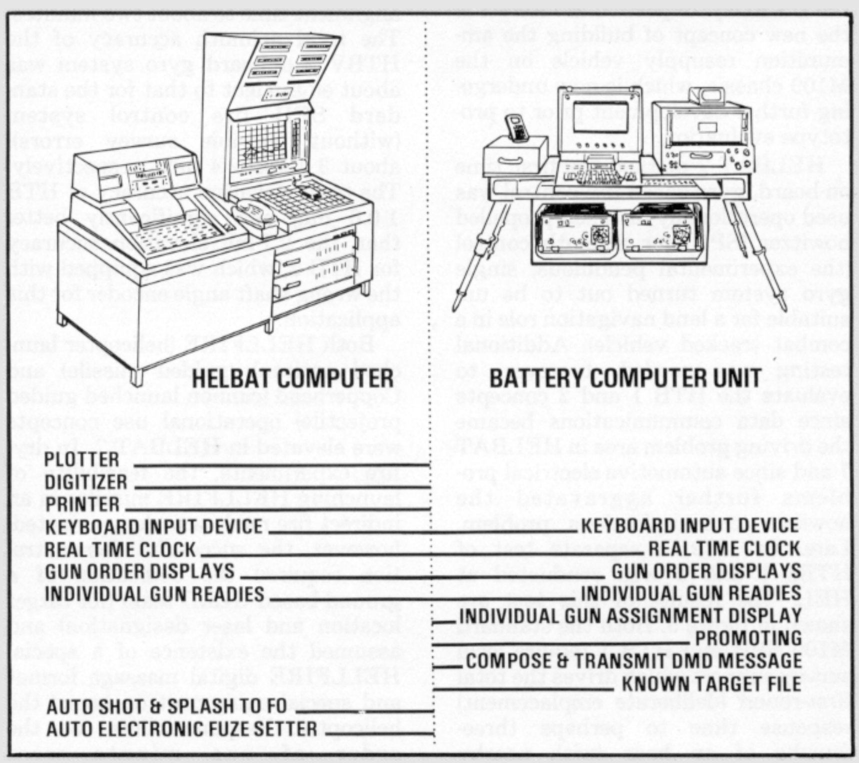


Figure 4. HELBAT 7 fire direction centers.

missions, the HELBAT target vehicles had to be up-armored to withstand 155-mm inert-round impacts.

The HELBAT 7 firing battery also included the following new ammunition resupply concepts:

•Armored M548 "stretch" ammunition resupply vehicle (ARV) with manual material handling equipment (MHE).

•Armored HEL ammunition magazine concept vehicle with powered MHE and horizontal storage pallets.

•Armored ARV built on the M109 howitzer chassis.

•Self-unloading cargo truck.

With a conveyor system as an interface, totally under-armor howitzer resupply was demonstrated. The new concept horizontal pallets were designed to permit individual round selection and restraint capability; thus short-notice moves did not result in loose ammunition rolling around in the ARV. With total system design considerations and the appropriate use of material handling equipment, it was shown that the now labor intensive aspects of ammunition resupply could be reduced drastically. Some of these concepts are now being pursued officially by the US Army; of particular interest is the new concept of building the ammunition resupply vehicle on the M109 chassis, which is now undergoing further development prior to prototype evaluation.

HELBAT 7 marked the first time on-board, gyro-based fire control was used operationally on a self-propelled howitzer (SPH) for azimuth control (the experimental pendulous, single gyro system turned out to be unsuitable for a land navigation role in a combat tracked vehicle). Additional testing was needed, however, to evaluate the HTB 1 and 2 concepts since data communications became the driving problem area in HELBAT 7 and since automotive electrical problems further aggravated the howitzer communications problem. Later in 1979, a separate test of HTBs 1 and 2 was conducted at HEL. The results of this test are shown in figure 5. Both the standard M109 SPH and HTB 1 require local survey support which drives the total first-round (deliberate emplacement) response time to perhaps three-fourths of an hour (with nearby survey control points). The HTB 2 response time was about nine minutes, and a further reduction of this time may be possible with the gyro technology potential for reducing the seven-minute zero-velocity alignment time to about two minutes. The total azimuth accuracy of the HTBV 2 onboard gyro system was about equivalent to that for the standard SPH fire control system (without possible survey errors), about 3.0 and 2.4 mils, respectively. The total elevation accuracy of HTB 1 0.6 mil) and significantly better than the 2.7-mil elevation accuracy for HTB 2, which was equipped with the wrong shaft angle encoder for this application.

	Time (minutes)		
	M109	**HTB 1**	**HTB 2**
Battery survey	40.0	40.0	7.3
Initial lay	4.3	6.3	1.3
First fire mission	1.0	0.0	0.7
Total	45.3	46.8	9.3
	Accuracy (mils)		
	M109	**HTB 1**	**HTB 2**
Azimuth initial lay	2.3	6.2	2.8
First fire mission	0.5	4.3	0.9
Total (root sum square)	2.4	7.5	2.9
Elevation initial lay	0.6	0.0	2.0
First fire mission	0.8	0.6	1.8
Total (root sum square)	1.0	0.6	2.7

Figure 5. Fire control experiment.

Both HELLFIRE (helicopter launched antitank guided missile) and Copperhead (cannon launched guided projectile) operational use concepts were elevated in HELBAT 7. In dry-fire experiments, the feasibility of launching HELLFIRE missiles in an indirect fire mode was demonstrated; however, the successful demonstration required the dedication of a ground-based GLLD team (for target location and laser designation) and assumed the existence of a special HELLFIRE digital message format and special equipment on board the helicopter. Response times on the order of one minute were demonstrated. Five inert Copperhead projectiles were fired at evasive HELBAT target vehicles (marking the first time Copperhead was fired at a manned target): three with the HELBAT closed-loop technique, and two with the standard preplanned target-area (FIST print) technique. Two projectiles (one in each technique) scored direct hits. As predicted by previous HELBAT simulated Copperhead missions, the response time with the preplanned technique was almost 50 percent greater than that with the closed-loop technique.

Because of the driving data communications problem (data-data net contention, spurious signals, and radio performance) only single-line, dedicated (FO-FDC-gun) fire missions were possible in HELBAT 7; therefore, neither multiple missions nor fire support coordination concepts could be adequately evaluated in the context of live fire missions. Further, the limited line-of-sight (LOS) capability from areas accessible by the experimental FIST headquarters vehicle (an improved TOW vehicle with a GLLD in the elevated TOW launcher) precluded its use in moving target fire missions. In spite of these problems, the FIST vehicle hardware and the FIST DMD, which was fabricated for HELBAT 7 to permit programmed radio net switching of data communications, were assessed and evaluated by the HELBAT 7 controller-user team, and most of the recommendations have been or are being incorporated by the US Army, including the initiation of a formal development program for the FIST DMD.

In review, past HELBATs have been a catalyst for the development of many potential improvement concepts in artillery battery-level firepower operations, including technical fire direction. In most cases, however, the demonstrated system performance represents, the *maximum* possible—not only because the demonstration was conducted in a benign, quasi-operational environment, but also because it was always assumed that a firing unit had already been available, selected, and approved to perform the required mission. That is, with few exceptions, the fire support planning, coordination, and tactical fire direction portions of fire support control have yet to be considered in this joint TRADOC-DARCOM field test bed series.

Fire support control in the future

In the future, fire support control development will be impacted by and in turn will impact the major rethinking of time-honored artillery organizations, operations, and doctrine as the Army enters the high-technology automatic data processing (ADP) world. The new FIST organization concept, for example, is already being implemented. This combination of artillery and maneuver unit mortar observers has raised the fire support control issue of whether the FIST chief can be both the primary observer and the company-level fire support coordinator (FSCOORD) and has generated a new fire support control materiel requirement for a special FIST Digital Message Device to permit the monitoring, editing, and automatic retransmission of data communications. One result of the Division Restructure Study (DRS) of 1976 is that the direct support artillery battery size will increase from six to eight guns which will normally operate as two four-gun elements, both with fire direction capability. Fire support control for the DRS battalion fire direction center will then involve interaction with six instead of three (for a three-battery battalion) subordinate fire-unit FDCs, each of which will have a Battery Computer System when it is fielded. The Division 86 Study organization, when implemented, will also have a serious impact on the fire support control system, in that 10 maneuver battalions instead of nine in a heavy division and four companies instead of three must be serviced by the fire support system.

The combined-arms Close Support Study Group II (CSSG II) recognized that, in the new TACFIRE world, there was an operational need for not only the FIST DMD but also for a functionally similar device for the battalion fire support elements (FSEs) in a maneuver brigade area. (The need for such devices will be especially critical when the mortar FDCs receive the Mortar Fire Control Calculators (MFCC), which operate in the data world.) Such data devices offer the promise of *real-time* fire support coordination as opposed to silence-is-consent. For example, as shown in figure 6, the FIST DMD (at FIST HQ) can serve as a data communication switch, a decision node controlled either actively by the operator or automatically as preprogrammed, to direct a fire request generated by a forward observer either to the organic company mortars or to the battalion FSE for a higher level of fire support, depending on the tactical situation, target type, or other criteria. With a new data device in the battalion FSE, the organic battalion mortars or higher fire support means can be selected at this decision node.

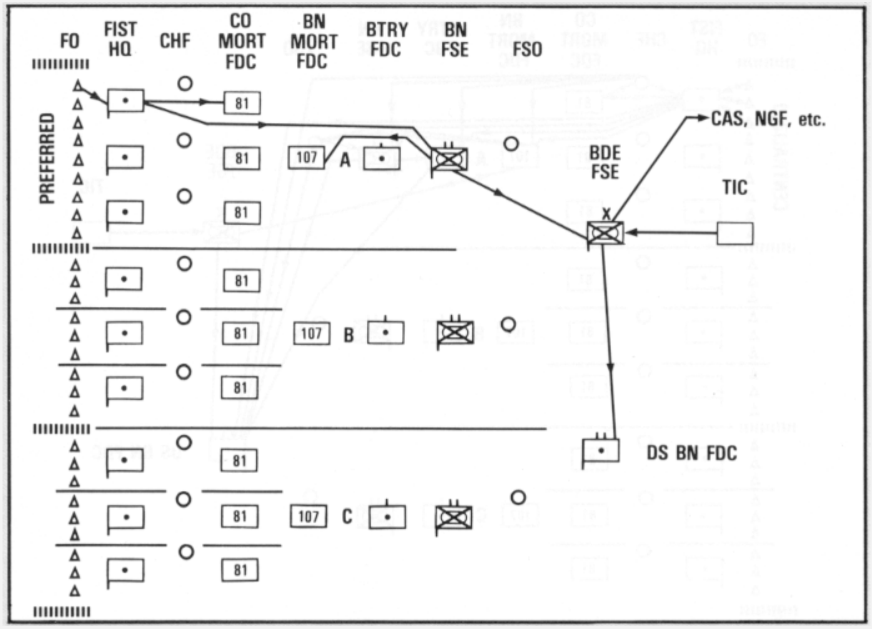


Figure 6. Fire support control elements, mechanized infantry brigade area.

In consideration of future Field Artillery Tactical Data system (FATDS) requirements, the TACFIRE TRADOC System Management Office (TSMO) continued this preferred centralized control scheme (which is actually a distributed processing system) to the brigade FSE. At this point, service of the fire request could be allocated to fire support teams represented in the brigade FSE (e.g., close air support sorties or naval gun fire) or could be passed on to the direct support field artillery battalion FDC, which in turn could select the appropriate battery or batteries or perhaps request a reinforcing battalion to fire the mission. To remove the target intelligence load on the battalion FDC, the TACFIRE TSMO also added a new element in the brigade area—the target integration center (TIC). Interfaced to the Firefinder radars, Remotely Piloted Vehicles (RPVs), and other new-technology target acquisition devices, the TIC with ADP aids can convert voluminous target intelligence data to confirmed target data for insertion into the active fire support control "circuit" and thereby reduce the data load on that circuit and the brigade area fire support control system.

The fire request routing depicted in figure 6 raises many issues, but the primary one undoubtedly is responsiveness. The need for the flexibility, i.e., the capability to short-circuit the preferred centralized scheme (for increased responsiveness), was recognized by the CSSG II. The data communications needline, as tabulated in the CSSG II report, show the desire for full flexibility—to be able to optionally operate with successively lower levels of centralization (figure 7) and even fully decentralized control where FO can direct his fire request to any fire support control element from the FIST HQ to the battalion FDC. As indicated in figure 8, it may even be desirable, under some circumstances, to permit the FO to deal directly with a preallocated weapon system for maximum responsiveness. The need for responsiveness is obvious, but there will also be crucial times when the force commander needs to be in full (centralized) control of the fire support forces; e.g., final-protective-fire massing and special tactical counterforce interdiction. If the preferred central control system is designed and developed appropriately, all lower levels of control will be possible from a materiel standpoint.

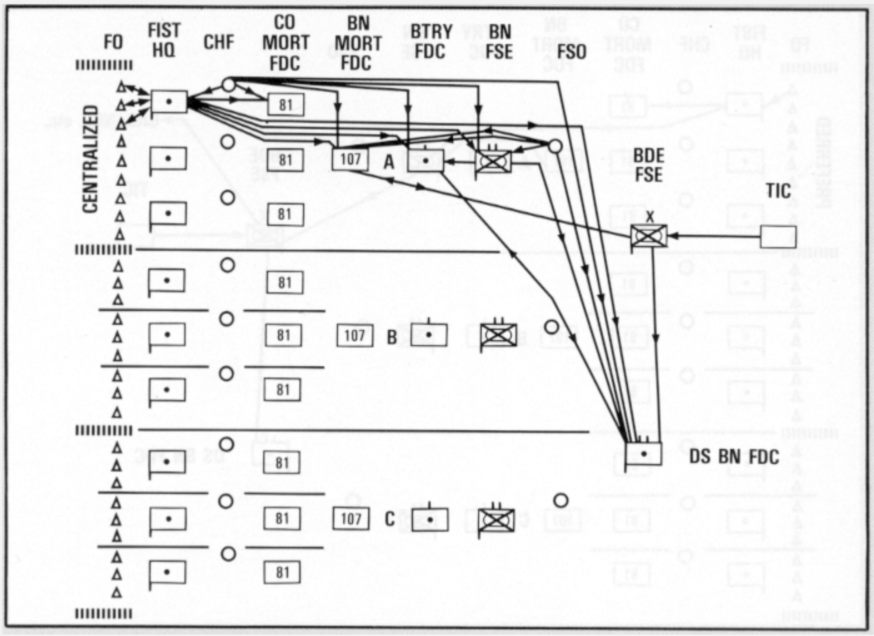


Figure 7. Fire support control elements, mechanized infantry brigade area.

Continuing with the rethinking of fire support control, a recent Field Artillery School draft doctrinal paper presents a potential generalized philosophy for fire support control in the 1985-2000 time frame. Citing the volume of targets that will be generated by new target acquisition devices (in one scenario simulation, an average of 1,586 target complexes was acquired in one direct support area in 24 hours) and the potential shrinking numbers of friendly weapon systems (together with growing numbers of enemy weapon systems), the paper recognizes that fire support assets must be time shared. The current approach to this problem has been face-to-face and voice communications and the use of ADP to automate manual procedures. The paper however presents a force design that will allow maximum exploitation of ADP technology, which is still growing at a rapid pace, along with the emerging automatic data transmission technology.

In this concept force design, the fewest possible weapons (one to four recommended) are organized into a fire unit (FU) that has its own technical fire direction and position/pointing system (probably on each weapon). Back-up technical fire direction could be performed by a hand-held calculator, or an adjacent weapon. The weapons in the fire unit would be dispersed and perhaps perform single-weapon missions with a gun-and-run tactic. Gun and run (or shoot and scoot) presents the toughest control problem and nearly the same on-board gun and run tactics; therefore, gun and run should be pursued. If the system is designed for gun and run, all lower flexibility options are possible, including massed fire. The weapon(s) in a fire unit should operate within a three-kilometer position extent and use "hide" areas for resupply. (However, a single hide area for many weapons may be detectable by the enemy.) Location and weapon status would automatically be transmitted to the battery (discussed below).

For higher-level fire support control, fire units would be organized into a battery, which would have a stable organization in peacetime, but would be task-organized when committed to combat. As shown in figure 9, the battery is divided into two main parts: the battery trains element and the operations (OPS) element. The operations element is normally located at the maneuver battalion command post (CP) to expedite the integration of fire support and maneuver fires. In lieu of the traditional battery FDC, the operations element performs fire support planning and coordination and tactical fire direction, coordinates fire unit movements, and also serves as a back-up technical fire direction system for subordinate fire units. The battery trains element is the principal ammunition and fuel resupply source for the fire units and also provides mess, maintenance, battlefield recovery, and other logistic services. The ADP system at the battery trains headquarters, which normally is used to coordinate, monitor, and direct logistics support, should be identical to the operations ADP system so that the trains ADP system can serve as a back-up operations unit.

For force control, conceptual batteries are organized into battalions, which also should be task-organized

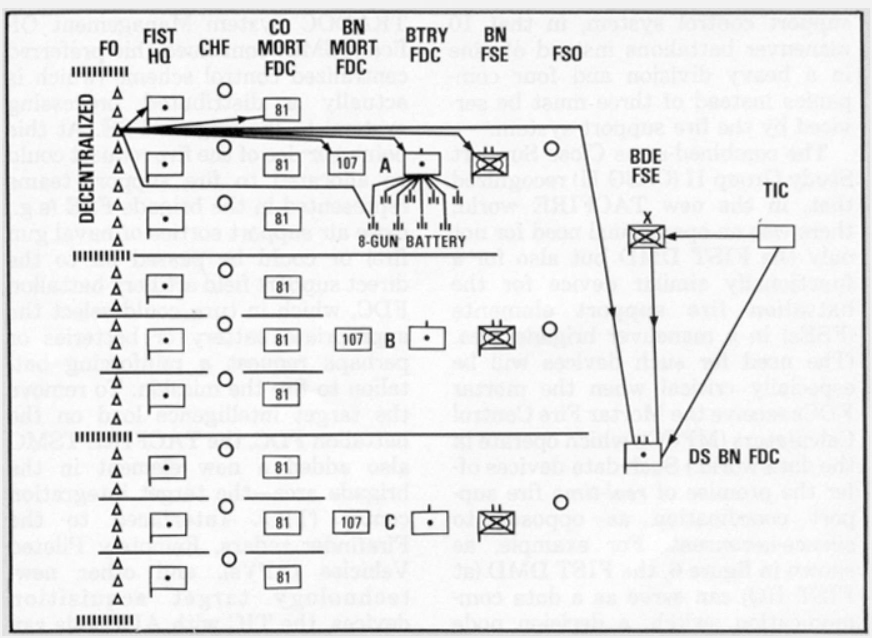


Figure 8. Fire support control elements, mechanized infantry brigade area.

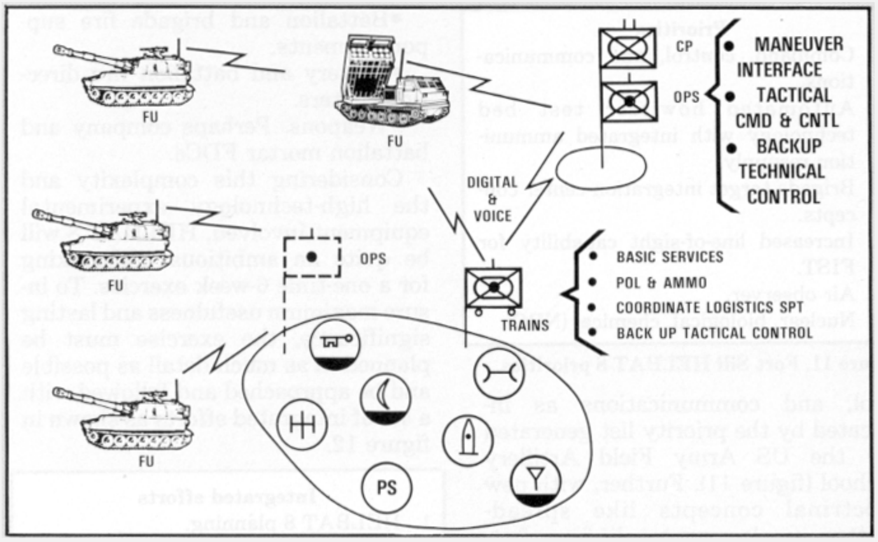


Figure 9. Battery concept.

in combat. The battalion, like the battery, is divided into operations and trains elements. The operations element, located at the brigade CP, would provide tactical control of the batteries and also serve as the artillery sensor integration and target center for the brigade command element. The battalion trains element would perform administrative and personnel services, but the principal logistics role would be to coordinate outside support for the battalion. The conceptual division artillery (div arty) and corps artillery units would provide neither administrative nor logistical support (they would rely on the supported force for this support). The div arty and corps units would have operations elements at both main and alternate CPs. The operations units would recommend task organization of subordinate forces, serve as artillery sensor integration and target centers, and perform nuclear and chemical fire planning for the supported force. A comparison of the current and proposed force design concept is provided in figure 10.

The recent Enhanced Self-Propelled Artillery Weapon System Concept (ESPAWS) analyses indicated that new technology materiel concepts may permit and require significant changes in artillery organizations and operations. Based on a situation wherein the FOs requested fire from the DS battery FDC and then dealt directly with one single gun (with perfect command, control, and communications), the analysts used a generic autonomous gun concept (single-gun missions with gun-and-run) with fire-and-forget munitions for direct support and fire-and-forget rockets or 8-inch munitions in general support; the analyses showed that two battalions of such weapon systems could support a division force significantly better than the more standard seven battalions of existing weapons in terms of point targets (APCs, tanks, and artillery weapons) killed in a mechanized threat. This does *not* mean that the division-slice force should be reduced to two battalions but, with new materiel and operations concepts, it is possible to have artillery force reserves for nonlethal roles, interdiction, and massive suppression—*if* the fire support control system can accomplish this kind of diversified application of artillery firepower (and other fire support means).

Regarding materiel, the ADP technology "dish" is overflowing: distributed common data base, software with interactive query language and the flexibility for personal programming and "what if" capability, and cannon hardware with graphics displays and tailored hard-copy output formats. The technology either exists or is emerging to meet these requirements. Microcomputers are getting smaller and smaller but yet more powerful and equally affordable. Large, flat display systems and voice recognition technologies are emerging. Artificial intelligence, gaming theory, and distributed decision processes research can be applied in the software to aid in putting the "man in the loop" without critically degrading responsiveness. At least two alternative automatic data distribution systems (ADPS) are under development:

•An enhancement of the developmental Position Location Reporting System (PLRS), a time division multiple access (TDMA) system under the control of a centralized computer with a finite number of unique "slots" for data transmission.

•The Packet Radio, and experimental system that "marries" a

Current	Proposed	Advantage
Pure force	Task organized	Flexibility
Smallest unit of fire—4-6	Smallest unit of fire—1-4	More effective allocation
Grouped positions..................................	Dispersed positions..................................	Survivability
Services provided by battalion..................	Services provided by battery......................	More responsive
Large battalion headquarters and service battery..	Large battery trains	Arm, fuel, fix, feed forward
Target routing	Target processing	More effective
FA representative at maneuver command post..	FA commander at maneuver command post..	Truly integrate fires with maneuver
Organization for combat by tactical mission	Organization for combat by tactical mission	Remains both flexible and responsive
Manual processing supported by ADP............	ADP processing support	Effective and responsive
FA brigades and groups	None	Force structure savings

Figure 10. Force design comparison.

radio and a microcomputer that forms data communications into "packets" and automatically distributes them.

To exploit new ADP technology and to meet future user needs, a TACFIRE Modulus Improvement Plan has been developed. This modular "product improvement" will permit sequential performance improvements so that the utility of the current hardware and field capability over the next 15-year period will be maximized. Moreover, with this approach the system software can be built upon and refined as opposed to initiating a new start. The improvements will be developed in three discrete steps:

1) Development of a new communications control system (CCS), which will be programmable to handle a variety of message structures and all communications systems to include dedicated automatic data distribution system (ADDS) radios.

2) Development of new remote terminals, which will employ interactive graphics and provide distributed processing and data bases.

3) Development of new, smaller, simpler-to-operate subsystems for the TACFIRE FDC computer group.

Fire support control test beds

Recent battle simulation analyses and field experiences have shown that fire support control (usually referenced as C^3—artillery command, control, and communications) is the key to improved fire support effectiveness and survivability. New fire support control doctrine and evolving user requirements are indicating the need for *both* fully centralized *and* fully decentralized control of fire support and all levels in between, so that control can be quickly tailored to tactical needs. With the automatic data processing (ADP) technology and concepts "dish" overflowing, the fire support control development problem can be compared to "boarding a speeding (technology) train" (in the context of an 8 to 10 year materiel development and acquisition cycle).

Test beds, such as the periodic HELBAT field exercises, can help in this problem area by providing a "vehicle" for the development and evaluation of alternative total *operating system* concepts and procedures. Thus, the main thrust of HELBAT 8 will be command, control, and communications as indicated by the priority list generated by the US Army Field Artillery School (figure 11). Further, with new doctrinal concepts like spread-battery emplacement, split 8-gun battery, and gun-and-run, there is a need to evaluate new tactical fire direction concepts at the battery level and automated position, pointing, and technical fire direction control on board the weapon. With the rapidly increasing need for and the difficulty of distributing data on the battlefield, as evidenced in HELBAT 7, there is a need to evaluate data distribution concepts and ways to reduce the data load such as the target integration center (TIC), which will convert the great magnitude of intelligence data to a smaller volume of confirmed target data. With reference to line-of-sight limitations experienced with forward observer vehicles in past HELBATs, concepts for increasing the observation capability from the FIST vehicle as well as air observer capabilities are to be evaluated. Since nuclear, biological, and chemical (NBC) protection is also a priority item, particular attention will be given to this area including, if possible, the incorporation of NBC protection on some of the hardware concepts fabricated or modified for HELBAT 8.

Priorities

1. Command, control, and communications.
2. Automated howitzer test bed technology with integrated ammunition resupply.
3. Brigade target integration center concepts.
4. Increased line-of-sight capability for FIST.
5. Air observer.
6. Nuclear, biological, chemical (NBC).

Figure 11. Fort Sill HELBAT 8 priorities.

New technology concepts to be evaluated in a fire support control system context should be compared with the newly fielded TACFIRE system as a baseline. Therefore, as a minimum, the exercise should be in the context of a maneuver brigade area since this is currently the lowest level of TACFIRE tactical fire direction and the smallest integral fire support control areas. This will require the following type "players" in the exercise:

•Forward observers.

•FIST headquarters.

•Battalion and brigade fire support elements.

•Battery and battalion fire direction centers.

•Weapons. Perhaps company and battalion mortar FDCs.

Considering this complexity and the high-technology experimental equipment involved, HELBAT 8 will be quite an ambitious undertaking for a one-time 6-week exercise. To insure maximum usefulness and lasting significance, the exercise must be planned in as much detail as possible and be approached and followed with a set of integrated efforts as shown in figure 12.

Integrated efforts

1. HELBAT 8 planning.
2. ACE simulator development (at BRL).
3. Artillery Control Experiment 1 (ACE 1).
4. HELBAT 8 subset evaluations (at HEL).
5. HELBAT 8 (fall 1981).
6. HELBAT 8 analyses.
7. ACE improvement and expansion.

Figure 12. Fire support control test beds.

One of the first efforts will be the development of a fire support control simulator (a computer-based *laboratory* test bed), called the Artillery Control Experiment (ACE), to aid in the planning of HELBAT 8 and subsequently to serve as a continually available tool for the development and evaluation of fire support control technology, materiel, organizations, and operations. With ACE, fire support control problems can be identified, analyzed, and defined in a series of alternative system and scenario contexts which will be quite helpful in generating and evaluating experiment designs for HELBAT 8. Further, hardware, software, and "skinware" (human interface) technology and system concept opportunities can be explored without building complete dedicated hardware. Perhaps most importantly, ACE can be used to investigate the application of key research areas (such as artificial intelligence, gaming theory, and distributed decision processes) to the tough problem of fire support control automation. As well as providing a much needed tool for user development and evaluation of alternatie organization and operation concepts, ACE may also be used as an automated command-post-exercise

(CPX) trainer. General examples of possible ACE investigation areas include:

•Computer assists at decision nodes.

•Improvement of man-machine interfaces (e.g., natural and query languages).

•"Intelligent" filtering of information presented to fire support officers.

•Short-hand graphics for responsive, simplified operations.

More specifically, as described in figure 13, ACE is an interactive, real-time, multiplayer fire support control simulator. Initially it will be developed on an in-house computer system (a Ballistic Research Laboratory PDP 11/70 with UNIX operating software); but, wherever possible, a common programming language (such as FORTRAN) will be used to facilitate the ease of exporting ACE or parts thereof to other organizations. ACE will be able to both accommodate and simulate tactical fire support control materiel; e.g., the TACFIRE Digital Message Device (DMD). Through simulation, tactical equipment availability problems can be avoided; "what if" changes can easily be incorporated and evaluated; and training spin-offs are possible. Through the accommodation of actual equipment, the time-consuming development of simulator programs can be avoided; hybrid mixes of actual and simulated conceptual equipment are possible; and automatic scenario-loaded testing can be performed. A supervisory ACE program is being developed to tie all the system components (actual and simulated) together; i.e., to model the network and to characterize realistic communications queues and delays and simulate full-force scenario loads.

ACE has been established as a major effort and to effect integration, ACE personnel are actively involved in major HELBAT 8 planning meetings. A DMD has been acquired and a DMD simulator is nearly completed. The FIST DMD simulator and the ACE supervisory programs are currently being written. Battery Computer System (BCS) software and hardware documentation has been acquired and the method of characterizing the BCS in ACE is now being considered. Once the DMD program is called up, the commercial

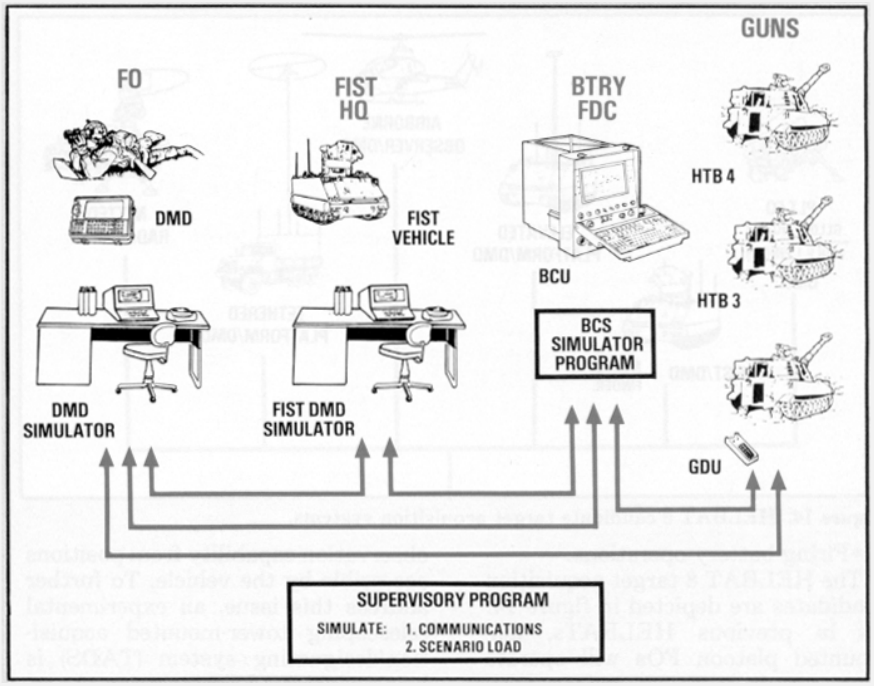


Figure 13. Artillery Control Experiment 1 (ACE 1).

terminal CRT (cathode ray tube) display provides a response identical to that of an actual DMD. The figure shows that DMD status display as filled out interactively by the operator and shows the movable cursor at the keyboard bell volume position.

In the near future, ACE personnel will interface an actual DMD to the computer system and will meet with Field Artillery School personnel to decide on initial scenario and experimental design. ACE personnel will also meet with Army Communications Research and Development Command personnel to develop simplified communications characterization algorithms and, under the auspices of The Technical Cooperation Program Subgroup W Action Group 6 (TTCP-WAG-6), with United Kingdom researchers who have developed the Computer Aided Staff Trainer (CAST), a voice communications command-post simulator, to identify potential cooperative efforts. Further ahead, a fire support control symposium may be co-sponsored with the Army Research Office to bring the best thinking of the other services, industry, and universities to bear on fire support control problems.

In general, the planned order of ACE work will begin, as described above, with the most basic fire support control elements and continue with the building of higher-level brigade area elements. The first system exercise will include the following elements: FO DMD, FIST DMD, Battery Computer System (BCS), and weapon (figure 13). The battalion FSE will be added as soon as this lower-level system is operating and some of the following issues are addressed: FIST concept (centralized vs decentralized; automatic decision making), use of graphics by the battery fire direction officer, and operations with on-board gunnery computers.

Concurrent with the running of ACE system exercises during the spring of 1981, another HELBAT 8 effort—the subset evaluations—will begin at the Human Engineering Laboratory. In this effort, candidate subsystems and interfaces will be evaluated and further developed for integration into HELBAT 8, which is now scheduled for the fall of 1981. As of this writing, candidate systems (DARCOM, TRADOC, and private companies) described below are being considered and in many cases are already being tailored for inclusion in the HELBAT 8 exercise. These systems can be grouped into three basic functional areas:

•Target acquisition.

•Fire support control in the brigade area.

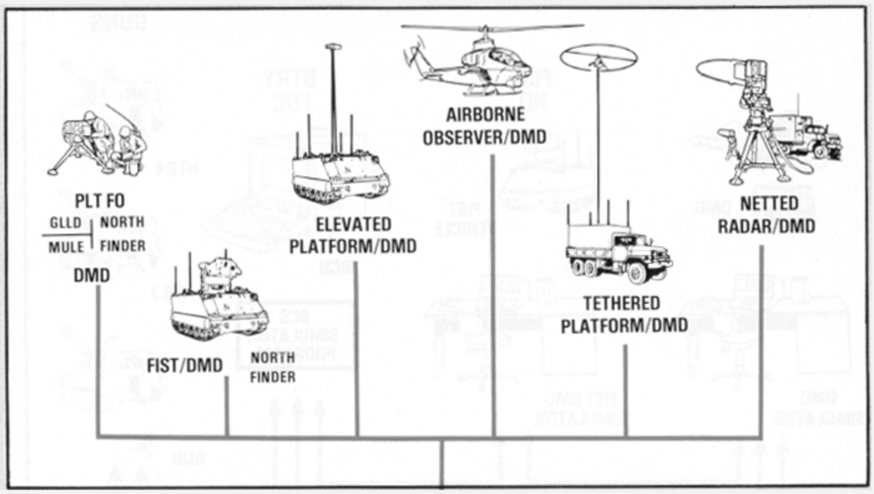


Figure 14. HELBAT 8 candidate target acquisition systems.

•Firing battery operations.

The HELBAT 8 target acquisition candidates are depicted in figure 14. As in previous HELBATs, dismounted platoon FOs will operate from terrain vantage points with various laser rangefinder (LRF) devices. These will probably include the tripod-mounted Ground Laser Locator Designator (GLLD) and the Marine variant of the GLLD, the Modular Universal Laser Equipment (MULE), both with automatic data links to the DMD and with developmental or experimental north-finder modules for azimuth reference. Other prototype tripod-mounted LRFs and the soon-to-be-fielded hand-held LRF may also be included in the exercise for comparison. The developmental FIST vehicle with its vehicular mounted GLLD will also be included as an acquisition device with the key issue being a line-of-sight observation capability from positions accessible by the vehicle. To further address this issue, an experimental telescoping tower-mounted acquisition/designating system (TADS) is being considered for inclusion. As requested in the HELBAT 8 priorities (figure 11), airborne observers will also be included; some of these at least will be equipped with stabilized TADS. Under the auspices of TTCP WAG-6, the participation of a tethered observation platform is being negotiated with a Canadian company.

An experimental computer-based radar netting system will be demonstrated at Fort Sill during early FY81. This system will be capable of automatically analyzing and integrating target intelligence data from Firefinder (counterfire) radars and ground-based and airborne moving target indicator (MTI) radars to form confirmed target data lists. Although this system does not (at this time at least) integrate all the brigade area target acquisition systems, it is an existing hardware concept that could be used to investigate the full brigade area target acquisition systems and target integration center (TIC) concept in HELBAT 8 and is therefore being pursued as a candidate for the exercise. Instead of employing active radar systems, the TIC may be "loaded" in the HELBAT exercise by magnetic tapes of time-ordered intelligence data recorded at the Fort Sill demonstration.

As shown in figure 15, the netted radar TIC would be set up to actively input target data to the brigade FSE and the battalion FDC. The TIC will be interfaced to these elements through "super" DMDs that will be especially modified for HELBAT 8 to permit alternative operation on wire line, standard push-to-talk radios, or automatic data distribution system radios. These super DMDs, which will also incorporate the HELBAT 7 modifications, automatic polar-to-grid conversion, and time-tag capability, will be used by other target acquisition candidates for data communications with one or more (multiple addressees) of the decision nodes in the brigade area fire support control system (FIST headquarters, battalion FSE, brigade FSE, and battery or battalion FDC), depending on the type mission being conducted. Experimental commercial hardware Packet (ADDS) radios, which will be mounted in environmentally controlled cases for ruggedization in the HELBAT field exercise, will be the primary communications means in the brigade area system depicted in figure 15. Although the Packet radios are not yet militarized and may not be fielded in the HELBAT 8 time frame, they are the only ADDS radios available to demonstrate dedicated high-technology data communication—the crucial key to reliable and responsive data-world fire support control and, more specifically here, to the successful operation of the new-concept, HELBAT 8 brigade area system.

For the first time in any HELBAT exercise, the full fire support control spectrum will be played: fire support planning, fire support coordination, and tactical and technical fire direction. As shown in figure 15, the

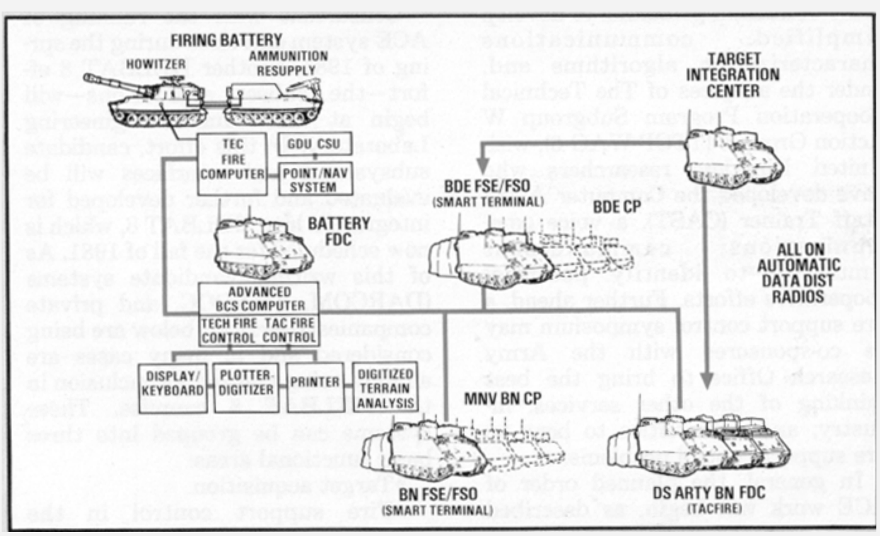


Figure 15. HELBAT 8 new concept fire support control elements.

players include both a battalion and a brigade FSE, a battery and a battalion FDC, and technical fire direction on the guns. In the HELBAT exercise, both the battalion and brigade FSEs will be equipped with (industry-conceived) experimental smart (flat-panel display), tactical graphics terminals (TGTs) that will be programmed to automatically perform some fire support planning and coordination functions and will automatically monitor and display (with military symbols) standard TACFIRE messages. A standard TACFIRE battalion computer center will be included as the battalion FDC and, like the other players, will be able to alternatively operate on the ADDS radios as well as on standard push-to-talk radios. At the battery FDC, graphics peripherals in the form of a printer and a plotter will be added to the FDC computer, and new software will be developed and used to permit the evaluation of limited tactical fire direction at the battry level. An existing experimental digitized terrain analysis system may also be interfaced to the battery FDC computer. The battery FDC will be set up and operated in a tracked vehicle with active NBC protection. This vehicle may be one of the prototype armored ammunition resupply vehicles (ARV) that was fabricated on an M109 howitzer chassis for HELBAT 7; the use of an ARV vehicle will afford the FDC a non-unique signature in the battery area.

The weapon systems which will be included in the new concept brigade area firing battery are described in figure 16. Building on lessons learned with Howitzer Test Beds (HTBs) 1 and 2 in HELBAT 7, HTBs 3 and 4 are currently being designed and fabricated as follow-on efforts. Both new howitzers will incorporate ADDS radio automatic data links, onboard technical fire direction computers, gyro systems for local self-survey and pointing reference, gunner display units (GDUs), and chief-of-section display units (CSUs). HTB 3 will be a fully integrated system using a gimballed gyro system and servos to permit even automatic laying (aiming) of the gun tube, while HTB 4 will utilize strapdown gyro hardware that was developed for the Advanced Attack Helicopter and the FIST DMD hardware reprogrammed to perform modified point-mass gunnery as well as the standard TACFIRE data

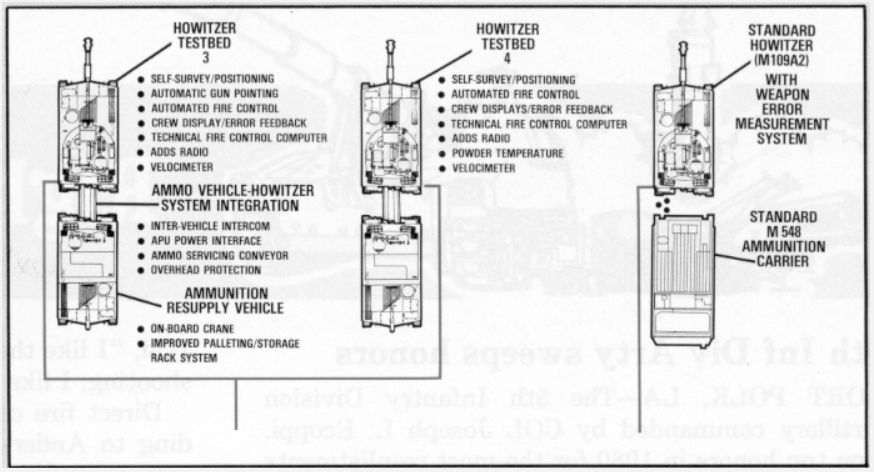


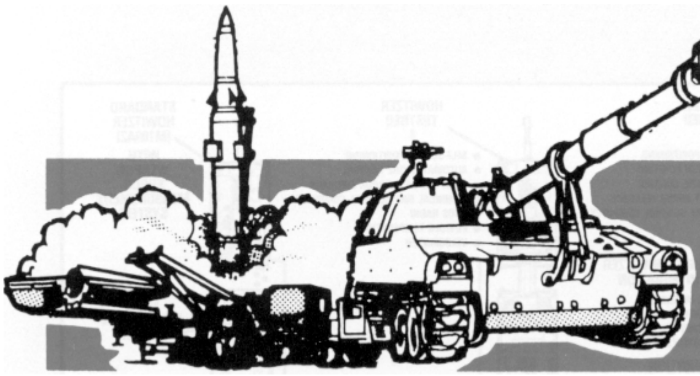
Figure 16. HELBAT 8 firing battery systems.

message terminal function. Both HTBs 3 and 4 will use automatic feedback from ballistics and fire control error sensors to investigate methods of improving predicted fire, and both will also be interfaced to the new prototype armored ARVs. A radio or wire-line data link between the howitzer and the ARV is used for communications, and the ARV auxiliary power unit (APU) can supply electrical power to the howitzer as a redundancy option. Standard howitzers and ARVs will also be included in the new concept brigade area for the collection of baseline comparison data.

A complete standard TACFIRE brigade area system (including the Variable Format Message Entry Device (VFMED) for the battalion and brigade FSEs) will be operated in HELBAT 8 to collect common baseline data against which the performance of the new concept brigade area can be compared. Both the brigade FSE and battalion FDC will alternatively serve as standard and new concept elements. Although the FIST chief and battalion FSO may be separated from their respective headquarters or element, this communications complication will not be played. Although not discussed above, the following equipment, if available, will also be included in HELBAT 8: Marine Corps Digital Communication Terminals (MFCC, a data-communications mortar gunnery computer), and the Field Artillery Meteorological Acquisition System (FAMAS, a system that can automatically update the meteorological data in TACFIRE). Also if time and resources permit, a scenario load will be developed to simulate a full brigade area load on the battery and battalion FDCs and battalion and brigade FSEs.

As a final note, the following international equipment may be included in the exercise under the auspices of TTCP WAG-6: Australian mortar fire control calculators; a Canadian Military Portable Artillery Computer (for a battery FDC computer) and the companion Gun Alignment and Control System (an off-carriage automatic gun laying system); and a United Kingdom towed field howitzer (FH-70).

Barry L. Reichard is a senior weapon system analyst at the Ballistic Research Laboratory, Armament Research and Development Command. He is a specialist in field artillery systems and has actively participated in the planning and carrying out of the HELBAT tests.



Right by Piece

5th Inf Div Arty sweeps honors

FORT POLK, LA—The 5th Infantry Division Artillery commanded by COL Joseph L. Ecoppi, won top honors in 1980 for the most reenlistments at brigade level, battalion level (3d Battalion, 21st Field Artillery), and battery/company level (K Battery, 29th Field Artillery).

Direct fire "kills" Killeen

FORT HOOD, TX—The firing battery moved its 155-mm howitzers into position upon a ridge which overlooked a long valley with scattered buildings and vehicles across its floor.

The valley had three built-up areas that the map identified as Killeen, Copperas Cove, and Nolanville. The cannoneers calculated the guns' positions, sighted them, and loaded ammunition into the breeches. In a matter of minutes the entire valley was under heavy artillery fire.

By the time all batteries of the 1st Battalion, 3d FA, 2d Armored Division, had fired, there was little chance that anything or anyone in the valley had survived. The towns, buildings, and vehicles had been destroyed. Round after exploding round left the valley under the cover of a smoking haze.

The 1-3d had been involved in a small scale war—literally. The ridge was just a small rise while the valley was just a little larger than a wide ditch. The buildings and vehicles were scale models, the artillery rounds were 14.5-mm training rounds, and even the map was scaled-down to account for the miniaturization.

The 1-3d built this small range to practice direct fire. An M31 training device was mounted inside the tube of the guns and the training rounds were fired using the normal methods of sighting and firing.

This range was built on a firing point from which they could also fire live, full-size rounds into the impact area, making it possible to train with both kinds of ammunition from the same firing point.

"In a way, direct fire is a lot more fun," said PFC Archie Anderson, an assistant gunner in Battery C, 1-3d, "I like the idea of being able to see what I'm shooting; I like to see it go up in smoke."

Direct fire can also be more challenging, according to Anderson. "If the target is moving, you have to account for a left or right lead—aiming ahead of the target. You can't do that in indirect fire."

Anderson thinks that the M31 is a good way to train. "For the loader, it's a lot different than the real thing—he just has the little rounds, no heavy work. For the gunner, there is no difference except that it is a lot quieter," he said.

When the batteries of the 1-3d finished firing in their small-scale war, they began firing a full-scale mission into the impact area. The batteries rotated in and out of firing positions, practicing everything from maneuvering to setting up camouflage. (Mike Myers)

EASY LOAD—SP4 Edward Richardson of Battery C, 1st Battalion, 3d FA, 2d Armored Division, uses one hand to load his 155-mm howitzer. The 1-3d used an M31 training device to fire 14.5-mm rounds at scale targets during a recent direct fire exercise. (Photo by Robert Lusby)

FIST Olympics

FORT BRAGG, NC—To enhance esprit de corps and pride in maintaining the traditionally high standards of the airborne fire support team (FIST), members of 2d battalion (Airborne), 321st Field Artillery, 82d Airborne Division Artillery, recently participated in its own version of olympic games. Complete with the proper setting (i.e., "Mt Olympus," otherwise known as Gaddy's Mountain and Coleman Impact Area), FISTs gathered in the typical airborne fashion. Following a parachute assault onto a nearby drop zone, the airborne FISTs competed for fastest assembly and subsequent movement to "Mt. Olympus" where the games were opened with a brief ceremony in a stadium specially constructed from hundreds of empty 105-mm howitzer ammunition boxes. Following the commander's opening remarks and prayer for their safe and rewarding olympic efforts, the FISTs witnessed the arrival of the olympic flame, airborne style of course, brought in by a skydiver of the 82d Airborne Division Sport Parachute Club.

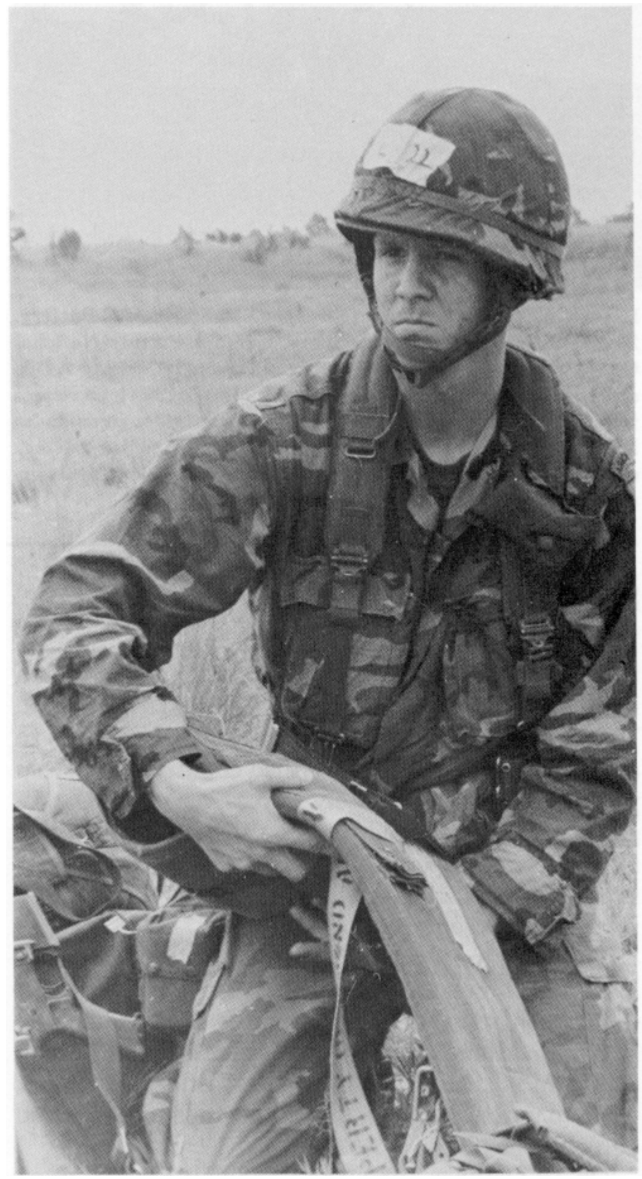
With the olympic flame still burning, FISTs began the games which proved to be every bit as grueling and demanding as envisioned by the designers. Three FISTs participated in each of three contests—pentathlon, decathlon, and mystery marathon—with each event consisting of foot and airmobile movements around the "Plain of Olympia" and stops at various points to demonstrate required skills.

The mystery marathoners, who represented the battalion's best, were not advised in advance of the events and skills needed; nevertheless, they performed well, taking in stride fire planning, occupation of an observation post, claymore mine and LAW (light antitank weapon) skills, observed fire techniques, first aid, coordinated illumination missions, a physical fitness test, and an NBC proficiency test.

Pentathlon participants, well trained for their game, showed their skill at rifle and LAW marksmanship, night orienteering, enemy armor/aircraft recognition, and precision registrations.

FISTs in the decathlon demonstrated their proficiency in assembly and disassembly of M16A1, M60, and M1911A1 weapons, aerial observations, 5-wheel operation of an M561, observed fire with night observation devices, night land navigation, 2-mile run with rucksack, first aid, communications, conduct of close air support, rappelling, and airmobile operations.

The end of the games brought bone-weary paratroopers back to "Mt. Olympus" for retirement of the olympic flame and a closing ceremony. With each announcement of gold, silver, and bronze medals, the FIST olympians roared their approval. After the ceremony, the tired but proud and happy paratroopers made their way back to the battalion area.



Determined FIST member of 2d Bn (ABN) 321st FA gathers his air items after completing his parachute jump onto Fort Bragg's Salerno drop zone. The airborne operation was part of the battalion FIST Olympics. (US Army Staff photo by Dave Matthews)

Battery defense—the ultimate weapon? Members of C Battery, 2d Battalion, 144th Field Artillery, California Army National Guard, display their version of "fixed Bayonets" during AT-80 at Fort Irwin, CA. In all, six of the unit's M109A1 howitzers were fitted with bayonets as a result of battalion commander LTC Joseph P. Surgent's guidance to emphasize battery defense. (Would you believe the officer responsible for this action was a former infantryman?)

Small Unit Exchange Program

FORT POLK, LA—In July of last year, the 3d Battalion, 21st Field Artillery, was notified that it had been selected to participate in the Army's Small Unit Exchange Program, the purpose of which is to allow battery-size units of Allied countries to "swap places" for approximately three weeks. This program exposes selected units to the equipment, tactical doctrine, operations, and military customs of the host unit as well as providing training on nonorganic weapon systems.

The exchange, which took place during October last year, involved A Battery, 21st Field Artillery (M110A2) from Fort Polk and J Battery, 3d Royal Canadian Horse Artillery Regiment (M109A1) from Shilo, Manitoba. During August and September, the two units conducted liaison visits and developed deployment plans.

On 10 October 1980, the Canadian battery (6 officers and 53 enlisted personnel) arrived at England Air Force Base, LA, on a Canadian Air Force C-130. After refueling, the US unit, B Battery, 3-21st FA (5 officers and 59 enlisted personnel), boarded the Canadian aircraft and headed for Manitoba. Upon arrival at their new homes, each unit occupied its exchange unit's barracks and "fell in" on the unit's equipment. Since neither battery deployed with individual small arms, the exchange unit's weapons were issued. (Each battery did, however, take a representative sample of their weapons for demonstration purposes.)

The Canadian battery spent the first week with orientation and instruction on the M110A2 with C Battery, 3-21st FA, providing support and assistance in training and logistics. Since there are no M110s in the Canadian Army, this was a valuable and unique training experience.

On the other hand, a unique aspect of the unit exchange for the US battery, in addition to manning the M109A1 howitzer, was using Canadian procedures for fire support, fire direction, and reconnaissance, selection, and occupation of position. The US battery had to make several organizational changes to adapt to the Canadian system to include the primary duties of battery officers.

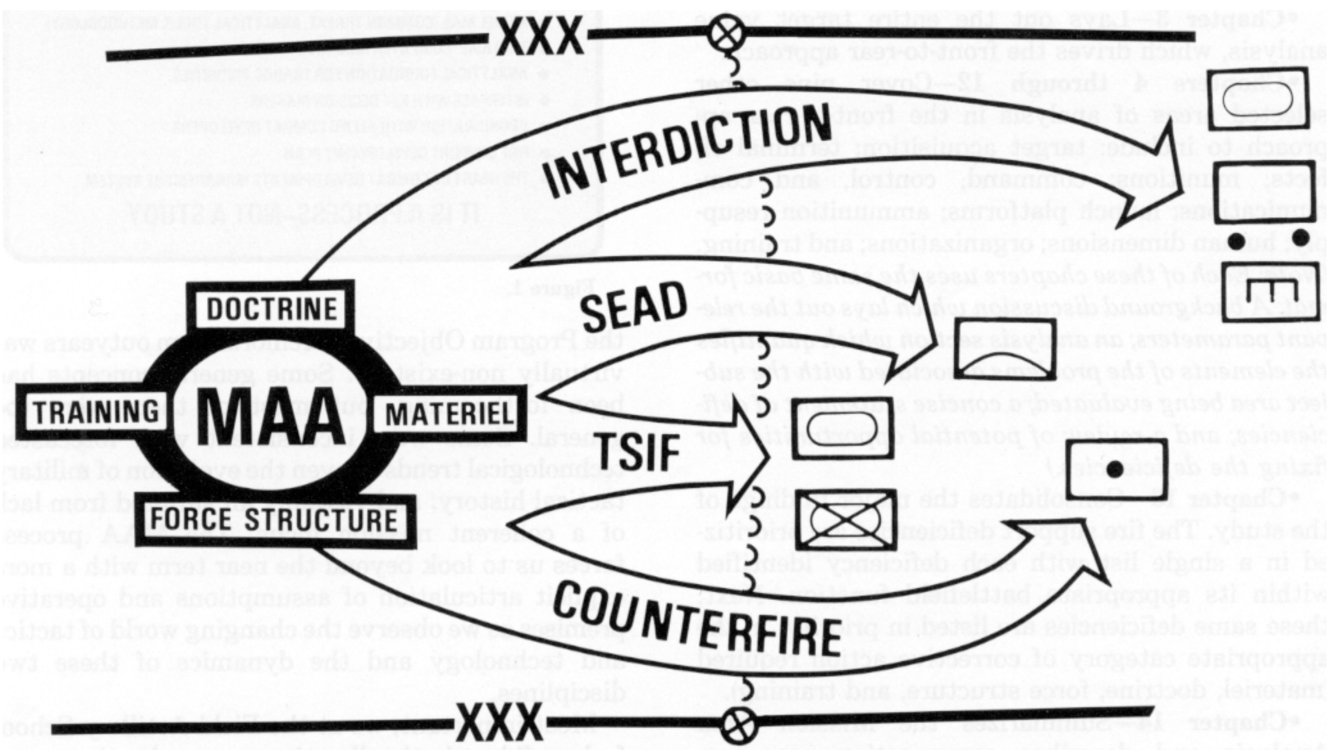
The Small Unit Exchange Program was a tremendous and an invaluable training experience for those involved. Soldiers in the 3d Battalion, 21st Field Artillery, gained a greater appreciation for the Canadian Army and their methods of operation. Another important thing the exchange confirmed was that artillerymen worldwide are professional and quality soldiers!

Two US soldiers from A Battery, 3d Battalion, 21st Field Artillery, assist in laying wire to the fire direction center during a field training exercise at Shilo, Manitoba.

MISSION AREA ANALYSIS:

Shaping the Future Field Artillery Force

by COL Anthony G. Pokorny



IT IS A PROCESS--NOT A STUDY

A project of major proportions, called the Fire Support Mission Area Analysis (FSMAA), was recently completed at Fort Sill. The Field Artillery School spent 15 months gathering data, conducting wargames, and analyzing the results of computer simulations in an effort to assess the requirements for winning on the modern battlefield.

One of the major objectives of the analysis was to identify deficiencies affecting the fire support system's ability to accomplish assigned fire support tasks. A second major objective was to highlight potential materiel, doctrine, force structure, and training opportunities which could remedy the identified deficiencies within the fire support system.

In form, the FSMAA is a "front-to-rear" analysis, and, as such, might almost be described as the reverse analysis of the life cycle of a projectile, from detonation on target back through initial source of supply. At its heart is a Target Value Analysis (TVA)—an entirely new approach to identifying and prioritizing fire support requirements. The TVA will identify high-payoff targets in terms of the impact of their destruction on enemy capabilities as well as probable enemy actions. In effect, then, it will provide for the first time an analytically clear linkage between the delivery of fire support and its tactical results.

The Field Artillery must continue to look for those high-payoff items which most increase our effectiveness, improve our survivability, and in general make us more useful members of the combined arms team. We must prioritize in an intelligent manner to make sure we get every last ounce of effectiveness from every new development dollar. *That is what this Mission Area Analysis is all about*.

The FSMAA Report, which will be published piecemeal in subsequent issues of the *Journal,* consists of the following chapters:

•**Chapter 1**—provides an overview which sets the framework of the report.

•**Chapter 2**—Outlines the study methodology, describes the analytical tools used, and states the overall quantitative results.

•**Chapter 3**—Lays out the entire target value analysis, which drives the front-to-rear approach.

•**Chapters 4 through 12**—Cover nine other selected areas of analysis in the front-to-rear approach to include: target acquisition; terminal effects; munitions; command, control, and communications; launch platforms; ammunition resupply; human dimensions; organizations; and training. *(Note: Each of these chapters uses the same basic format: A background discussion which lays out the relevant parameters; an analysis section which quantifies the elements of the problems associated with the subject area being evaluated; a concise statement of deficiencies; and a review of potential opportunities for fixing the deficiencies.)*

•**Chapter 13**—Consolidates the major findings of the study. The fire support deficiencies are prioritized in a single list with each deficiency identified within its appropriate battlefield function. Next, these same deficiencies are listed in priority, in the appropriate category of corrective action required (materiel, doctrine, force structure, and training).

•**Chapter 14**—Summarizes the Mission Area Analysis and describes some action programs necessary to solve the fire support deficiencies.

The 15 months of concerted effort spent on the Mission Area Analysis approach was worth all the resources invested in it. Figure 1 lists some of the important spinoffs that were triggered by the FSMAA which convinces us that the FSMAA is not just another study that will gather dust. Rather, it is a process which gets people who are interested in building a better Army pulling together to make the right things happen. It has opened the information exchange channels far beyond our expectations and offers a healthy new approach that should be implemented throughout the Army.

Before the Mission Area Analysis, combat developments was essentially a top-to-bottom process; however, it has been proved that new strength and vitality can be gained by the bottom-to-top MAA process. Also, before the MAA requirement, infusion of doctrinal development considerations into the Program Objectives Memorandum outyears was virtually non-existent. Some general concepts had been forthcoming, but most of them were too general. Some were inconsistent with forecasted technological trends or even the evolution of military tactical history, and virtually all suffered from lack of a coherent mission focus. The MAA process forces us to look beyond the near term with a more explicit articulation of assumptions and operative premises as we observe the changing world of tactics and technology and the dynamics of these two disciplines.

SPINOFFS

- DARCOM SCIENCE & TECHNOLOGY PLAN COORDINATION
- DIALOGUE WITH THE FIELD
- TECHNOLOGY ASSESSMENT MEETINGS
- INDUSTRY R&D PROGRAMS
- FRONT END ANALYSIS FOR CSWS TASK FORCE
- FRONT END ANALYSIS FOR DSWS TASK FORCE
- CONCEPT FOR FUTURE FA COMMAND CONTROL
- QUICK RESPONSE CORPS SIMULATION
- TARGET ANALYSIS HANDBOOK
- TARGET ANALYSIS TRAINING TEST BED
- PPBS INPUT
- MODEL MAA (COMMON THREAT, ANALYTICAL TOOLS, METHODOLOGY)
- TACTICAL COMPUTER GRAPHICS
- ANALYTICAL FOUNDATION FOR TRADOC PRIORITIES
- INTERFACE WITH KEY DECISION MAKERS
- COORDINATION WITH ALLIED COMBAT DEVELOPERS
- FIRE SUPPORT DEVELOPMENT PLAN
- THE HEART OF COMBAT DEVELOPMENTS MANAGEMENT SYSTEM

IT IS A PROCESS--NOT A STUDY

Figure 1.

Most important, we at the Field Artillery School feel confident in the direction we are charting as we have a combat development management system that works well. The FSMAA is the heart of that system. We remain convinced that decisions made during the next decade concerning fire support systems are critical to the Army. As hit and kill probabilities for direct fire systems approach unity, there is decreasing opportunity for technological leverage. Where there is no qualitative advantage, numbers count; and, when numbers count, we lose. The opportunity we must seize for relative advantage, then, lies in the over-the-hill battle.

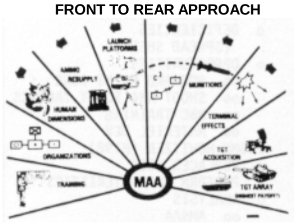
The final sentence in the report states: "If challenged—we *can* win." We truly believe this now that we better understand the dynamics of modern warfare through the FSMAA work. Future issues of the *Journal* will carry articles about specific aspects of the analysis where we hope to demonstrate that the Field Artillery School has "its act together" for shaping the future force.

FIRE SUPPORT MISSION AREA ANALYSIS

CHAPTER 1
OVERVIEW

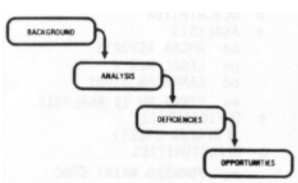
A. PURPOSE
  ○ IDENTIFY DEFICIENCIES
  ○ DEVELOP ACTION PROG
B. ENVIRONMENT OF CHANGE
  ○ PRINCIPLES OF WAR
  ○ CHANGING THREATS
  ○ IMPACT OF TECH CHG
C. SHAPING THE FUTURE FORCE
  ○ DOCTRINE
    ○○ MANAGING THE 2D ECH
    ○○ TACTICAL NUC DOC
    ○○ TGT ACQUISITION
    ○○ C^3
    ○○ DELIVERY OF FIRES
  ○ FORCE STRUCTURE
  ○ TRAINING

FRONT TO REAR APPROACH



D. ARMY WIDE MAA
  ○ " -- IT IS OF GREAT POTENTIAL VALUE TO THE EFFECTIVE MANAGEMENT OF THE ARMY'S LIMITED RESOURCES."
  ○ " -- THE ARMY SHOULD MOVE PROMPTLY TOWARD EARLY ADOPTION OF THE MISSION APPROPRIATE TO MANAGEMENT."
E. WHERE THE ARMY IS HEADING
  ○ FORCE PACKAGES
  ○ INTEGRATED BATTLEFIELD ENVIRONMENT
  ○ ALL COMPONENTS READY
  ○ SUSTAINABLE FORCE
  ○ FULLY MANNED
  ○ REALISTIC TRAINING
  ○ STANDARDIZATION
  ○ RAPID MOBILIZATION
F. FORMAT OF REPORT

CONSTRUCT OF CHAPTERS 4-12



CHAPTER 2
ANALYSIS

A. GENERAL
  ○ INTRODUCTION
  ○ PURPOSE
B. METHODOLOGY
  ○ GENERAL
  ○ TVA
  ○ FIRE SUPPORT SYS ANALYSIS
C. MODELS AND SUPPORTING ANALYSES
  ○ MODELS
    ○○ VECTOR-2 MODEL
    ○○ FA SIMULATION TWO-SIDED (FAST) MODEL
    ○○ INTEGRATED CORPS MODEL (ICOR)
    ○○ SUPPORT
  ○ SUPPORTING ANALYSIS
    ○○ AMSAA
    ○○ TRASANA
    ○○ CACDA
    ○○ USABRL
    ○○ CONTRACT SUPPORT
D. PERFORMANCE/EFFECTIVENESS
  ○ GENERAL
  ○ BASE CASE DEFINITION
  ○ SIMULATIONS/ANALYSIS
    ○○ 1980 CASE DEFINITION
    ○○ TARGET DISTRIBUTION
    ○○ TERMINAL HOMING MUNITIONS
    ○○ INCREASED RANGE MUNITIONS
    ○○ ENHANCED SP ARTY WPN SYS
    ○○ PREFERRED MIX
    ○○ ELEMENTS ACQUIRED, ATTACKED, AND/OR DESTROYED
    ○○ AMMUNITION RESUPPLY
    ○○ 107MM MORTAR ANALYSIS
    ○○ CORPS SUPPORT WPN SYS
  ○ UNCERTAINTIES
    ○○ BEST AVAILABLE DATA
    ○○ ENEMY REACTION
    ○○ INTERACTION OF MANEUVER
  ○ SUMMARY
    ○○ HIGH PAYOFF WITH TERMINAL HOMING MUNITIONS
    ○○ ESPAWS
    ○○ IMPROVE SURVIVABILITY WITH INCREASED RANGE
E. FORCE-ON-FORCE ANALYSIS
  ○ GENERAL
  ○ GAMES PLAYED
    ○○ BASE CASE
    ○○ BASE CASE SENSITIVITIES
    ○○ NUCLEAR EXCURSIONS
    ○○ FUTURE SYSTEMS CAPABILITY EXCURSIONS
  ○ ICOR BASE CASE
  ○ BAD WEATHER SENSITIVITY RESULTS
  ○ TACAIR TO COUNTERFIRE SENSITIVITY RESULTS
  ○ NUCLEAR RESULTS
  ○ FUTURE SYSTEM EXCURSION RESULTS
  ○ ESPAWS EXCURSION RESULTS
  ○ MLRS TGSM EXCURSION RESULTS
  ○ CSWS EXCURSIONS
  ○ ANALYSIS OF UNCERTAINTIES
    ○○ INEXPERIENCED GAMERS
    ○○ BLUE AIR ATTRITION
    ○○ EFFECTIVENESS OF COPPERHEAD
    ○○ COMMO AND ELECTRONIC WARFARE
    ○○ SIZE AND CAPABILITIES OF FORCE GAMED
F. TRENDS
  ○ LOGIC
  ○ PURPOSE
  ○ FIRE SUPPORT TASKS
  ○ STANDARDS FOR THE FIRE SUPPORT SYSTEM
    ○○ TARGET SERVICING
    ○○ COUNTERFIRE
    ○○ INTERDICTION
  ○ FIRE SUPPORT SYSTEM DEFICIENCIES
    ○○ 1980
    ○○ 1986
    ○○ 1990
  ○ FIELD ARTILLERY BASIC LOADS
  ○ FIRE SUPPORT ALLOCATION

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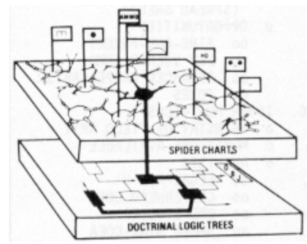
TARGET VALUE ANALYSIS

A. GENERAL
  ○ INTRODUCTION
  ○ TARGET SET
  ○ BATTLE DYNAMICS
  ○ DOCTRINE LOGIC TREES
  ○ SPIDER BODIES
  ○ TVA STUDY FLOW
  ○ SCENARIOS



B. ANALYSIS AND RUN INSIGHTS
  ○ RED ATTACK DECISION CRITERIA RUN
  ○ DELAY-IN-THE-BREAKTHROUGH-ZONE RUN
  ○ DELAY-IN-THE-SUPPORTING-ATTACK-ZONE RUN
  ○ TGT ACQ RESOURCE AND RECONSTITUTION RUN
  ○ DIV CORPS AND COUNTERATTACK RUNS
  ○ DIV COUNTERATTACK RUN
  ○ CORPS COUNTERATTACK RUN
  ○ 1980 ARTILLERY FORCE CASE
  ○ 1980 WITHOUT INTERDICTION
  ○ SLOWED DOWN CASE
  ○ SUMMARY
C. TVA SPREAD SHEETS
  ○ PURPOSE
  ○ EUROPE
    ○○ TARGETS IDENTIFIED
    ○○ RESPONSE
  ○ MIDDLE EAST (TO BE PUBLISHED)
D. TARGET SHEETS
E. SUMMARY
  ○ LIMITATIONS AND CONSTRAINTS
  ○ OPPORTUNITIES
F. APPENDIX A (SOVIET DOCTRINE/LOGIC)
G. APPENDIX B (DECISION CRITERIA)
H. APPENDIX C (SPIDER BODIES)
I. APPENDIX D (STUDY INSIGHTS DISCUSSION)
J. APPENDIX E (PERCEPTIONS FROM THE FIELD)

CHAPTER 4
TARGET ACQUISITION

A. GENERAL
  ○ DESCRIPTION/DEFINITION
  ○ FORMAT
B. TGT ACQ BEYOND LINE OF SIGHT
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ TGT VALUE ANALYSIS
    ○○ CONC ANALYSIS AGENCY
    ○○ DEFENSE NUCLEAR AGENCY
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ PAVEMOVER
    ○○ RPV IMPROVEMENTS
    ○○ PRECISION LOC STRIKE SYSTEMS
    ○○ DATA FUSION
    ○○ SLAR
    ○○ MULTISTATIC RADAR
    ○○ MICRO-ELECTRONICS
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C. ATTACK OF FIRE SUPPORT SYS
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ TRASANA
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ IMPROVED FIREFINDER MOBILITY
    ○○ PASSIVE DETECTION SYS
    ○○ FIND BEFORE FIRE
    ○○ ATTACK OF EMITTERS
D. DIRECT OBSERVATION
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ HELBAT
    ○○ TNG EFFEC ANALYSIS, FO
    ○○ ARMY TRAINING STUDY
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ POS AND LOC REPORT SYS
    ○○ NORTH FINDING MODULE
    ○○ GLOBAL POS SYS
    ○○ FO RADAR
    ○○ CO_2 LASER
    ○○ LIGHT WT EQUIP
E. GRD BASED TGT ACQ AND SURVEIL RADARS
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ MTI
    ○○ RADAR INFO DISSEMINATION
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ RADAR SIG AND DATA PROCESS
    ○○ ADV SYNTH APERTURE RDR
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F. NRT TGT PROCESSING AND FILTERING
  ○ BACKGROUND
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    ○○ CRITICAL EVENTS
    ○○ CONC OF STRIKE WINDOWS
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    ○○ TGT INFO FLOW AT CORPS
    ○○ FLOW OF TGT AT DIV
    ○○ INPUT TO TACFIRE
  ○ DEFICIENCIES (SPREAD SHEET)
    ○ OPPORTUNITIES
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    ○○ ALL SOURCE ANAL CNTR
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    ○○ PLRS/JTDDS HYBRID
    ○○ MICRO-ELECTRONICS TECH
G. TARGET ACQUISITION SURVEY
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ SURVEY EQUIPMENT
    ○○ SURVEY CAPABILITY
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    ○○ DIV ARTILLERY SURVEY
    ○○ DIV SURVEY TIMES
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ PLRS
    ○○ NORTH FINDING MODULE
    ○○ GLOBAL POS EQUIPMENT

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A. GENERAL
B. CONVENTIONAL MUNITIONS
  ○ BACKGROUND
    ○○ TARGETS
    ○○ NEW DEVELOPMENTS
  ○ ANALYSIS
    ○○ GENERAL
    ○○ JMEM
    ○○ TYPE TERMINAL EFFECTS
    ○○ MUNITION CAPABILITIES
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ TERMINAL HOMING
    ○○ FAMAS
    ○○ PADS
    ○○ GUIDANCE ON BASIC LOADS
    ○○ TRAIN FIST
    ○○ RPV
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  ○ BACKGROUND
    ○○ BATTLEFIELD
    ○○ INVENTORY
  ○ ANALYSIS
    ○○ EXISTING SYSTEMS
    ○○ RECENT ANALYTICAL DATA
    ○○ RELATIVE EFFECTS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ MODERNIZE FORCE
    ○○ DEVELOP DOCTRINE
    ○○ DETERMINE TARGETING TECHNIQUES
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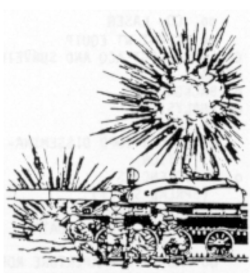
  ○ ANALYSIS
    ○○ CW MUNITIONS
    ○○ EFFECTS COMPARISONS
    ○○ CONSTRAINTS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ EXISTING AGENTS
    ○○ INTEGRATION OF ALL MUNITIONS
    ○○ TARGET ANALYSIS



E. SMOKE MUNITIONS EFFECTS
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ EMPLOYMENT
    ○○ EFFECTIVENESS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ PROCURE SUFFICIENT NUMBERS
    ○○ USE TECHNOLOGY
    ○○ SMOKE DOCTRINE
    ○○ DEVELOP TECHNIQUES
F. ILLUMINATION
  ○ DESCRIPTION
  ○ ANALYSIS
    ○○ RELIABILITY
    ○○ EFFECTIVENESS
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  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ SUFFICIENT QUANTITIES
    ○○ ADDITIONAL NIGHT VISION DEVICES

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  ○ BACKGROUND
  ○ FORMAT
B. 105MM MUNITIONS
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  ○ NO NEW 105MM CARTRIDGES
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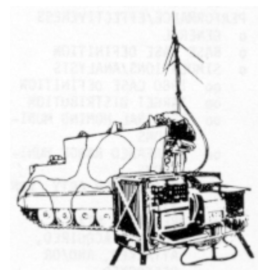
    ○○ AMSAA
    ○○ FAS 105/155 ANALYSIS
    ○○ LEGAL MIX V
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ FIRE-AND-FORGET
    ○○ LOW VULNER AMMO
    ○○ ADVANCED PROPELLANTS
    ○○ FUZES
C. 155MM MUNITIONS
  ○ MAINSTAY OF FIELD ARTY
  ○ MUNITIONS AVAILABLE
  ○ ANALYSIS
    ○○ LEGAL MIX V
    ○○ COPPERHEAD COEA
    ○○ BRL STUDIES
    ○○ SMOKE MINI-COEA
    ○○ FASCAM COEA
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ FIRE-AND-FORGET
    ○○ IMP RAM ARTY SYS
    ○○ LOW VULNER AMMO
    ○○ TIME FUZE
    ○○ NEW SMOKE
    ○○ DOCTRINE RANGE AMMO
    ○○ PROPELLANTS
D. 8-INCH MUNITIONS
  ○ COUNTERFIRE ROLE
  ○ MUNITIONS AVAILABLE
  ○ ANALYSIS
    ○○ LEGAL MIX V
    ○○ AMSAA M110E2 COEA
    ○○ TOP ATTACK STUDY
    ○○ CAMPAIGN ANALYSIS
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ FIRE-AND-FORGET
    ○○ EXTENDED RG MUNITIONS
    ○○ RAAM
    ○○ IMP RAM ARTY SYS
    ○○ LOW VULNER AMMO
    ○○ TIME FUZE
    ○○ PREDAMS
    ○○ PROPELLANT
E. MULTIPLE LAUNCH RKT SYS
  ○ GENERAL
  ○ ANALYSIS
    ○○ CAMPAIGN ANALYSIS
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ TERMINAL GUIDED WHD
    ○○ SCATTERABLE MINES
    ○○ OTHER MATERIEL DEV
F. LANCE MUNITIONS
  ○ GENERAL
  ○ ANALYSIS
    ○○ LEGAL MIX V
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
    ○ OPPORTUNITIES
    ○○ IMP ELEC TEST SET
    ○○ IMP NONNUCLEAR WHD
    ○○ OTHER MATERIEL DEV
G. PERSHING
  ○ GENERAL
  ○ ANALYSIS
    ○○ DEFENSE NUC AGENCY
    ○○ USA MICOM STUDY
    ○○ FSMAA PH II ANALYSIS
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ MATERIEL DEV

CHAPTER 7
C^3

A. GENERAL
  ○ INTRODUCTION
  ○ DEFICIENCIES/ECH MATRIX
B. C^3 AT CORPS, DIV, FA BDE, BN AND BTRY LEVELS
  ○ BACKGROUND
  ○ ANALYSIS
    ○○ FS COORDINATION CONC
    ○○ INTERDICTION PLANNING
    ○○ NUC SYS PROG REV
    ○○ TACFIRE COEA
    ○○ SIGNAL SCHOOL'S MAA
  ○ DEFICIENCIES (SPREAD SHEET)
  ○ OPPORTUNITIES
    ○○ COMM SYS ENGINEERING PROGRAM
    ○○ FS TASK MANAGEMENT
    ○○ MATERIEL DEVELOPMENTS AND PROCUREMENT



C. SUMMARY
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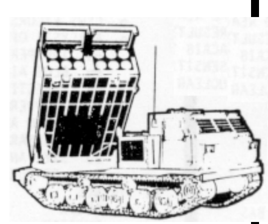

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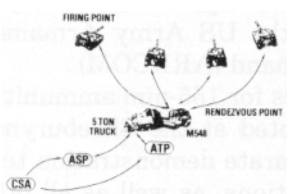

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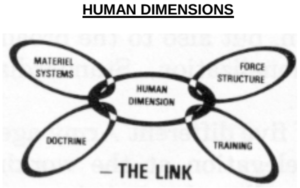
<u>**HUMAN DIMENSIONS**</u>



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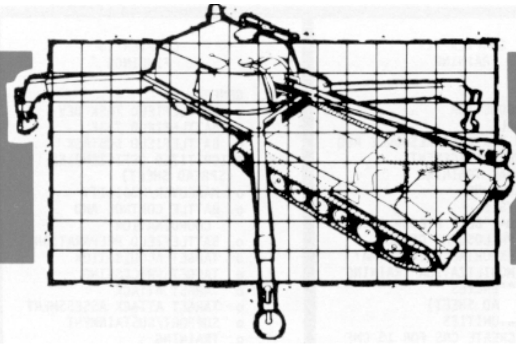
Col Anthony G. Pokorny is the Director of the Directorate of Combat Developments USAFAS, Fort Sill OK.



FA Test and Development

design • development • testing • evaluation

Development of improved smoke round nears completion

Engineering development of the XM825 155-mm improved screening smoke projectile is nearing completion at the US Army Armament R&D Command's Chemical System Laboratory (CSL). The new round will provide a significant improvement in visual ground screening effectiveness over the Army's current standard projectiles.

According to Mr. James L. McKivrigan, CSL's project officer, "The XM825 is an artillery-delivered projectile that ejects white-phosphorus (WP) saturated felt wedges above the target area. The wedges fall to the ground, producing a dense obscuring cloud up to 250 meters in length. There are a total of 116 felt wedges in all, capable of producing improved dispersion and persistence of a WP smoke screen for up to 10 minutes."

The projectile, which is designed for use with the M109A1 and the M198 howitzer weapon systems, is expected to be adopted for Army use within two years. *(Army R, D&A magazine)*

Allies achieve progress in ammunition compatibility

Significant progress toward achieving full compatibility of 155-mm ammunition and commonality of 155-mm test procedures among military forces of four Western allied nations was reported following meetings held recently at Shoeburyness, England.

Attending the week-long Third Quadrilateral Safety Working Group Meeting were representatives of the United States, United Kingdom, Federal Republic of Germany, and Italy.

The meeting was combined with a series of demonstration test firings of a 155-mm projectile and a 155-mm propelling charge, both developed by the US Army, and a 155-mm howitzer developed by the three European members of the working group.

The M549A1 rocket-assisted projectile and the M203 propelling charge, developed at the US Army Armament Research and Development Command (ARRADCOM) under management of the Office of the Project Manager for Cannon Artillery Weapon Systems (PM-CAWS) were fired from the trilaterally-developed FH70 towed howitzer.

Developed jointly by the British, West German, and Italian armed forces in a cooperative effort, the FH70 is now being produced in Europe. It is a counterpart of the US Army's M198 towed howitzer, which was placed in production last year at Rock Island, IL, by the US Army Armament Materiel Readiness Command (ARRCOM).

Uniform test procedures for 155-mm ammunition were developed and adopted at the Shoeburyness meeting. As a result, separate demonstration tests and trials by the four nations, as well as all other members of the NATO planning to deploy 155-mm weapons, will no longer be necessary. Results of tests conducted by one NATO member will be accepted by the other members. Therefore, while some NATO members are planning to field the FH70 and others the M198, the ammunition and testing procedures will be interchangeable.

The working group was formed as the result of a Quadrilateral Memorandum of Understanding. Following the Shoeburyness meeting, its accomplishments were seen as highly significant not only to the 155-mm interoperability program, which was its immediate concern, but also to the broader program of NATO Rationalization, Standardization, and Interoperability.

Nine representatives of five different Army agencies made up the US delegation at the working group's third meeting. Heading the American contingent was LTC William J. Schumacher of PM-CAWS, product manager for 155-mm ammunition. *(Army R, D&A magazine)*

Hardened shelter is lighter, stronger

A hardened tactical shelter (HATS) has been developed that decreases a soldier's vulnerability to nuclear blasts and conventional fragments by 75 percent.

Jointly developed for ERADCOM by Harry Diamond Laboratories (HDL) and the Ballistics

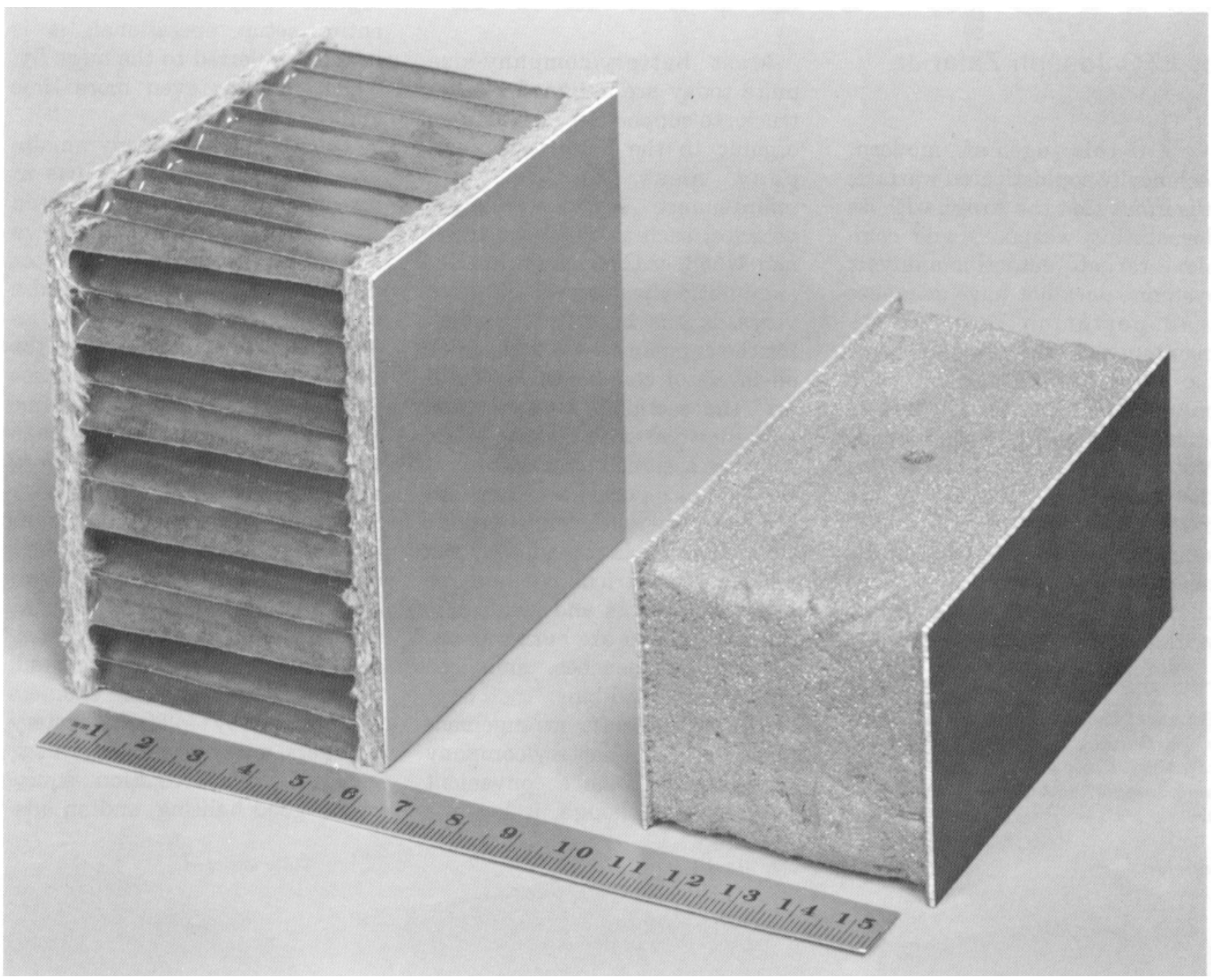
Research Lab (BRL), eight prototype shelters will be produced by Craig Systems, Inc., of Lawrence, MA, under terms of a $1.6 million engineering development prototype contract awarded in October 1980.

The hardened tactical shelter could replace the S-280 and S-250 electronics shelters. The shelter wall is a composite structure designed to stop fragments and resist tearings due to a nuclear blast. There are two laminate skins, each composed of seven layers of "Kevlar," a strong artificial fiber developed by Dupont. An interior aluminum skin provides protection from electrical and electromagnetic threats. It has half the weight and twice the strength of aluminum, which is currently used in shelter walls.

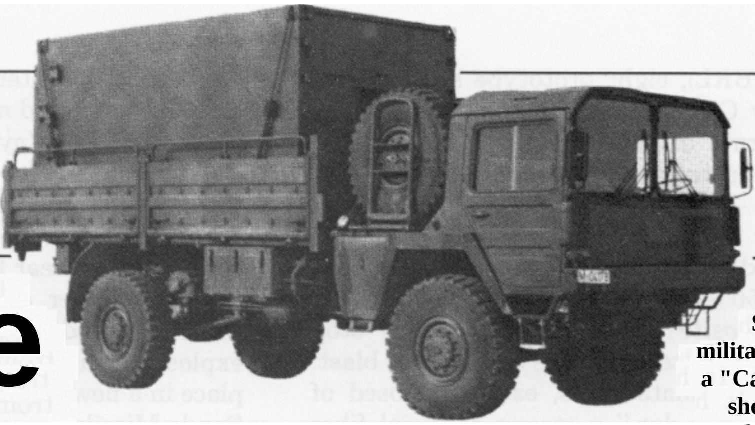
Two of the shelters will be delivered this spring in time for simulated nuclear blast tests. The first test is set for late May of early June in France. The shelter will be the first non-French system to be tested in that country's 36-foot diametr Large Blast Simulator, the world's only shock tube facility for simulating nuclear blasts on complete systems.

In September, a truck-mounted prototype shelter will be exposed to a blast wave from 620 tons of high explosives, and simultaneous exposure will take place in a new full-scale thermal simulator at White Sands Missile Range, NM.

A decision on whether to mass produce the hardened tactical shelter is to be made after October 1983. All critical electronics systems with a nuclear survivability requirement—such as Pershing II —would use the hardened tactical shelter.



At left is a wall section using skins made of "Kevlar," an artificial fiber developed for the hardened tactical shelter to replace the conventional aluminum and foam wall (right) currently used in 95 percent of the Army's electronics shelters.



Shown is a German military 5-ton truck with a "Cabin 2", all purpose shelter. Shelter can be used for communications, mess and maintenance operations.

Mobile maintenance shop vehicle

by LTC Joseph Zalar Jr.

In this age of modern, technically sophisticated warfare, it is ironic that the Army, with its devastating weaponry and complex target detection/analysis systems, does not have adequate transportation for its maintenance section, which keeps the Army moving and is second only to the mess section in providing the lifeblood of land forces. Not only is the maintenance section unable to transport to the battleground the tools and personnel so vital to the unit's maintenance posture, but, once there, the section has no workshop.

Most battery/company-size units today are assigned 2½-ton trucks to support service sections organic to the battery or company mess, supply, and maintenance sections. Larger vehicles, such as the 5-ton truck and M548, or Goer, are primarily ammunition-bearing vehicles. For years, it has been "acceptable" for the company mess section (at all levels of command) to "build up" the section's 2½-ton truck with plywood and other materials to carry assigned equipment and provide a portable shop to prepare food with some protection. Lighting is provided by the vehicle's electrical system or gasoline lanterns and inside this portable shelter are burner units, ranges, workbenches, and iced storage area and bins.

This makesshift arrangement provides the battery/company mess section with a convenient shop area. Although, it is quite burdensome, is not truly mobile and requires considerable time for assembling and dismantling organic equipment to make the entire setup operational, it is usually preferred to the mess fly, which requires even more time and effort to erect.

The battery/company maintenance section normally has at its disposal one of the 2½-ton trucks organic to the battery, a 1½-ton cargo trailer, a generator set (1.5-kilowatt or larger), and a maintenance shelter with an A-frame. For operations in the field, the battalion maintenance section has generally the same equipment as the battery/company section along with recovery vehicles, wreckers, possibly a jeep, and an additional vehicle such as an M561 or M880 pickup.

In garrison (CONUS), the battery maintenance section uses at least one maintenance bay (usually covered, enclosed, and heated) with tool and parts cabinets (authorized by MTOE), battery chargers, a vise, a grinding wheel, compressors, lubrication equipment, good lighting, and an adequate

German "Cabin 1" all purpose shelter which features a "drive under" loading capability. Photo sequence shows loading procedure for the 2-ton service unit vehicle.

working environment. Of course, the seasoned motor sergeant uses his experience to contribute to the efficiency of the organizational maintenance operation by enhancing available facilities and providing for the comfort of his personnel. However, when the maintenance operation is moved out of the garrison environment, how much of this efficiency can be maintained in the field?

When he has loaded all the personnel and equipment he can carry on the 2½-ton truck and trailer, the maintenance sergeant can forget about protection from the elements and "in-garrison" efficiency. With a good loading plan, the maintenance section can get all of its tools and equipment on the 2½-ton truck, but the vehicle is only a means of transportation—it will not serve as a mobile maintenance shop. Once in a stable position area or during a lengthy halt, maintenance personnel can offload the shelter and erect it on the A-frame, set up the generator(s), and hook up a light set if one is available and if light discipline is not critical (as it almost always is among combat units in the field). The maintenance sergeant must then sort out the equipment meticulously "packed" in the deuce-and-a-half, mount his vise and grinder on the bumper, and begin repair work. Normally, the mechanics work on location wherever a vehicle goes down. In CONUS-based and most overseas units, if a situation cannot be corrected by a quick substitution or turn of a bolt or two, the vehicle will be evacuated to a more adequate maintenance facility. In combat operations, however, evacuation may be impossible.

The present maintenance field facility, like the portable mess vehicle, is not the epitome of mobility and, if the section must relocate before completing the work started, the operation usually cannot pick up where it left off. A tremendous amount of time must be spent in loading and unloading-time that could be more efficiently used on maintenance tasks. In other words, it is literally time wasted.

The deuce-and-a-half used by the maintenance section can be and usually is built up with plywood and planking to provide some shelter; however, equipment organic to the section must be offloaded before the truck can be effectively used as a shop.

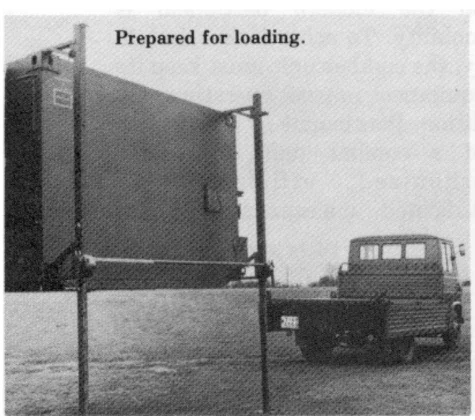
This built-up truck does offer limited advantages. A lighting system can be set up using either the vehicle electrical system or generator-supplied power (with a "buttoned-up" shelter, light discipline poses little problem). Additionally, reference material can be shelved, benches can be constructed and some protection from the elements is provided for personnel doing tedious repair work.

On the other hand, even though plywood and two-by-fours are relatively inexpensive, by the time an adequate facility is constructed, the cost of this built-up shop could become expensive. Also, lighting in such flimsy wooden structures, whether electric or gasoline, is barely adequate and extremely dangerous and, since battery/company maintenance involves maintaining heavy, bulky components and subcomponents, the built-up structure could soon be reduced to splinters.

The point is: Why should a unit go to the expense and time to build up vehicles that will still be functionally inadequate, particularly when the need for a mobile maintenance module is so widely recognized?

The M109-series shop van is currently available to a limited extent but usually not in combat arms battalion or companies. Where they are available, these vans are used as electronic/communications and special weapons vans. Although relatively small in size, the M109 shop van could be outfitted with cabinetry and used for storing small parts and, even though it would not be an efficient self-contained shop, it would be better than the built-up truck insofar as utility, durability, safety, and practicality are concerned.

For the mission of the maintenance section, the M109-series van has two major disadvantages—its size and limited availability. There is an alternative however that would counter both of these disadvantages—designing and fielding a more suitable vehicle which can accommodate the necessary equipment and still provide the working environment necessary for good shop organization and efficiency in the field. It should be designed so that it can be used as a shop where facilities are not


Prepared for loading.


Loading process.


Mounted and ready for use.

available or where the construction of permanent facilities is not desirable (for example, in overseas areas where military installations are only temporary).

In considering the need for such a vehicle, the personnel efficiency aspect is of foremost concern since haphazard facilities spawn haphazard task production. Currently, too much effort is spent in attempting to overcome the inadequacies of field facilities and, as a result, time spent in performing maintenance in the field is lost and productivity and efficiency are low.

In this age of modern warfare when technology is being applied to every aspect of weaponry and individual as well as unit protection, some of the same technology must be applied to support means. Since mobility is required in a hostile environment and equipment maintenance is critical to the survival of a unit on the battlefield, the maintenance section is of ever-increasing importance to the combat unit. As such, the degree of maintenance and repair that must be accomplished in the field warrants better material support, an adequate means of transporting the maintenance operation, and a shop facility more sophisticated than the bed of a 2½-ton truck. To satisfy these requirements, the M109-series van upscaled to a 5-ton van would be very adequate.

The 5-ton cargo truck has proved its reliability for transporting ammunition and heavy equipment; however, vans as currently configured for use with this vehicle (primarily the collapsible van) are not structurally suited for maintenance operations. Rather, a sturdy shell on a medium length base would be ideal. Such a van could be equipped with semipermanent fixtures such as shelving, workbenches, parts cabinets, reference cabinets, a desk, and storage capability. The "box" would be self-contained with lighting, heating, and even cooling. Additionally, an external powerplant in the form of a small 1-kilowatt generator currently in the inventory and authorized company/battery-size elements would be suitable. A 1½-ton cargo trailer, also currently authorized, could be used to transport additional equipment required, petroleum products, and other necessary items.

The 5-ton truck is economical both in fuel consumption and upkeep cost, and it provides the pulling power necessary for a van configuration containing heavy material.

The sketches in figures 1 through 6 of a proposed modular shop are not to scale and no measurements are shown, but items illustrated could easily be manufactured to fit in the 5-ton van. The drawings are offered as suggestions to stimulate ideas of what specific items should compose a functional mobile maintenance shop.

In the design of the mobile maintenance van, two primary considerations are portability and the greatest possible degree of self-containment, including as much as possible those elements that facilitate organization and efficiency in a garrison operation. For example, the van must have:

•Accessibility to storage for tools and parts.

•Space for a small built-in desk and filing cabinet to serve as a shop office.

•Accessibility to and adequate storage for reference manuals and log books.

•Adequate lighting and comfortable working area.

•Adequate storage space on the floor with tiedowns if needed.

•A cabinet for overalls and safety equipment.

A 1½-ton trailer will provide the additional capability of transporting petroleum products and other bulky items of equipment. All storage areas, cabinets, and shelving units must have tiedowns or sliding metal doors to secure items during movement. There should be two entry/exit points to permit personnel to enter or leave the facility without disturbing operations in other parts of the van with double doors in the rear to facilitate loading and unloading. (The double doors would also allow another van (5-ton or M109-series) to back up to the mobile maintenance van and thus create a second "wing".) This concept would be particularly useful in the case of a battalion maintenance section where an M109 van containing PLL items or parts in cabinets could complement the 5-ton vans and eliminate necessity for storing large quantities of such items in the working area. Parts bins and/or cabinets could also be located in the 1½-ton trailer.

A frame could be erected at the rear or side of the van to provide a canvas-covered maintenance shelter where vehicles could be pulled up to the van for necessary repairs. Spotlights could even be mounted on the outside of the van to light the maintenance shelter.

A 5-ton van outfitted as shown in figures 1 through 6 would provide all the elements necessary for an adequate field maintenance operation and could be easily modified to suit the needs of maintenance activities at any echelon.

In summary, the key to success on the modern battlefield is mobility. To achieve that mobility, the combat unit must keep its equipment in peak operating condition. Paramount to the success of a combat unit is a well-organized, efficient, and dedicated maintenance section

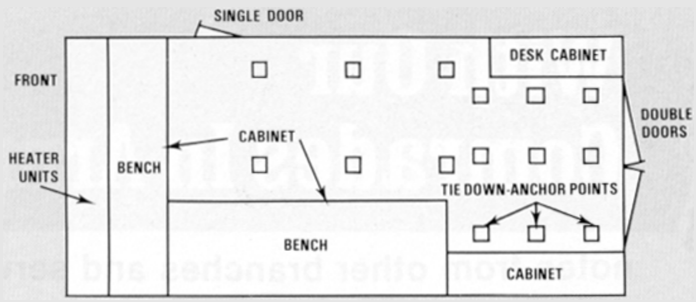


Figure 1. Mobile maintenance shop floor diagram.

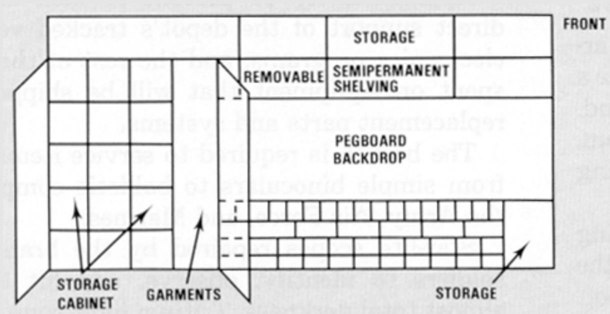


Figure 2. Mobile maintenance shop left side (inside) diagram.

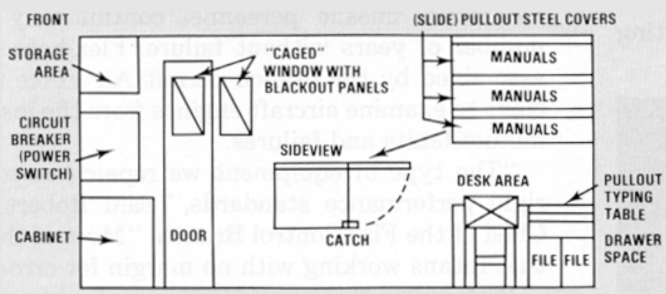


Figure 3. Mobile maintenance shop right (inside).

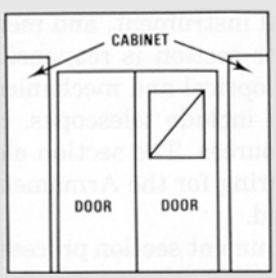


Figure 4. Mobile maintenance shop back (inside).

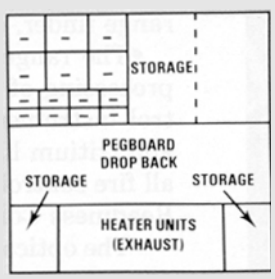


Figure 5. Mobile maintenance shop front (inside).

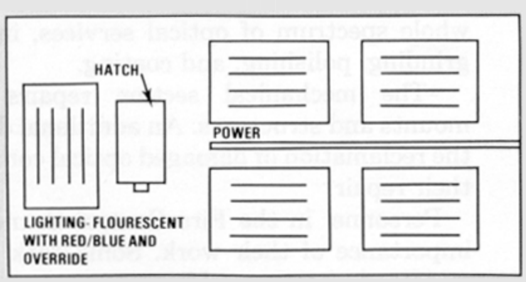


Figure 6. Mobile maintenance shop top (inside ceiling).

provided with the best of equipment and facilities. Since much has been done to provide units in garrison with modern maintenance facilities with ample lighting, adequate working and storage areas, and comfortable surroundings, the standards for field maintenance facilities should receive the same attention.

A unit should not have to fabricate a vital and necessary piece of equipment once a need has been firmly established; yet it is not uncommon to see field mess and maintenance facilities haphazardly constructed on Gama Goats, jeep trailers, trucks, and other vehicles because portability and mobility are crucial. Economy is achieved by converting vehicles that serve as a means of transportation into shops or work areas.

Within the Army and other services, we must strive to increase the practicality and efficiency of support equipment as well as weaponry. Even though the most sophisticated weaponry known to man is available for combat, combat units can become powerless if support means are antiquated, slow, or inefficient. Such units must have the support means with the equipment to be serviced so that maintenance can be performed instantaneously. The mobile maintenance shop vehicle would satisfy this requirement.

The concept of a 5-ton van designed to fulfill the specific needs of the maintenance section would not require excessive costs for development since the 5-ton truck is already in the inventory. Although some chassis modification would be required, the cost would not be excessive. This need is long overdue.

LTC Joseph Zalar Jr. is the Executive Officer of the 212th Field Artillery Brigade, Fort Sill, OK.

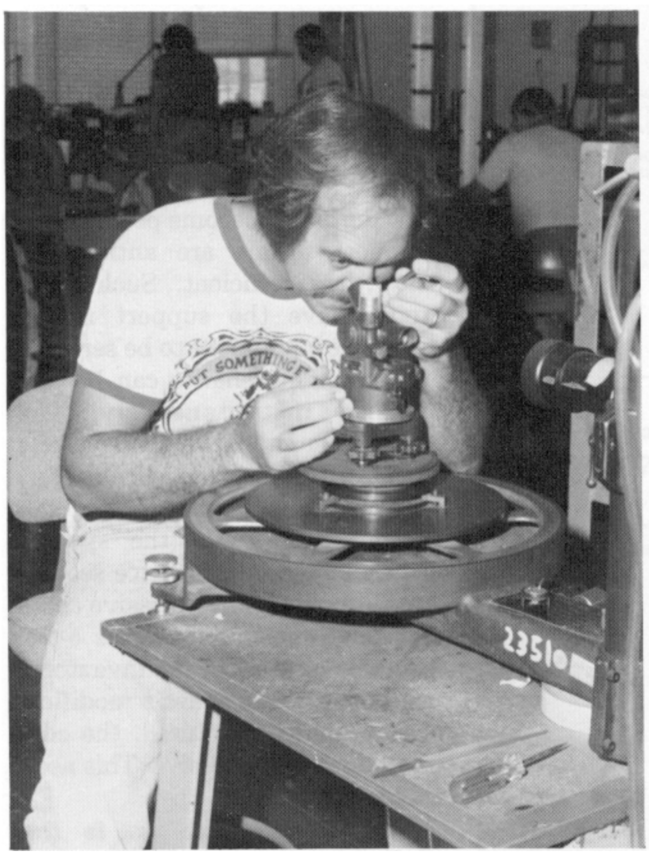
With Our Comrades In Arms

notes from other branches and services

Depot helps keep soldiers on target

Imagine that you're a forward observer for an artillery unit and an aggressor force is about to make a night assault on positions you're helping to defend. You know they're out there, but you can't see them, and you can't give away your position by using flares. What are your chances?

Increasing the chances of seeing and hitting enemy targets is one of the principal goals of the Fire Control Branch at Letterkenny Army Depot. The activity is responsible for the repair, overhaul, and modification of a wide range of instruments designed to assist soldiers in finding and hitting targets.



Blaine Smith aligns the optical and mechanical axis of an aiming circle. The device is used to aim or lay in conventional artillery.

Approximately 30 percent of their work is in direct support of the depot's tracked vehicle and electronics programs, and the rest of their time is spent on equipment that will be shipped out as replacement parts and systems.

The branch is required to service items, ranging from simple binoculars to ballistic computers, for the Army, Air Force, and Marines.

Star-lite scopes repaired by the branch enable soldiers to identify, observe, and hit targets in almost total darkness. Tritium light sources installed by the branch provided instrument illumination for Hawk missile personnel continuously for a number of years without failure. Flex-bore scopes assembled by the branch permit Air Force technicians to examine aircraft engines from the inside for minute faults and failures.

"The type of equipment we repair has to meet rigid performance standards," said Robert Lake, Chief of the Fire Control Branch. "Most of the time that means working with no margin for error."

Performing this work is a force of more than 90 employees which is divided into three sections: range finder, optical instrument, and mechanical.

•The range finder section is responsible for the processing of large optical and mechanical fire control instruments to include telescopes, computers, and tritium light sources. The section also handles all fire control fixturing for the Armament Materiel Readiness Command.

•The optical instrument section processes smaller optical instruments such as aiming circles, microscopes, and various measuring instruments for the Air Force. The section is able to furnish a whole spectrum of optical services, including lens grinding, polishing, and coating.

•The mechanical section repairs mechanical mounts and structures. An additional duty involves the reclamation of damaged optical components and their repair.

Personnel in the Fire Control Branch know the importance of their work. Some dark night in the middle of a battle a soldier will be glad they do. (Jim Picard)

AIR CONTROLLING—During testing at Fort Carson, CO, US Air Force forward air controllers demonstrate the Laser Target Designator (LTD), a device that pinpoints targets for aircraft or laser-guided weapons. The Air Force is currently conducting a follow-on test and evaluation of the LTD at several military installations. The devices are being used to "hand-off" targets to A-10 and A-7 aircraft equipped with Pave Penny laser spot trackers. The LTD can designate a target more than six kilometers away for "hand-off" to a Pave Penny-equipped aircraft flying more than 20 kilometers from the target. The tests are being conducted with several of the first production LTDs recently delivered by Hughes Aircraft Company under contracts with the US Army Missile Command. These tests, including tactics and doctrine exercises, have been successfully completed for Pave Penny-equipped A-10s.

NATO lags in tank production

The Warsaw Pact countries of the Soviet Union, Czechoslovakia, and Poland will produce almost 95 percent more tanks than NATO during the next six years, according to a recently published study by DMS Inc. of Greenwich, CT. The TANKS Special Study forecasts that Warsaw Pact tank production facilities will outproduce the NATO countries of France, the Federal Republic of Germany, the United Kingdom, Greece, Italy, and the United States by a factor of 2 to 1 between 1981 and 1986.

Overall, DMS's TANKS report forecasts that the Warsaw Pact will produce 22,520 tanks during the six-year period as compared to NATO's 11,625. Eight other countries—Argentina, Austria, Brazil, the Peoples Republic of China, India, Israel, Japan, and Sweden—will produce an estimated 5,570 tanks. An average of 6,600 tanks will be produced annually throughout the world during the next six years, according to DMS.

Warsaw Pact tank production will be concentrated on the T-72 with the Soviet Union forecast to produce almost 12,500 units between 1981 and 1986 and Czechoslovakia and Poland each producing 1,900 during the forecast period. United States tank production will be highlighted by the delivery of almost 5,000 XM1 main battle tanks during the next six years.

Not only will more tanks be developed, but their design and modularization will be improved. It has been remarked that the "black boxes" carried by modern combat aircraft are often more important than the platforms that carry them, and while this stage of development has not yet been reached in the field of tank design, the componentry that goes into a modern tank has clearly assumed a greater, and often critical, importance.

During the first 40 years, the formula for new tanks was always "bigger and heavier, with thicker armor and more powerful guns," but this theory became obsolete when tanks reached a weight of about 50 to 60 tons, which drastically limited the tank's tactical usefulness. Also, the number of secondary-road bridges rated at 50 tons capacity is quite small, and the standardization of railroad tunnels and clearances further restricts the exterior dimensions of tanks. Thus, these factors led directly to a search to increase tank effectiveness without increasing the weight and size. The result has been a tremendous growth in such components as night vision devices, laser rangefinders, digital fire control computers, high performance engines including turbines and variable-compression diesels, new metallurgical approaches to ammunition and armor plate, and innovative suspension systems.

The new approach has also given rise to a booming industry in tank modification programs. A large number of these components can be retrofitted onto existing tanks, permitting a country to modernize its tank fleet for a fraction of the generally astronomical cost of a full production run of new battle tanks. Since the new generation tanks such as the XM1 and Leopard 2 will cost about $1.5 million apiece, many countries facing a requirement to modernize a fleet of several hundred to several thousand tanks have opted to modernize their current fleet through the retrofitting of fire control systems, new engines or night vision equipment. In fact, the high cost of new tanks has made such programs almost universally attractive, and not only have countries with limited defense budgets such as Pakistan, Norway, Spain, and Morocco eagerly embraced this new trend, but the United States has put new guns and engines into the 1,900 M48 battle tanks used by the reserves and thus projected their useful life into the 1990s at about one-sixth the cost of producing new XM1s.

Viper tests

The US Army Missile Command (MICOM) recently conducted the first successful manned firings of the Army's new Viper tank killer.

MICOM and General Dynamics Corp., Viper prime contractor, conducted a joint flight test program at Redstone Arsenal, AL, the first with a man in the loop, to demonstrate Viper safety and accuracy and assure that weapon system noise levels are acceptable.

"Flight tests were highly successful," said COL Aaron J. Larkins, Viper Project Manager.

Larkins said additional firings are planned, along with environmental tests (hot and cold temperatures, vibration, shock, etc.) before the Army and General Dynamics conclude the program this year.

Earlier Viper firings were unmanned shots from a fixed launcher.

To man-rate the eight-pound tank killer, eight General Dynamics gunners each fired three rounds—a single round one day and two rounds less than a minute apart the next day.

Medical experts from Fort Rucker, AL, monitored the tests and performed audio checks on gunners before and after they fired.

"There was no degradation, not even a temporary hearing loss, in any of the gunners," Larkins said.

Light, compact, and shoulder-fired from a throwaway case that serves as the launcher, Viper will be substantially more powerful, accurate, and effective than the M72 LAW and will have a much longer effective range.

Once in production, Viper will be issued as a round ammunition.

Viper, the eight-pound tank killer, is shoulder-fired from a throwaway case that serves as the launcher.

Major first to jump masked

On 23 August 1980, a 37-year-old US Army major made his 151st parachute jump on a remote Fort Benning drop zone. As he struggled to collapse his parachute in the 100 degree heat, two movie cameramen and two still photographers moved in quickly to record every movement, yelling from time to time for him to slow down or move this way or that to face the cameras.

After rolling up his chute and packing it into his kit bag, MAJ Daniel D. Turner, US Army Infantry Board, had completed all of the steps required of an Army parachutist upon landing, and he would continue his assigned mission in the contaminated area wearing the M17A1 protective mask. Turner had just become the first American soldier to execute an authorized parachute jump while wearing a protective mask.

The jump was the first in a series to be conducted by the Infantry Board as part of an operational test entitled "Parachute Procedures in Chemically Contaminated Areas" (PAPRICCA). The tests will determine what changes need to be made to current parachuting procedures for soldiers to land safely in contaminated areas. Present training literature does not contain any such procedures nor does the Army have any experience in jumping while wearing protective masks and equipment. Data collected in the tests will provide a base for developing Army doctrine, plus current interest in anything chemical is high because of the recent publicity to Soviet chemical warfare capabilities.

Aside from the high level concern for the subject, the testing is a contest between man and his environment; the parachutist must try to land safely while restricted by the mask and hood and must keep the mask tightly sealed so he will not be overcome by any chemical that might be in the air or on the drop zone.

After Turner made the first jump successfully, two other Board testers jumped wearing masks. CPT Tommy H. Giles III and SSG Sherman W. Jordan made two jumps each without any apparent problems.

Testing is scheduled to continue with test jumps on Fryar Field at Fort Benning, followed by jumps at Fort Devens, MA, with the 10th Special Forces Group and mass tactical jumps in the 82d Airborne Division. (Billy Arthur)

New Transport aircraft

Included in the FY81 Defense budget is $35 million to begin development of a new Air Force transport aircraft, called the C-X, to airlift large, heavy outsize Army equipment to the battlefield to support NATO reinforcement and the Rapid Deployment Force. Currently, only the C-5 can carry outsize cargo such as the 60-ton XM1 tank.

Design specifications for the C-X call for an unrefueled range of at least 2,400 nautical miles when carrying at least 130,000 pounds of cargo, with a cruising speed of at least 475 miles per hour at an altitude of not less than 26,000 feet.

It must be able to operate from small, austere airfields and be able to back up and turn around in as little as 90 feet. The C-X should need a maximum of 4,000 feet of runway to land with its maximum payload and be able to take off in 3,000 feet with a 70,000-pound payload.

Preliminary estimates indicate the size of the C-X will be about half that of the C-5. Its cargo compartment will be long enough to carry three infantry fighting vehicles and wide enough for the XM1 tank.

Assault Breaker sled test

On 15 December last year, Vought Corporation (aerospace subsidiary of the LTV Corporation) announced that the US Department of Defense has confirmed successful completion of the first high-speed sled test of the Vought Assault Breaker dispensing system.

The test was accomplished 20 August 1980 at the Naval Weapon Center at China Lake, CA. Assault Breaker is a Defense Advanced Research Projects Agency joint Army/Air Force feasibility demonstration of a system to defeat second echelon armor.

In the test, the Vought system dispensed 10 submunitions of five different types:

•Terminally guided submunitions (TGSM) with balloon parachute stabilization.

•TGSM with fin stabilization.

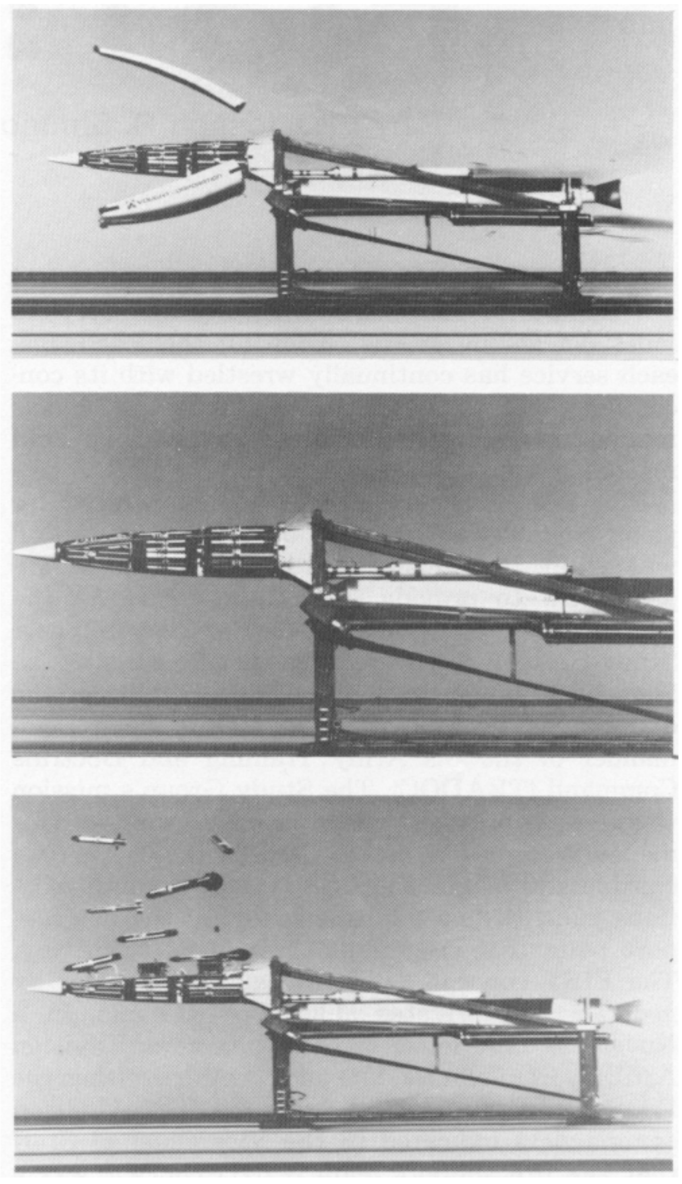
•Skeet delivery vehicle assemblies (SDVA) with balloon parachute stabilization.

•SDVA with fin stabilization and non-stabilized inert munitions.

The warhead skins separated and cleared the structure, and the submunitions remained within the vehicle until the programmed dispense time, when they were ejected with specified separation and stability.

Sled tests are being conducted under a contract awarded to Vought last fall to provide six T-22 missiles and six dispensing systems for the Assault Breaker demonstration program. The dispensers are to be capable of distributing submunitions in a controlled pattern over a target area.

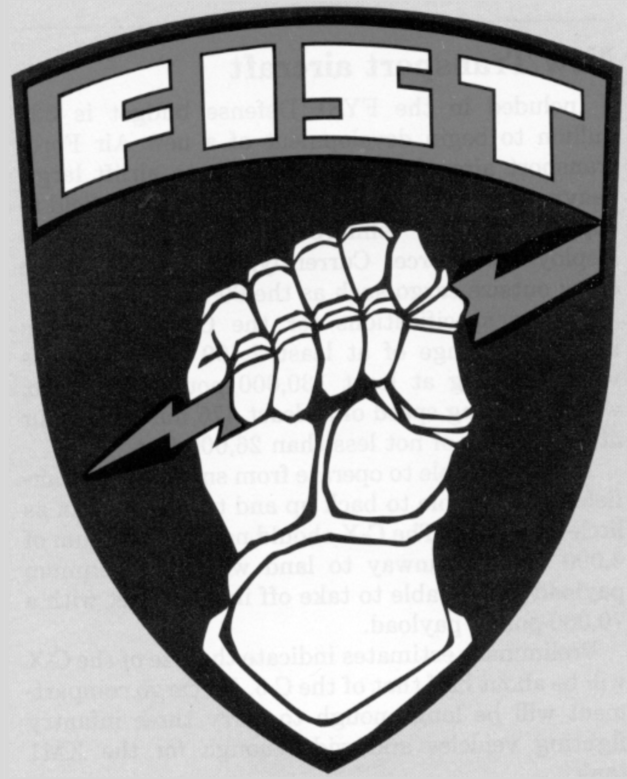
The Vought T-22 for the Assault Breaker demonstration is a variation of the Army Missile Command's Simplified Inertial Guidance Demonstration (SIG-D) missile which was successfully tested at White Sands Missile Range, NM.



High speed synchro-ballistic photographs show the first sled test of LTV's Vought Corporation Assault Breaker dispensing system. The top photo shows the outer skins separating and clearing the dispenser. In the center picture, the submunitions remain inside the vehicle until programmed dispense time. The bottom photo shows the dispension of the five different types of submunitions. (Vought Corporation photo)

Don't forget your FIST!

by LTC Joseph R. Simino



The military's primary mission is to deter war and, should this deterrence fail, our armed services must defeat the enemy. Knowing this challenge, each service has continually wrestled with its conceptual, organizational, and equipment problems related to fulfilling its respective role in this overall responsibility.

The Field Artillery School had recognized for years that the US forward observer organization was small, inadequate, and badly in need of improvement to provide good fire support for the maneuver forces. In July 1975, the Close Support Study Group (CSSG) was formed at Fort Sill by the School's Commandant, MG David E. Ott, at the direction of GEN William E. DePuy, then Commander of the US Army Training and Doctrine Command (TRADOC). The Study Group's mission was "to optimize observed fire support for maneuver forces on the modern battlefield." After considerable work, the CSSG made recommendations which led to implementation of the fire support team (FIST) concept throughout the Army. The FIST concept has been called a disaster by generals and privates alike. For example, in a November 1979 letter to the 3d Armored Division Artillery Commander, MG Jack N. Merritt (then the FA School Commandant) wrote that "two division commanders indicated to the Vice Chief of Staff that the fire support team (FIST) concept was a disaster." More recently, others have said worse. I contend, however, that the concept is sound. There are problems which will be around for a while, but artillerymen should concern themselves with working around these areas and concentrate on providing the best possible fire support to the maneuver forces.

FIST concept

The FIST concept calls for an artillery lieutenant to direct and control his team of observers in support of "their" maneuver company. Here the FIST chief is the company commander's fire support coordinator. His observers are armed with the 13F Military Occupational Specialty (MOS), which indicates a special training in the adjustment of artillery, mortar, naval, and close air fires. Another essential ingredient of the concept calls for a specific FIST organization to support each type of division (figure 1) with increased communications, transportation, and fighting capabilities (figure 2).

		Type unit				
Position	**Rank**	**Mech inf**	**Armor/cav**	**Inf**	**Abn**	**Air assault**
FIST chief	LT	1	1	1	1	1
Fire support sergeant	SSG	1	1	1	1	1
Forward observer	SGT	3	0	3	3	3
Fire support specialist/driver	SP4	1	1	1	1	1
Radiotelephonic operator (assistant FO)	PFC	3	2	3	3	3
TOTALS		9	5	9	9	9

Figure 1. FIST personnel summary.

Equipment	Type	Mech inf	Armor/cav	Inf	Abn	Air assault
Vehicle	M113A1	**0	**0	0	0	0
	M151A2 with trailer	2	2	2	0	1
	M561	0	0	0	1	0
Navigation	PADS*	1	1	0	0	0
Communications	VRC-47	1	1	1	0	1
	GRC-160	2	2	2	3	1
	PRC-77	3	1	3	3	4
	KY-38	1	1	1	1	1
	GRA-39	2	2	2	2	2
	SB-993	1	2	1	1	1
	MK456A/GRC	1	1	1	1	1
	RC-292	1	1	1	1	1
	DMD*	4	2	4	4	4
Observation	G/VLLD*	1	1	0	0	0
	GVS-5	3	1	3	3	3
	LTD*	3	1	3	3	3
	PVS-5	1	1	1	1	1
	TVS-5	1	1	1	1	1

*Projected new equipment.
**Preferred vehicle. (Note that mechanized infantry and armor/cavalry units are assigned M113s.

Figure 2. FIST major equipment summary

Major strengths and weaknesses

The caliber of individuals currently assigned to FIST throughout the Army provide the greatest strength to this concept. The artillerymen who make this fire support system work are absolutely critical to the operations of both the artillery battalion and the supported maneuver unit.

There is an inherently greater capability for combined arms fighting and training with FIST which is reflected by the technical fire support qualifications placed with each maneuver company, along with better communications for directing fire support. It is perhaps the best system the Army has ever had. The FIST mobility capability, which is equal to or greater than that of the maneuver force, allows artillerymen to keep pace with their company commanders, resulting in better use, control, and integration of fire support assets throughout the division.

Certain weaknesses of FIST are recognized, however. For example, there is a current severe shortage of key noncommissioned officers and junior enlisted soldiers which influences the kind of fire support FIST can provide the maneuver unit. Also full implementation of the concept not only requires qualified people, but also requires an acceptance of FIST by our maneuver commanders. A lack of depth and solid fire support experience can be overcome, to some extent, by assigning more experienced personnel to fill FIST chief positions. Personally, I have seen a general reluctance to assign the most experienced lieutenants to FIST positions; rather, they are placed in firing battery positions. In his article in the January-February 1978 *Field Artillery Journal,* LT Luther Dunn points out that his unit filled the FIST slots first and operated without a firing battery assistant executive officer for 11 months. In other words, keeping FIST healthy will keep the program out of trouble and will allow the artillery to perform its primary mission—of fire support.

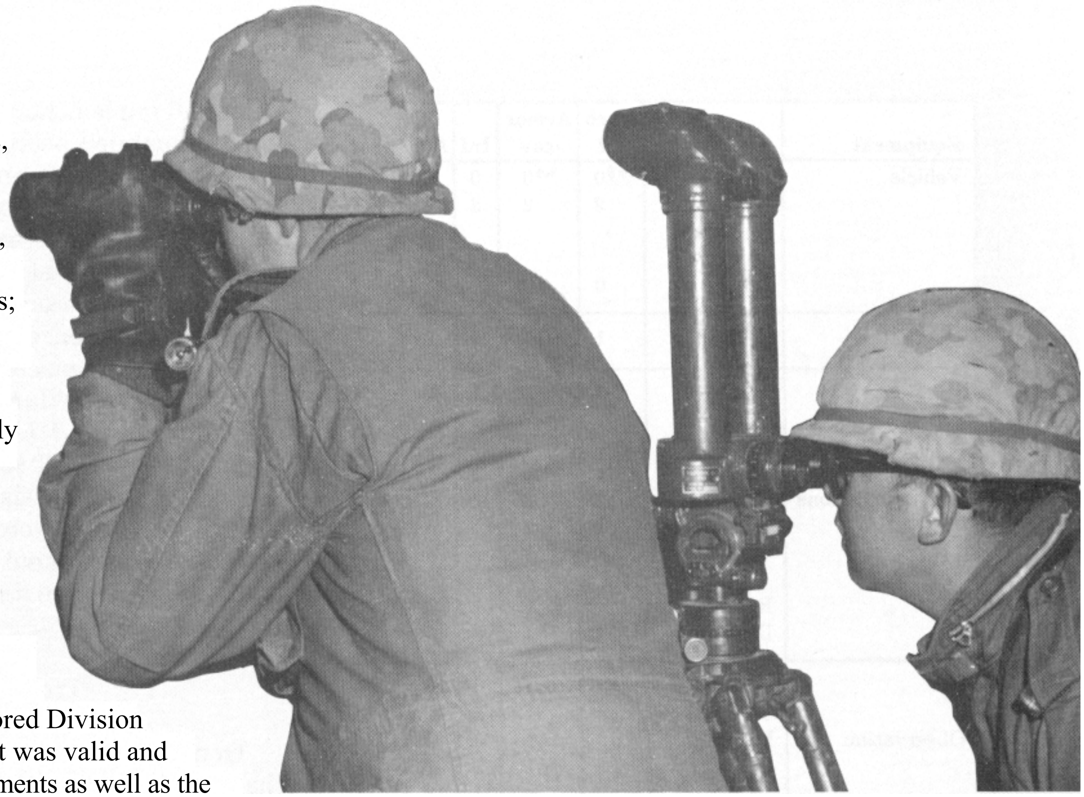
Training experiences

Once the Field Artillery School recognized that it had to change the forward observer concept to improve fire support for the maneuver units, it did just that. The supported unit, however, must do its part by training and giving wholehearted support to the fire support mission while overcoming normal detractors. Daily requirements and the fact that artillery and maneuver units are often miles apart make coordination and training of FIST personnel somewhat more difficult. This situation can be overcome, however, with aggressive fire support personnel and support from the commander.

During the three years I was assigned to the 3d Armored Division Artillery, FIST moved from a division quick-fix arrangement to an approved modified table of organization (TOE) concept for the artillery. After implementation, efforts paid off since the division, brigade, and battalion commanders now realized that fire support with FIST was superior to what they had in the past. The fact that FIST fought in M113 armored personnel carriers, kept up with their maneuver partners, had a better communications capability, and could do a better job overshadowed and outweighed personnel and equipment shortages.

FIST evaluations were expanded during all maneuver and artillery Army Training and Evaluation Programs (ARTEPs). The thrust was to make FIST a division problem, not just a division artillery problem, and to involve everyone who had a stake in fire support. To strengthen FIST, written examinations were prepared and given in garrison and then administered in the field prior to maneuver ARTEPs. FIST and observed fire training was directed toward strengthening weak areas.

During maneuver ARTEPs, fire support seminars were conducted for company commanders, platoon leaders, battalion fire support personnel, and FIST members; frequently, battalion commanders and staff members *also* attended these seminars. Classes were usually presented by the fire support officers and FISTs, using mock-up maps drawn on butcher paper with stick-on symbols, which showed tactical situations common to maneuver ARTEP tasks requiring fire support.



Experience in the 3d Armored Division showed that the FIST concept was valid and belonged to the maneuver elements as well as the artillery. Some recommendations for strengthening FIST training are as follows:

•Conduct professional development programs such as fire support seminars to provide commanders a better understanding and awareness of FIST.

•Stress home station training and preparation, with close coordination between fire support and maneuver personnel.

•Use all fire support assets, with emphasis on use of mortars, since mortars frequently are not used properly.

•Provide technical and tactical advice to mortar sections and platoons.

•Emphasize classes in map reading, target location, land navigation, reporting procedures, calls for and adjustment of indirect fires in training.

•Administer qualification examinations for FIST personnel, using howitzer section and fire direction examinations.

•Hold basic observer classes.

•Utilize careful management of FIST commitments.

•Use training devices such as the M31 14.5-mm and BT-33 observed fire trainers.

"Our" FIST program required everyone's efforts and continual tuning, supervision, and monitoring by the battalion and division artillery commanders.

Conclusions

The new FIST concept offers a revolutionary step forward in the fire support system for the artillery and maneuver communities.

Comparisons drawn from other artillerymen show that, although implementation has varied somewhat from division to division, the problems are essentially the same. As in 3d Armored Division, sufficient personnel and equipment remains the number one concern. With this exception, most of the problems can be solved at the unit level, to include physical separation of units, FIST training programs, management, and support for the program. Additionally, the shortage of 13Fs may require that cannoneers be trained and transferred to FIST positions.

Fort Sill can help by immediately addressing the FIST personnel and equipment shortages. The School needs to take steps to get equipment to the field and to retrain transferred and reclassified NCOs and provide 13Fs in sufficient numbers so that FIST positions can be filled. Additionally, FIST instruction should include maneuver tactics, communications, map reading, and vehicle maintenance. The tactical environment is such that it is necessary for the FIST chief and fire support NCO to be proficient in platoon and company tactics.

FIST does have some growing pains, but the concept is sound and does represent the best fire support system the Army has had. For best results, however, FIST needs the full support of its commanders and all personnel concerned.

LTC Joseph R. Simino is the Commander of the 2d Battalion, 321st Field Artillery, Fort Bragg, NC.

FRAGMENTS

During the past several months, the *Journal* has received numerous letters and phone calls from potential contributors requesting information on how to submit material for publication. Typical questions are what kinds of subjects, how long should an article be, and what are your deadlines.

Since I suspect there may be others with similar thoughts, the following information has been extracted from our current "Writer's Guide" which hopefully will answer not only those questions, but also stimulate some much needed business.

Readership: The *Field Artillery Journal's* circulation is approximately 17,000, with a target audience consisting primarily of Field Artillery officers, noncommissioned officers and soldiers, both Active and Reserve. Distribution is also made to other service schools, ROTCs, colleges, universities, major commands worldwide, and other agencies and activities that have a requirement to remain current in Field Artillery matters.

As such, the purpose of the *Field Artillery Journal* is to disseminate professional knowledge; furnish information concerning the field artillery's progress, development, and best use in combat; and cultivate, with the other arms, a common understanding of the strengths and limitations of each. Contributors then should choose a subject that meets these criteria or any others believed to be of general interest to the *Journal's* readership. Some examples are Field Artillery training, tactics, techniques, and organization; history; weapons and equipment; strategy; maintenance; foreign armies and equipment; officer and enlisted career information; future concepts; and humor.

An initial letter or call to us might assist in formulating an approach to, or treatment of, a chosen subject.

Style: Concise and direct wording, expressed in the active voice, is preferred. Use simple, everyday words and phrases rather than flowery prose or "Pentagonese". Make certain your facts are correct. Document quotes and identify any previously published material. Some material requires copyright permission, so furnish a bibliography or give credit where appropriate.

Length: Articles normally received run approximately 8 to 16 typed pages doubled-spaced (1,000 to 3,000 words); however, if the subject cannot be covered adequately in 2,000 words, use as much space as required. News (feature) items such as those in "Right by Piece" should be limited to 500 or 600 words, if possible, and book reviews should be held to approximately 1½ to 2 double-spaced pages.

Copy: All material should be typed, double-spaced, and on one side of the paper. If possible, send two copies, but be sure to keep one for personal record. Include your name, address, AUTOVON or commercial telephone number, and current assignment. Accompanying artwork, (such as black and white photos, maps, line drawings, etc) is extremely helpful and important to inviting reader attention.

Acceptance: We assume that manuscripts are original, previously unpublished works which are not under consideration by any other periodical at the time of receipt by the *Journal*. All manuscripts are acknowledged either in writing or by phone call and queries will be answered promptly.

Deadline: All copy and artwork is forwarded to the printer one month prior to issue date. Accordingly, we must receive material approximately three weeks prior to "shipping date" to allow for edit and normal staff review. For example, for the July-August issue, material should reach us by the first week in May. —Ed.

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