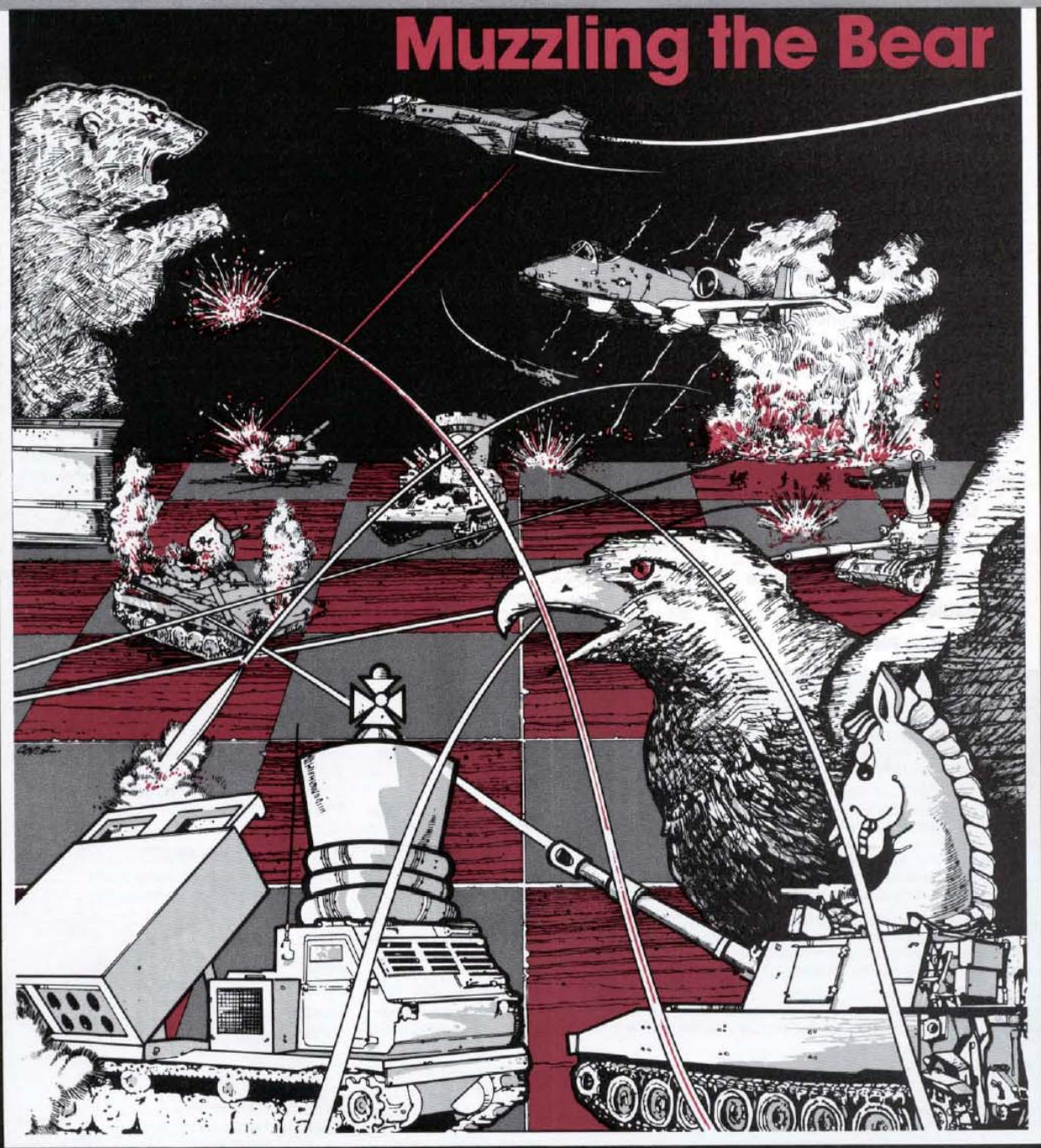
Field Artillery

A Professional Bulletin for Redlegs

April 1989

Muzzling the Bear



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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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Understanding Counterfire's Challenge

Before the Battle of El Alamein, Winston Churchill summoned General Montgomery and suggested that he study the logistics of the battle. Montgomery doubted that he should become involved in such technical matters. "After all," he said, "you know what they say, familiarity breeds contempt." Churchill replied, "I would like to remind you that without a degree of familiarity, we could not breed anything."

Perhaps our relative lack of familiarity with effective counterfire techniques has been a function of the difficulty of creating training realism, the challenge of allocating scarce resources to execute multiple roles and confusion as to who takes responsibility and when. Some of our authors assert that this challenge has been in the "too hard" box for too long. But what happens if we don't train well for the counterfire fight? Major General Hallada's "On the Move" column hits this target dead center—we make a useless charge into the "Jaws of Death."

This issue of ***Field Artillery*** is packed with information that will help you solve the problems that make the counterfire role so difficult. Of course, a combined-arms approach and consideration of the factors of mission, enemy, terrain, troops and time available (METT-T) remain pivotal.

A thorough discussion of counterfire can lead only to a greater understanding of the course we must take and the technical detail we need to execute this vital role now and in the future. We hope this edition of ***Field Artillery*** breeds the familiarity we need.

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On the Move

MAJOR GENERAL RAPHAEL J. HALLADA

The Charge of the Light Brigade
(The Third Stanza)

Cannon to right of them,
Cannon to left of them,
Cannon in front of them
Volleyed and thundered;
Stormed at with shot and shell,
Boldly they rode and well,
Into the jaws of death,
Into the mouth of hell
Rode the six hundred.

Alfred, Lord Tennyson
1865

Counterfire for the Jaws of Death

Tennyson's poem eloquently describes an action from the Crimean War that was, in fact, counterbattery. The Light Brigade was ordered to attack frontally and capture a Russian artillery position. The attack was conducted without any support, and the result, forever immortalized by Tennyson, was disastrous—less than a third of the Brigade survived. The massacre of this valiant force serves as a haunting lesson on the critical importance of employing Field Artillery in its counterfire role.

Today, if our maneuver forces are to survive the pummeling of Warsaw Pact artillery poised in eastern Europe, we must deliver overwhelmingly accurate and timely counterfire to silence enemy fire support and allow the ground-gaining arms to maneuver. Simply providing excellent fire support in the close battle, at least initially, won't ensure our combat forces will survive the massed firepower of Threat artillery.

Given the Threat's numerically superior correlation of forces, especially artillery, it's imperative we improve our counterfire posture. This entails an all-encompassing analysis and revamping of our current system—doctrine, training, force structure and weapons. If not, today's maneuver forces will, just like Tennyson's Light Brigade, ride straight into the Jaws of Death.

This month's ***Field Artillery*** is dedicated to counterfire. Though this is only one aspect of the Field Artillery's mission, it's a critical dimension for our success. In this column, I focus on the two areas of counterfire—force structure and weapon systems—from which we'll realize the most immediate and highest payoffs. Though training and doctrine for counterfire are equally important, they're still very fluid and evolving—as the articles that follow show.

Before we can resolve these issues, we must first explore our current and anticipated counterfire needs. With that said, our mission remains fixed and inviolable—to destroy, neutralize and suppress the enemy by means of cannon, rocket and missile fire. In this regard, the focus of Field Artillery is to support the maneuver commander. Make no mistake about that—it's our primary function on the battlefield.

Facing the Threat

In accomplishing this mission, the Field Artillery functions in three distinct roles—close support, deep attack and counterfire. All three are necessary to secure victory. The latter, however, becomes especially crucial when one considers the numbers of Warsaw Pact artillery. We must, at least initially, overcome that sheer mass. Clausewitz wrote in *On War,* "Superiority of numbers in a given engagement is only one of the factors that determine victory, but it is the most important factor in the outcome of an engagement, so long as it is great enough to counterbalance all other contributing circumstances."

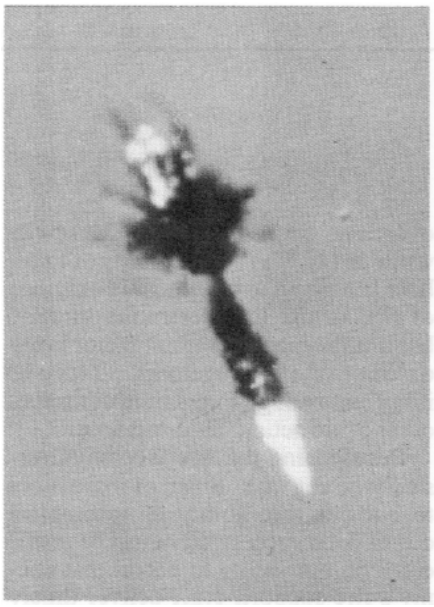
Recognizing that we face an adversary who can mass seven or more tubes to our one, the ability to accomplish our mission successfully must be predicated on our ability to defeat that enemy's fire support, e.g., deliver timely and accurate counterfire and survive to engage the enemy's second-echelon forces. In this light, our 770,000-man Army can, in many ways, be likened to the Light Brigade. Today, however, we can't afford another fatal charge.

Counterbalancing the Threat

Our urgent task is to pursue the "factors" that will counterbalance the sheer size of the opposing force artillery. The greatest potential threat to our success in supporting the maneuver commander will be the Threat artillery. If the opponent degrades our artillery, we're in danger of losing the battle. Conversely, if we neutralize his artillery, we gain a significant advantage.

For this reason, we're pursuing a number of initiatives in force structure and weapons systems to improve our counterfire capabilities. Within the Field Artillery "System of Systems," four modernization programs are under way to enhance our counterfire posture. These initiatives will help us increase the numbers of multiple launch rocket systems (MLRS), provide a precision-attack capability, field a more survivable artillery and mortar acquisition means and improve our command, control and communications (C^3) and sustainment systems.

Target Acquisition. The ability to deliver timely and accurate counter-fire is tied to our ability to locate the enemy in enough detail to target and attack him successfully. The Firefinder improvement program (Firefinder Block II) will enhance survivability and reduce crew size by one-third.



Scheduled for fielding in the mid-1990s, SADARM has submunitions that sense targets and fire explosively formed penetrators to destroy them.

Moreover, Block III will have an increased target location capability and be able to acquire targets and then process and pass that targeting data while moving.

Increased Munition Lethality. The sense and destroy armor munition (SADARM) is the latest in a series of "smart" munitions under development. The SADARM has the potential to increase the lethality of our counterfire by two to three times. It's designed to be fired from either the 155-mm howitzer or MLRS launcher. Against artillery and other thin-skinned targets, it's a deadly, cost-effective counterfire weapon.

More Efficient Delivery. With the intermediate-range nuclear forces (INF) backfill and the phase out of the 8-inch howitzers from the active force, we'll glean enough spaces to create additional MLRS battalions and still stay within the mandated force structure. This restructuring of the force will increase the responsiveness, range, accuracy and survivability of the counterfire system. Moreover, it'll require less manpower.

Sam Orr

The MLRS can fire SADARM, which is primarily a counterfire munition.

The AFATDS Components for Battery or Platoon FDCs or the Battalion Fire Support Element

Automated C^3. We'll have no shortage of targets to attack when facing the Threat. Therefore, counterfire becomes a problem of selecting the high-value targets whose destruction will interfere the *most* with the enemy's conduct of the battle. Even this subset of key targets is likely to outnumber the assets available for their attack; so we must evaluate each target to establish an order of priority. Our ability to execute this complex process successfully hinges on C^3.

The advanced Field Artillery tactical data system (AFATDS) is the control system for the fire support node in the Army command and control system (ACCS) architecture. The AFATDS is essential to our execution of AirLand Battle doctrine. This new system will allow us to automate target-value analysis and allocate and distribute fires. By decentralizing this function down to platoon level, we greatly enhance the survivability of C^3 systems. The AFATDS will feature small, redundant, common hardware with a very rapid processing capability.

Supporting Our Maneuver Forces

The pay-off for our counterfire efforts will be enemy artillery losses. The System of Systems approach we're pursuing will significantly increase our counterfire effectiveness—five to six times greater than our current capabilities. In the final analysis, this plan ensures that when we face the enemy's second-echelon forces, the majority of our Field Artillery systems will be ready to provide the accurate fire support necessary to win this close battle.

Only fire support can mass lethal fires across the battlefield quickly. We'll determine the outcome of this crucial battle by silencing the enemy's artillery and attacking deeply with accurate fires to disrupt the Threat's battle tempo. In this way, we'll ensure our maneuver forces are never in the position of Tennyson's Light Brigade. However, without the benefit of an improved counterfire capability, our success on the next battlefield is very much in doubt.

Incoming

LETTERS TO THE EDITOR

Corrections:

Field Artillery apologizes to Captains D. L. Kearns and J. D. Riegel, USMC, for incorrectly portraying the chart in their article "Marine Corps Split-Battery Operations," Page 36, February 1989. The chart should read as follows:

USMC Firing Battery of a DS Artillery Battalion

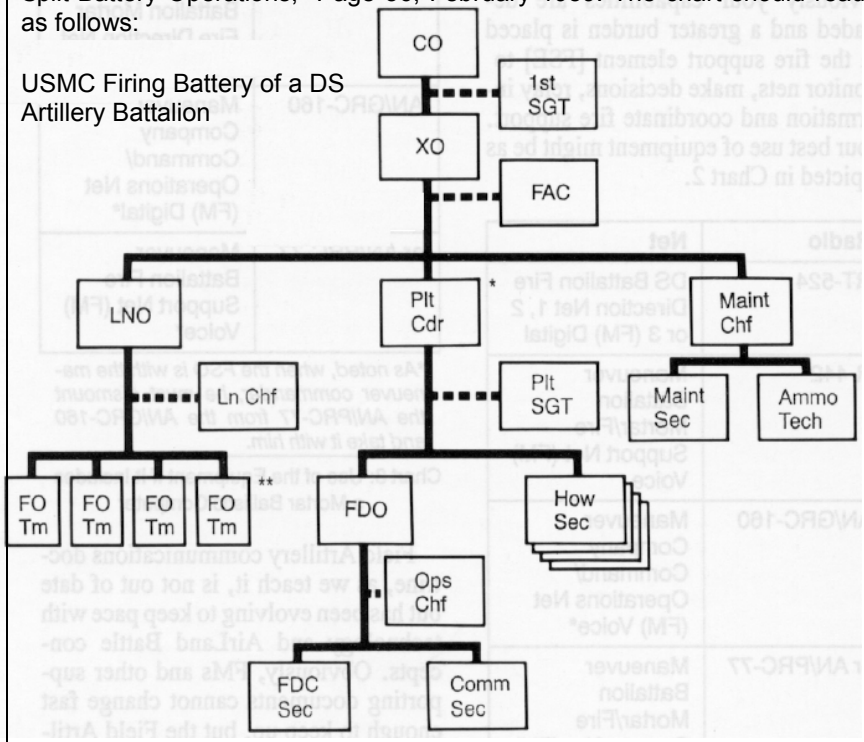


*Diagram shows the organization of one of the two platoons in each battery.
**Most firing batteries won't have the fourth FO team until the infantry battalions they habitually support field their fourth infantry company.

Figure 4 on Page 20 of the article "3x8 and Beyond: Force Structure Changes for the Field Artillery of Tomorrow," February 1989, is inaccurate. Though the numbers are correct, we reversed the color codes for the Army National Guard (ARNG) and US Army Reserve (USAR).

Thoughts on HIP and Counterfire

The June 1988 issue of ***Field Artillery*** was one of the best issues to date. I would point out that, with the advent of HIP, the Field Artillery will have the pivotal point on which AirLand Battle precepts and concepts can be effected. The HIP howitzer will be able to provide direct support to the deep attacking division in a manner never seen before. I suggest that the Field Artillery School include in its dialogue with maneuver forces that, because of HIP, attacking forces will never run out from under the umbrella of direct support howitzers.

I also would suggest the School consider moving the mission of counterfire out of the division and back to corps, especially if a longer tube or range howitzer is built.

Arthur C. Meier II
COL, GS
Chief, Advanced Systems Concepts Office
Armament Research, Development and Engineering Center
Picatinny Arsenal, NJ

Shortage of Radios for FIST

I am a company fire support officer (FSO) attached to an infantry battalion in South Korea. I have been in this position since January 1988. During May, my team lost one AN/PRC-77 radio due to a modified table of organization and equipment (MTOE) change. This left my team with three AN/PRC-77s, one AN/GRC-160 and one AN/VRC-47.

While attending the Officer Basic Course, I was taught that fire support team (FIST) headquarters had to operate in five different radio nets: artillery fire direction (FD), command fire, maneuver company command, company fire direction and battalion fire direction nets. Because of the shortage of radios, my headquarters cannot operate on all these nets.

Currently, FIST headquarters only operates in two nets, company FD net and artillery FD net. When assigned priority of 4.2 mortar fires, they monitor this net also. The major problem is degraded responsiveness, especially when operating dismounted. An attempt is being made to get the additional radio back, but this may take some time.

According to the latest doctrine, should the MTOE include the additional radio for the company FIST? If not, are the FMs and the School's teachings out of date? What nets should company FIST headquarters operate in?

Earle G. Sanford
2LT, FA
1st Bn, 506th IN
ROK

Response to "Shortage of Radios for FIST"

We aren't sure why the AN/PRC-77 was dropped from your MTOE. Your major command (MACOM), Eighth US Army, develops your MTOE from a TOE that the Directorate of Combat Developments designed here at the Artillery School. The TOE establishes the minimum essential wartime requirements for personnel and equipment in a generic organization. The MTOE, on

the other hand, establishes the authorizations for a particular unit's personnel and equipment that a MACOM can afford. Your unit should soon receive an MTOE based on TOE 06385L000. This TOE requires each company FIST have three AN/PRC-77s, two AN/GRC-160s and one AN/VRC-47. Until you receive a new MTOE, you should request a MTOE change through your Field Artillery battalion S3. In the charts, I'll show you how to configure your radio nets based on the TOE and on what you really have.

In Chart 1, your current situation, obviously your capabilities are degraded and a greater burden is placed on the fire support element [FSE] to monitor nets, make decisions, relay information and coordinate fire support. Your best use of equipment might be as depicted in Chart 2.

Radio	Net
RT-524	DS Battalion Command Net (FM) Voice* DS Battalion Fire Direction Net 1, 2 or 3 (FM) Digital
R-442	Maneuver Battalion Fire Support Net (FM) Voice
AN/GRC-160	Maneuver Battalion Mortar Fire Direction Net (FM) Voice
AN/GRC-160	Maneuver Company Command/Operations Net (FM) Voice**
or AN/PRC-77	Maneuver Battalion Mortar Fire Direction Net (FM) Voice

**The FIST operates in this net when not in a direct support (DS) role.*
***The FSO operates in this net when not physically located with the maneuver commander. When with the maneuver commander, he dismounts the AN/PRC-77 from the second AN/GRC-160.*

Chart 1: The Current Situation

Radio	Net
RT-524	DS Battalion Fire Direction Net 1, 2 or 3 (FM) Digital
R-442	Maneuver Battalion Mortar/Fire Support Net (FM) Voice
AN/GRC-160	Maneuver Company Command/Operations Net (FM) Voice*
or AN/PRC-77	Maneuver Battalion Mortar/Fire Support Net (FM) Voice*

**When the FSO is with the maneuver commander, he must dismount the AN/PRC-77 from the AN/GRC-160 and take it with him.*

Chart 2: The Best Use of the Current Equipment

If your unit has the mortar ballistic computer, consider the net shown in Chart 3.

Radio	Net
RT-524	DS Battalion Fire Direction 1, 2 or 3 Net (FM) Digital
R-442	Maneuver Battalion Mortar Fire Direction Net (FM) Digital
AN/GRC-160	Maneuver Company Command/Operations Net (FM) Digital*
or AN/PRC-77	Maneuver Battalion Fire Support Net (FM) Voice*

**As noted, when the FSO is with the maneuver commander, he must dismount the AN/PRC-77 from the AN/GRC-160 and take it with him.*

Chart 3: Use of the Equipment If It Includes a Mortar Ballistic Computer

Field Artillery communications doctrine, as we teach it, is not out of date but has been evolving to keep pace with technology and AirLand Battle concepts. Obviously, FMs and other supporting documents cannot change fast enough to keep up, but the Field Artillery School has a good system of review and is moving quickly to update these references. Bear in mind, though, that the manuals offer a way to do business, but you must allocate resources based upon your unit's mission and its MTOE.

Frederick J. Maxwell
CPT, SC
Communications/Electronics Department
Field Artillery School

Pershing Two-Track Decision: Coup of the Decade

Congratulations to ***Field Artillery*** for being the ONLY publication I have seen anywhere that takes credit where credit is due for successful implementation of the "two-track decision" ["The End of the Pershing Era: The INF Treaty" by Major Daniel L. Breitenbach, October 1988]. The decision committed soldiers and materiel to fielding Pershing II and, in turn, achieved the desired result of securing Soviet acceptance of our demands for arms reduction.

Few politicians, here or in Europe, had high hopes that the required unanimous approval of that decision by the NATO Alliance could be secured or that spending the money for R&D [research and development] and deploying GLCMs [ground-launched cruise missiles] and Pershing IIs would force the Soviets to negotiate. This saga was the diplomatic coup of the decade, but only ***Field Artillery*** seems to have pegged it with Major Breitenbach's fine article.

Congratulations are due the author and the soldiers who did so well during the deployment and, now, stand-down of the Pershing II force.
Kudos are due as well to Dr. Robert A. Kromer for his article "Field Artillery Ammunition Resupply Solutions,"

[October 1988]. I have been a division ammunition officer and commanded the Scranton Ammunition Plant, which made most of the 155-mm and all of the 175-mm munitions at the time, so Dr. Kromer's article hit home. Tacticians and politicians alike tend to forget about ammunition supply in peacetime, and then in wartime, **it's too late.**

Daniel K. Malone
COL(R), OD
Purcellville, VA

Response to "Field Artillery Ammunition Resupply Solutions"

I found the article written by Dr. Robert A. Kromer titled "Field Artillery Ammunition Resupply Solutions" published in the October 1988 issue of ***Field Artillery*** to be extremely interesting and timely due to the increased emphasis on fire support in future warfare. Dr. Kromer correctly addresses one of the most challenging problems for artillery unit S3s and unit logisticians: the resupply of artillery units with badly needed ammunition to support the maneuver forces. During the past several years as our weapons systems technology and lethality have improved, our CSS [combat service support] effort has fallen behind.

Dr. Kromer accurately points out that as technology in the Field Artillery improves in the next several years, the ability to sustain ammunition resupply in European conflicts, with our current resupply system, will be greatly taxed. The incorporation by the US Army of the MOADS [maneuver-oriented ammunition distribution system] concept of pushing required ammunition as far forward as possible will show dividends to fighting units by cutting down the turn-around time required for ammunition resupply within those units.

I was especially interested in Dr. Kromer's prepackaged ammunition loads for types of missions artillery units can expect. One of the most serious problems to be addressed in ammunition resupply is the amount of turn-around time required for the ammunition resupply vehicles once they deliver their loads to the unit and have to return to the ATP [ammunition transfer point] or the ASP [ammunition supply point] for a reload. If an ATP or ASP could put ammunition in combat-configured loads, as Dr. Kromer suggests, this would greatly increase the efficiency of the ATP and reduce turn-around time for the using units. Current methods of loading ammunition vehicles by having several stops within an ATP or ASP are both confusing for the vehicle crew and time consuming for crew and ATP personnel.

I do disagree, however, with Dr. Kromer's analysis of the types of high-density ammunition required for operations. The smoke types of ammunition, HC [hydrogen chloride] and WP [white phosphorous], will be used far more frequently in combat operations than he suggests. Maneuver commanders are emphasizing smoke enough in their operations to warrant placing them in the A-pack of combat-configured loads. The SADARM [sense and destroy armor munition] projectile, like Copperhead, won't be a high-density ammunition.

This, of course, is only a matter of adjusting the configuration of the ammunition packs, but it would more accurately reflect the types of ammunition required. However, the idea of prepackaged ammunition loads is logistically a very sound, effort-saving idea that should be explored.

The III Corps Artillery at Fort Sill is considering developing FASCAM [family of scatterable mines] minefield packages into standard configurations. This FASCAM package allows for the emplacement of one 400-by-400-meter, medium-density minefield. This is just one example of units' attempting to make ammunition resupply a bit more efficient.

Dr. Kromer's idea about limited-purpose howitzers is also an interesting one. Limiting the number of howitzers within a unit that will carry the specialized ammunition will allow the remainder of the howitzers to stock more "killing" projectiles and ease the resupply situations somewhat by requiring delivery of special ammunition to just a few howitzers in the battalion instead of all of them. I'm sure this would be accepted warmly by the personnel in the ammunition sections who would then have to deliver only specialized munitions to one howitzer per platoon instead of all four. This concept is reminiscent of the days when the flank gun of the battery got all of the illumination rounds and was designated as the "illum-gun" of the battery.

However, we must consider that TACFIRE [tactical fire direction system] computes effects based upon four-gun platoons' or six-gun batteries' engaging targets for commanders' desired effects criteria. Limiting the number of howitzers that could engage a target would mean the effects criteria would have to be modified.

Also, this concept does not take into consideration combat losses of howitzers, which will further affect fire support requirements. There are just not enough howitzers to go around.

I do take exception to turning over the requirement for specialized missions (illumination and smoke) to the infantry mortar platoons. Due to range and ammunition limitations (mortars have only WP smoke, not HC), the Field Artillery can never divorce itself from providing these battlefield support necessities. I'm also sure the doctrine writers at the Infantry and Armor Schools would not go along with this concept. The Field Artillery has long prided itself on its ability to provide smoke to screen friendly movements and obscure the enemy's vision and to provide illumination to assist the maneuver forces in night operations.

Dr. Kromer's idea of a device to ease the transfer of ammunition from the ammunition vehicles to the ARV [ammunition resupply vehicle] or M548 is a good one. Any device that would work in concert with the materiel handling

devices on the HEMTT [heavy expanded mobility tactical truck], ARV or M548 to speed up resupply operations and reduce crew handling would indeed be a boon to resupply operations. This would become especially critical after days of sustained combat operations where fatigue and loss of manpower would increase time of ammunition transfer.

The idea of using HEMATs [heavy expanded mobility ammunition trailers] in a cannon battalion is not necessarily a good one. Placing HEMATs in the combat trains without a prime mover readily available poses a problem for units should combat trains have to move as frequently as is envisioned in the next war. The trade-off of increasing the load-hauling capability of the Field Artillery battalions by giving them HEMATs would be offset by the requirement to move them frequently and to find HEMTTs not moving to the ATP or firing unit to move the trailers.

The Field Artillery School is currently rewriting *FM 6-20-1 Field Artillery Cannon Battalion.* This manual will include a chapter on CSS and will address ammunition resupply. Some of the ideas Dr. Kromer has originated may very well be considered for inclusion in this publication.

In summary, I found the article contained some interesting and well-thought-out concepts that deserve consideration by our Army's tacticians and logisticians. It was gratifying to read of someone's interest in simplifying resupply operations and attempting to reduce the man-hour requirements of ammunition resupply. Dr. Kromer, I hope you have indeed provoked some action in this direction, as you desire.

Richard A. Jeffries
MAJ, FA
Advanced Fire Support Branch
Fire Support and Combined Arms
Operations Department
Field Artillery School

Author's Response

I appreciate Major Jeffries' comments concerning my article "Field Artillery Ammunition Resupply Solutions." He correctly identifies some of its areas that are unclear. Let me respond to some of his major points.

My concern about the future ammunition resupply system for heavy forces is not that it would be "greatly taxed"; my concern is that it will be unable to support the firing rates projected for the HIP howitzer unless changes are made. The suggestions for efficiency offered in the article are to be viewed as "tweaks" to the system doable by artillerymen in the field. The overall system requires a thorough review by the logistics, ordnance and artillery communities working in concert.

Regarding the amounts of smoke and illumination to be carried by the limited-purpose howitzers, my figures were based on previous studies (still current) and current scenarios used by the Field Artillery School to analyze combat in Europe. If there are serious discrepancies between the studies and projections the School is using for development of combat doctrine and systems and what the field is using, the discrepancies should be resolved.

I agree that TACFIRE should be modified to account for less than the standard four- or six-gun firing units. As Major Jeffries observes later in his letter, combat attrition will reduce the number of howitzers. The TACFIRE should be geared to accept this consequence of combat and to support the semiautonomous howitzer employment concept envisioned for the HIP.

I hope Major Jeffries will explore further the concept of transferring the primary responsibility for illumination and smoke missions to the maneuver community. Rather than conclude "the doctrine writers...would not go along with this" and "we've always done it this way" (the latter paraphrased), why not analyze the problem? How many smoke and illumination missions can be expected in a typical battle? What are the ranges to be fired? What amount of ammunition will be required? Can the mortars provide this capability? At what cost, etc? It may be this idea's time has come; don't reject it out of hand.

Last, Major Jeffries expressed concern about having enough prime movers to move the HEMATs in the event the combat trains moved. There is no "neat" solution that ensures a HEMTT prime mover will always be available to move the HEMAT. What about using other prime movers in the battalion (pulling it with the wrecker, for example)? What about ferrying the trailers to the new position? The minimum benefit of employing HEMATs is to have an additional 55 tons of ammunition in the artillery battalion at the start of the battle. That capability is worth something and ought to be investigated.

My fundamental plea is that we take a "**hard**" look at new ways to accomplish a mission we are currently incapable of performing. None of the solutions presented is cost-free; however, they do have the virtue of contributing toward solving the problem.

Dr. Robert A. Kromer
LTC(R), FA
Lawton, OK

Response to "Continuous Operations and the Human Dimension"

I applaud "Redleg VI" for his article on the human dimension and battle stress [October 1988 "On the Move" column by Major General Raphael J. Hallada titled "Continuous Operations and the Human Dimension"]. He put "steel on target" when he said the human dimension was a key ingredient to winning the next war. I'd like to offer a few suggestions on how to beat battle stress...a large part of the human dimension.

First, before the war ever starts, you must train your people to believe they'll survive. "Lo, as I walk through the valley of death I fear no man, for I am the meanest one in the valley." Soldiers must believe in themselves, their

equipment and their leaders. They must believe that, in the unlikely event they should become a casualty, the battery will evacuate them to safety *immediately.* Attitude can do a lot to beat battle stress.

Second, counterfire, like a jealous lover, is a *definite* stress inducer. It's a tough one to handle, but we can reduce its effectiveness by putting our soldiers and equipment in barns and buildings. The overhead cover provides protection from counterfire, weather, chemical agents and direct observation from enemy aircraft. The overhead cover also provides a place to pull maintenance and sleep in relative comfort and access to food, water, telephone, fuel and medical supplies, as these are found to some degree in almost every little town. Sleep and "the creature comforts" can do a lot to beat battle stress.

Third, batteries must move if they are to survive, but moving is very tiring and stressful. When you're moving, "you ain't sleep'n and you ain't shoot'n." About four moves per day per firing battery is all we can do if troops are to sleep, eat, bathe, pull maintenance, etc. When and how often to move is situation-and GDP [general defense plan]-oriented, and there's no textbook solution.

My point is to move when necessary, but we can't sustain 10 to 12 moves per day per firing battery. Our troops can't sustain that pace for more than three or four days with the stress of combat.

Last, mail, food, water, sleep, keeping the troops informed, personal contact with leaders and confidence in each other, self, equipment and leaders are all key elements in beating battle stress. We can't make the mistake of thinking good leadership is a suitable substitute for sleep. Come day four of the war, all the good leadership in the world won't be a substitute for much needed sleep. Fellow Redlegs, there are too many two- and three-man tank or scout crews out there at the battle's edge for us not to remain intact and responsive to their calls for fire.

In the words of Major General Fred Franks when he was the Commander of the 11th Armored Cavalry Regiment (Blackhorse), "Redlegs, when that radio cracks, it is not a call for fire that you will hear—it is a scream for help from your buddies, friends and neighbors. I know because I have screamed for that help many times myself."

Thanks Major General Hallada for addressing the human dimension. All the new equipment in our inventory is greatly needed and appreciated, but new equipment is only as good as the dirty-faced, tired and hungry soldiers at the controls. **I'd rather write to Congress and ask for 1,000 more tanks than write one letter to a mother telling her, her son's dead.**

Fred V. Flynn, Jr.
CPT, FA
Asst. IG
US Forces Command

The OH58D's AFSO, The Human Element

The October 1988 edition of ***Field Artillery*** contained the article "OH58D: The New Eye on the Battlefield" illustrating the broad capabilities of the OH58D helicopter. However, I would like to point out the human element. The key to the OH58D's fire support success is the training and experience of the artilleryman functioning as a crew member in the cockpit.

Early in the development of the training program for the OH58D FAAO [Field Artillery aerial observer], we felt a name change was appropriate. The name FAAO did not convey the enhanced capabilities of the observer. Therefore, we chose aerial fire support observer (AFSO). We hope this name change connotes the full-time mission of the artilleryman doing this important task. Maintaining proficiency in this advanced helicopter is not a part-time job.

The AFSO is truly a crew member on a crew-served weapon; he is not just a passenger shooting indirect fire. With current air-crew training policies and regulations, safety factors and the environment, the AFSO is not idle.

Traditionally, in every war since the American Civil War, the Field Artillery has led the way in exploiting the capabilities of the aerial platform. A well-trained artilleryman in the left seat of an OH58D gives the fire support community the "New Eye on the Battlefield."

George W. Chappell
MAJ, FA
Aerial Observer Branch
Field Artillery School

Time on Target

While observing fire during a recent battalion field training exercise (FTX), I was unpleasantly surprised with the number of graze or 40-meter-plus heights of burst encountered when firing fuze time. It seemed that about half the rounds fired in effect either functioned too high or were graze bursts.

Further investigation revealed that the cause was a software problem in the battery computer system (BCS). The current software in the BCS does not differentiate between time-fuze models when it transmits data to the gun sections. The section chief's gun display unit (GDU) displays only "fuze TI" when time is fired in adjustment or effect.

Time settings for fuze M564 and M582 are not always (or even usually) the same. For example, when firing Charge 7 whitebag at a range to target of 14,700 meters, the M564 fuze setting is 58.1 seconds while an M582 fuze should be set to 57.5 seconds, a difference of 0.6 seconds. These time setting differences vary from 0 to 0.8 seconds (0.2 seconds being the norm), depending on charge, range and method of fire (high or low angle). While 0.2 seconds may seem insignificant, a projectile with a terminal velocity of 184 meters per second (the terminal velocity of Charge 1 green bag at a range of 3,500 meters, which is the lowest listed in the AM-2 tabular firing table—TFT), will travel 36.8 meters in 0.2 seconds. This produces either a graze or height of burst of 56.8 meters. Incidentally, the time-setting difference for this particular situation is exactly 0.2 seconds.

During the FTX graze and height bursts, the BCS was computing and transmitting the fuze setting for time fuze M564, but the GDUs only indicated fuze TI, which means any time fuze. In the absence of specific fuze commands, the number two cannoneers were installing the first time fuze they grabbed. If the BCS computed time for an M564 fuze, but an M582 was installed, a ground burst resulted. Conversely, if BCS computed time for an M582 fuze and an M564 fuze was fired, an airburst of more than 20 meters occurred.

After contacting the BCS New Equipment Training (NET) Team and the Field Artillery School Gunnery Department's Research and Development Branch, I discovered there are three possible solutions:

- Give only one type of time fuze to the gunners until they fire them all, then distribute the other fuze model. However, this is not practical in a wartime situation.
- Have the fire direction center (FDC) send a voice command "Fuze 564 (or 582)" for all fire missions using fuze time.
- Establish the time-fuze model to be fired first in the fire order. For example, fire M582 fuzes on all time-fuze fire missions until all are expended, report when this occurs and then fire M564 fuzes.

This latter procedure requires some additional training for both FDC personnel and gun crews to make it work. But it should provide a usable "workaround" until the software in is updated to correct the time-fuze problem.

Robert R. Jones
CPT, FA
Cdr
A Btry, 3d Bn, 18 FA
Fort Sill, OK

Response to "Time on Target"

In reference to Captain Robert R. Jones' letter to the editor "Time on Target," the "workaround" described is one way to overcome the problem.

Another method is to manage by exception. The FDC standing operating procedures may be that whenever the FDO announces "Fuze, Time" in the fire order, the M564 (TIA) is used automatically. When using the M582, the FDO would announce "Fuze Time M582" in the fire order.

The BCS Version 8 software (currently waiting a funding decision) does not correct the problem. Designers have not included a correction for this deficiency in Version 9 software either.

Steven G. Taylor
SFC, FA
Gunnery Department
Field Artillery School

Fight the 8-Inch Howitzer Demise

Let's not sink our 8-inch howitzers, as the United States did its ships between the World Wars, in the hope it will prevent any further wars. The Field Artillery community seems to think the 8-inch weapons system has gone the way of the dinosaur and is no longer a necessary weapon system. Many people argue that with the increase in the Warsaw Pact countries' equipment and manpower and change of tactics, we need an area weapon to counter that threat. I say they are right, but let's not sacrifice the reputation and superiority of the US Field Artillery by not being able to provide the necessary fire support.

We have a good, extremely accurate, long-range, heavy-artillery capability that we should not discard because some people do not think it's needed at this time. Tactics and doctrine change constantly, as well as ways of waging war, and it would be extremely unwise to give up our heavy-artillery capability.

From a historical perspective, all armies have maintained heavy artillery. History is full of examples where heavy artillery has been brought to bear and turned the tide of battle. Here are just a few:

- During April 1944, the 240-mm howitzers arrived at Anzio and their greater range made it possible to reach out and pulverize enemy rear-area positions and attack German artillery that could not be reached with our lighter artillery.
- In the conquest of the Phillipines, artillery was brought to bear on strongly fortified Manila. Semicircles of 155-mm and 8-inch howitzers blasted Japanese strongpoints in the buildings of the University of the Phillipines. The enemy retreated into cellars and had to be driven out or destroyed by direct fire.
- More recently, in my personal experience in Vietnam during 1969-1970 as a liaison officer (LNO) with the II Field Force and as a forward observer with the 1st Cavalry Division (Airmobile), I more than once called on 8-inch and 175-mm support to fire high-explosive rounds with delay fuzes on bunker positions that were heavily fortified with overhead cover because the 105-mm and 155-mm rounds did not have the punch necessary.

A ballistic crew shelter would improve survivability.

Even though current Soviet doctrine does not recognize the defense except as a temporary condition until they can go on the offensive again, who is to say there may not be times we will have to encounter them in a defensive role. And if we do, would our 105-mm, 155-mm and MLRS [multiple launch rocket system] systems be adequate to dislodge them from their positions?

The MLRS is a step in the right direction and long overdue. However, there have always been and always will be missions that are better suited for heavy artillery.

The US Field Artillery should begin working on ways to improve the M110 series howitzers as it has done with the M109 series. Repair parts need to be restocked and an adequate supply on hand and production should be started up again to increase the number of tubes. Also, research and development could work on developing one carriage for the M109 and M110 howitzers, thereby cutting costs and simplifying logistics by making interchangeable parts possible. A ballistic crew shelter for the 8-inch also would provide the howitzer crew a better chance of survival from counterbattery, ground attack and sniper fire.

The Warsaw Pact countries continue to develop heavy artillery as well as multiple rocket systems. We do not need to be paranoid and copy the Warsaw Pact countries simply to be copying them. But historical perspectives show that we need heavy artillery.

There is also the nuclear and chemical mission that the 8-inch howitzer has the responsibility for. If we do away with 8-inch howitzers, that reduces our nuclear and chemical capabilities, which we can't afford considering the current world situation and the large standing armies the Soviet Union, China and other countries maintain. Also, the burden for firing nuclear, chemical or biological support would be increased for the present 155-mm batteries and may overtax them at the expense of providing needed fire support to the maneuver units.

In conclusion, let's keep the present 8-inch howitzer weapon system we have, look for ways to improve it and work on an 8-inch HIP to provide the full range of options necessary to support the maneuver units and ensure the Field Artillery maintains its reputation as "The King of Battle."

Leon D. Vaupel
MAJ, FA
J3, SouthCom
Panama

Joint Attack on Artillery

The Air Land Forces Application (ALFA) Agency, Langley Air Force Base, Virginia, has been tasked to develop a multi-services pamphlet dealing with tactics, techniques and procedures for countering Soviet artillery. As we work toward this goal, we're looking for input from the field or any agency that has information to contribute. We're developing the pamphlet because of high-level concerns about NATO's ability to successfully counter or survive the initial Soviet or Warsaw Pact artillery barrage at the start of the next war.

This is a "real-world" problem. In 1973, NATO was modestly outnumbered by a technologically inferior artillery force. Today, NATO is significantly outnumbered by artillery approaching technical parity. In fact, Warsaw Pact artillery now outranges most comparable NATO guns, and it has higher rates of fire. This problem is compounded as the Soviets continue to pursue even more advanced capabilities.

The problem isn't restricted to the European Theater, nor is it restricted to the "war-starting barrage." Soviet doctrine calls for massed artillery barrages before major offensives. Therefore, we can expect a massed artillery barrage before any major offensive action anywhere we face Soviet trained, equipped and advised forces.

Given these facts—now what? If we go to war, how do we fight and win outnumbered in the artillery arena? These questions are some ALFA will respond to in the pamphlet on countering Soviet artillery. As with similar tasks, we have specific parameters. We must—

1. Ensure it's a multi-services pamphlet. It must be a synchronized, fully coordinated effort.

2. Attack the "artillery system" (i.e., look at more than tube kills in computing success and effort). Artillery communication nodes, ammunition sites and soft-skinned command and control vehicles are lucrative targets that can provide results comparatively equal to tube kills.

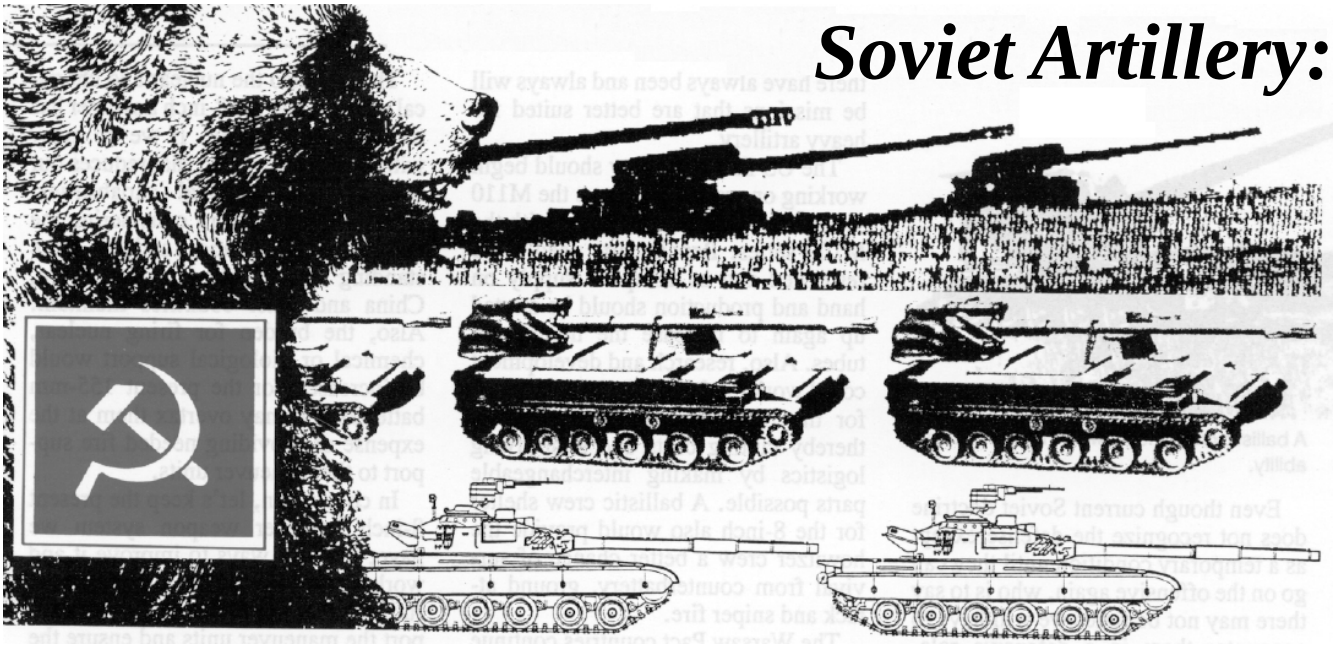
3. Include a systematic intelligence preparation of the battlefield (IPB) process to identify and locate all artillery targets, being particularly sensitive if intelligence sources indicate artillery is massing.

4. Destroy 75 percent of the Soviet artillery's effectiveness in the first 24 hours of battle. War-gaming indicates this will preclude the Soviets' success in offensives.

5. Make this a joint and combined-arms battle.

If you have any experience, training or thoughts concerning jointly attacking enemy artillery, we would like to hear from you. Points of contact are Major Gary Wilson (US Army) and Major Bob Awtrey (US Air Force): Headquarters, Training and Doctrine Command, ATTN: ATDOALFA, Langley Air Force Base, Virginia 23665-5557 or call AUTOVON 574-5934.

Cato L. Reaves
COL, USAF
Dir., ALFA



Soviet Artillery: Myth Versus Reality

by Captain Michael D. Holthus, USAR

Soviet artillery forces, as well as those of the Warsaw Pact, have been the subject of intense discussion and study in the Department of the Army and Department of Defense in the past few months. Much of the discussion has centered around the perceived weaknesses and strengths of the largest artillery arm of any of today's modern armies. A critical study of these characteristics is important to US force modernization and development of new operational art. The question of artillery effectiveness influences every battlefield element in this era of precision-guided munitions, advanced reconnaissance systems and automated command and control.

Unfortunately, a *critical* discussion of the weaknesses of our most capable potential adversary is frequently incomplete. Many military professionals in the West fall back on truisms that have been cornerstones of our career understanding of Soviet artillery for a variety of reasons. Security, differences in battlefield requirements and a ceaseless description of not-yet-fielded NATO developments all contribute to this practice. Unfortunately, many of the old truths about the Soviets and their allies are no longer applicable. This article exposes a number of such myths and attempts to put them in proper perspective.

Myth 1

Soviet Artillery Weapons Are Poorly Designed and Less Sophisticated Than Those of the West

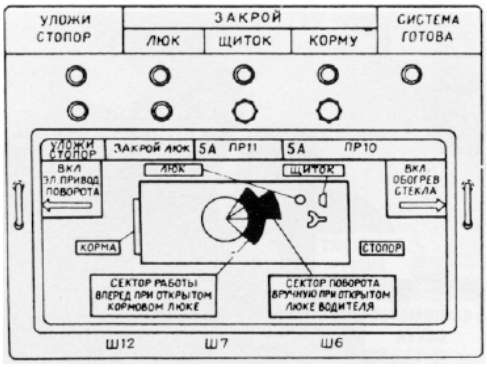
This first myth is a long-standing idea that, in part, stems from a difference in design philosophy. Often, Soviet weapons appear to be sloppily manufactured because of unfinished welds and loose operating parts, for example, the AK-47 rifle. Reality, however, is quite the opposite. Soviet artillery weapons are designed with especially difficult conditions in mind, often with apparent disregard for a finished external appearance. While external appearance is secondary, Soviet artillery equipment's functionality is painstakingly well-thought-out. The Soviet 122-mm self-propelled howitzer 2S1 is an example.

Functionality

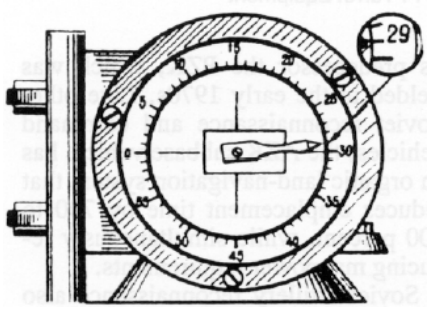
Designed in the mid-1960s and widely fielded in the early 1970s, the

The Interior of a 2S1 Howitzer: on the left is the Commander and on the right, the, Gunner.

A 2S1 Firing Element



Display Panel for 2S1, Indicating Hull Integrity



Interior Turret Azimuth Reference for 2S1

2S1 is amphibious and has a nuclear, biological and chemical (NBC) overpressure system; night vision devices; and an electrically driven chain rammer in a fully turreted system. The gunner has a control panel that indicates hull integrity and locks out the firing mechanism in unsafe conditions. Its PG-2 indirect fire control system, positioned to allow easy access to the gun commander, has indicator lights that tell the gunner to elevate, depress or halt the tube. Unlike US artillery weapons, the 2S1 has shaped-charge antiarmor munitions and a direct-fire telescope with ranging scales for both armor-piercing and fragmentation high-explosive projectiles.

Other innovations include an interior azimuth indicator that shows the gunner and commander the turret orientation as compared to the vehicle centerline. Each howitzer also has a lighted range stadia rod that can be remotely elevated from inside the turret. This simple device aids in rapidly and accurately determining piece displacements while crew members remain in their vehicle. Colored lights on top of the panoramic telescope prevent confusion when laying the gun at night. Communications include the R-123M radio and permanent connections for wire mounted on the outside of the vehicle. The 1V112 and 1V113 communications equipment complexes permit voice and, probably, digital communications among the howitzers and the fire direction center (FDC). One would be wise to consider that other Soviet weapons are equally as well designed and that newer Soviet weapons have incorporated additional advanced features.

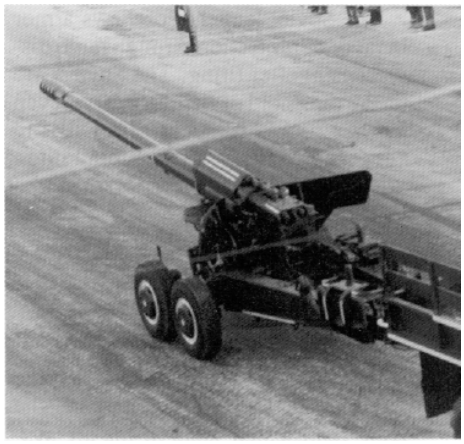
Range and Rate of Fire

In some areas, the Soviets have clearly been ahead of the West from the beginning. Particularly in the areas of range and rate of fire, Soviet cannon artillery has long held an advantage over the West. The 152-mm guns 2S5 and 2A36 have been in the Soviet inventory since the mid-70s and have a rate of fire of four to five rounds per minute, with an impressive 28-kilometer conventional range that can easily be boosted to 35 kilometers or more with base-bleed projectiles.

Soviet high rates of fire are possible largely because they have retained the brass cartridge case for 122-mm and 152-mm cannon. The case prevents the powder bags from touching hot chamber walls and also absorbs a significant amount of heat that's immediately removed from the chamber when the cartridge case is discarded. We expect future Soviet weapons to have an increased range and at least maintain their current rates of fire.

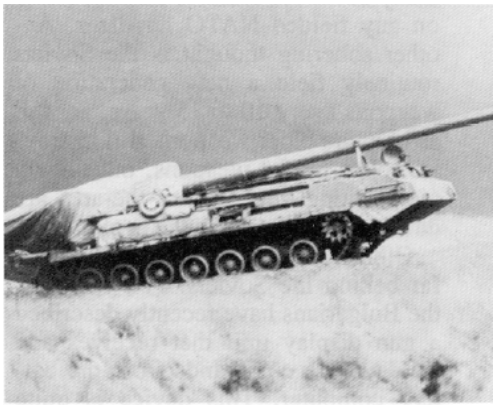
An area where the Soviets have held an undisputed advantage is in the number and variety of multiple rocket launchers (MRL). These area-fire weapons are designed to engage large or inaccurately located targets. The Soviet 16-tube 220-mm rocket launcher BM-22 (also referred to as the BM-27) was fielded in the mid-1970s, antedating the US M270 multiple launch rocket system (MLRS) by more than five years. In spite of its earlier deployment, the BM-22 has a greater range than MLRS (40 kilometers) and a much more diverse array of rocket warheads that include unitary high explosives and warheads with fragmentation, incendiary and "scattermine" submunitions. In addition, each launcher carries 25 percent more rockets than MLRS does.

While the BM-22 is not known to have a land-navigation system, this is not necessarily a disadvantage. A BM-22 battery FDC *does* have such a capability, and the battery consistently fights as an entity, rendering individual launcher navigation redundant.

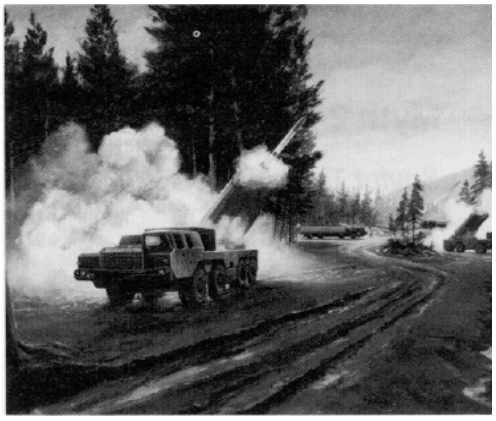


Defense Intelligence Agency

A 152-mm Towed 2A36 Gun



A 203-mm Self-Propelled 2S7 Gun that Can Fire Nuclear, High-Explosive or Improved Conventional Rounds



The 280-mm MRL under development lays down a broad field of fire, threatening armored vehicles, infantry, airfields and rear service areas.

The Soviet launcher eschews armor in favor of protection through rapid displacement after firing. The Soviets are on the threshold of fielding a new, even heavier rocket launcher that will fire advanced unitary and submunition warheads to greater ranges than the BM-22.

State-of-the-Art Replacement Systems

One thing to keep in mind is that the 2S1 and its 152-mm counterpart, the 2S3, represented state-of-the-art systems when fielded and incorporated many advanced features still not found on any fielded NATO howitzer. Another sobering thought is the Soviets routinely field a new generation of weapons every 10 to 15 years, as well as upgrade older weapons still in service. New Soviet weapons, once again representing the state-of-the-art, are due for introduction in the cycle.

Other Warsaw Pact states will not be far behind the Soviets. For example, the Bulgarians have recently described a gun display unit that receives and displays fire commands from the battery computer. This device is quite flexible with erasable, programmable read-only memory (EPROM) and a battery power supply so they can use it with towed as well as self-propelled artillery.

Myth 2

Soviet Target Acquisition is Slow, Primitive and Inaccurate

This is a particularly disturbing myth that, in part, stems from (1) our having Firefinder, undoubtedly the best weapon-locating radar in the world and (2) excellent Soviet operations security. The Soviets consider their artillery reconnaissance methods and capabilities extremely sensitive—secrets worth keeping. Soviet artillery reconnaissance includes not only weapon-locating radars, but also advanced sound-ranging systems, laser range finders, artillery-dedicated spotting helicopters, moving-target locating radars and modern radar direction-finding sets.

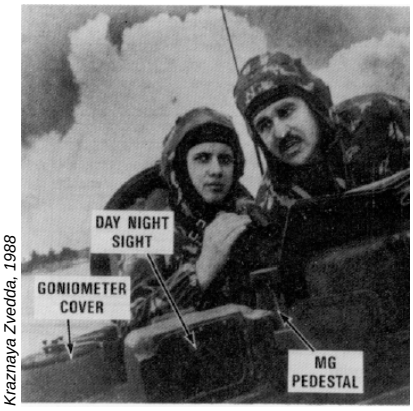
Reconnaissance Capabilities

These dedicated artillery target acquisition systems are supplemented and cued by ground reconnaissance patrols, electronic intercept, as well as manned and unmanned fixed-wing reconnaissance aircraft that provide imagery and radar data. The Soviet DR-3 drone is reportedly capable of producing television imagery as well as photographic reconnaissance. The Soviets have a wide range of reconnaissance capabilities that cover a very broad spectrum of signatures, reducing the impact of the countermeasures we might field.

The Soviets have always emphasized thorough artillery reconnaissance. A case study that highlights this dedication covers dedicated artillery reconnaissance vehicles. The APNP artillery mobile reconnaissance post had state-of-the-art range finding, optical and night-vision equipment. In the 1970s, these vehicles were replaced by the PRP-3 mobile reconnaissance post that has improved night-vision equipment and a laser range finder, on-board land-navigation system and moving-target locating radar. Each artillery battalion has one PRP-3 that acts as a mobile reconnaissance platform, independent of the battalion and battery commanders' observer vehicles. Within the last few years, the Soviets have fielded the PRP-4, undoubtedly upgrading the PRP-3's capabilities with more modern radar, night-vision and communications capabilities. The US artillery does not have an equivalent system.

Sound Ranging

The Soviets and their allies also have retained sound ranging as a viable, passive means of locating cannon artillery. The newest Warsaw Pact system is automated, undoubtedly a fully developed capability similar to that demonstrated in the mid-1970s by the US. The Soviets would refer to such a system as an *Avtomatikii Zvukometrecheskii Kompleks* (automated sound-ranging complex) or AZK. Similar Western systems can calculate a target location in 10 to 15 seconds to an accuracy of 0 to 200 meters, depending on the range. The AZK also employs radio data links, a capability introduced by



Kraznaya Zvedda, 1988

IV14 Turret Equipment

its predecessor the PZK, which was fielded in the early 1970s. Like other Soviet reconnaissance and command vehicles, the AZK subbase vehicle has an organic land-navigation system that reduces emplacement time by 700 to 800 percent, while simultaneously reducing manpower requirements.

Soviet artillery reconnaissance also has a different tactical and technical problem than that faced by the West. After organizing for combat, Warsaw Pact forces outnumber US forces approximately three or four to one. This means there's a comparable reconnaissance system-to-target ratio of 6-8:1 in favor of the Soviets.

Using these ratios, we can draw an example from the recent past when sound ranging was still a US artillery target acquisition capability. A US division facing a Soviet combined-arms


Vremya, 1988

Sound-Ranging Command Post

army would have had two sound bases to cover the 60 to 80 kilometers of frontage, with 50 to 60 *batteries* in each sector. The combined-arms army would have six to eight bases with only eight to 12 US firing *platoons* operating in each base sector. Under these conditions, even a sound base with a manual record reader would be acceptable for the Soviet force, while a similar system for the US commander would be overloaded. Similar conditions exist for Soviet weapon locating and moving-target locating radars. Thus, while US force structure and manpower constraints push our requirements to develop the best (and consequently the most expensive) systems possible, the Soviets and their allies can function with less-capable, cheaper equipment.

Myth 3

Soviet Headquarters Primarily Operate Manually and Can't Effectively Control the Large Number of Units Under Them

Probably no other Soviet artillery "weakness" is more widely cited than this one, and no other is probably further from the truth. The Soviets have always had superlative technical fire control. Their PUO fire control devices are carefully made, finely machined instruments that provide excellent graphic accuracy and can be used in conjunction with 1:25,000 or 1:50,000 series maps. Soviet manual calculations are so thorough that their full preparation—equivalent to our meteorological plus velocity error (MET + VE) corrections—accounts for the *average* errors made when determining coordinates and calculating corrections, in addition to the usual corrections for ballistic conditions.

The Soviets were using digital fire direction computers in the early 70s, only a few years after our Field Artillery digital automatic computer (FADAC) was widely fielded. They began using programmable calculators in artillery headquarters simultaneously with the US Army Field Artillery. In the tremendous modernization and force expansion of the last 15 years, they have closed the gap on the West in both technical and tactical automated fire control.

Technical and Tactical Fire Control

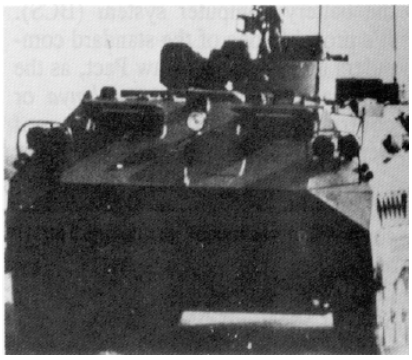
The Soviets pioneered the use of specially equipped command and reconnaissance vehicles (ACRV) for artillery battery and battalion commanders and staffs. Although the US fielded the M-577 command-post vehicles in the mid-1960s, these were little more than armored trucks that carried radios and fire direction equipment. Soviet ACRVs, whose deployment trailed the M-577 by only five years, were specifically designed with artillery technical and tactical fire control in mind.

These vehicles come in battalion sets of eight vehicles of four specific types. The tracked version, designated 1V12, is based on a variant of the eminently successful MT-LB light-armored tractor. All the vehicles in the set have NBC protective systems, are amphibious and have at least four radios on board, one of which is portable.

Three vehicles, designated 1V13, are the battery fire direction centers (FDCs). They're equipped with a panoramic telescope, an azimuth gyroscope that can be laid through the armored window on the right side of the vehicle, a map plotter that indicates the vehicle's position, digital data receivers and manual fire direction equipment. The digital terminal, abbreviated APK, is linked to the battalion FDC vehicle, designated 1V16.

The 1V16 vehicle has expanded communications capabilities, a fire direction computer 9V59, but no land-navigation system. The lack of a land-navigation system in this vehicle is not a detriment, however, as the 1V16 doesn't require it to determine the battery center or observation post location. It also has a weather set for determining local meteorological conditions.

The battery and battalion commanders' vehicles, the 1V14 and 1V15 respectively, are essentially the same, with the exception of communications equipment. Each has land-navigation devices, laser rangefinders, night-vision equipment, and manual fire direction



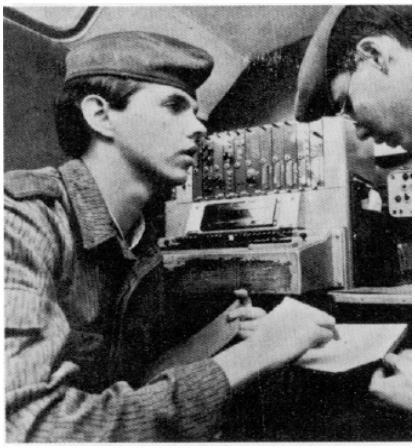
June's Defense Weekly

IV15 Battalion Commander's Armored Cavalry Vehicle

equipment to back up the FDC. These vehicles are equipped so the commander and his crew can carry out their dual role of fire support coordination and target area reconnaissance. The analogous US vehicle, the M981 fire support team vehicle (FSV), was fielded about 14 years after the 1V14.

Fire Direction Computers

As previously mentioned, the Warsaw Pact has long had technical fire direction computers. The East Germans use the PU-3M computer for technical fire direction. This computer appears to have modules that control basic functions and memory. The display is small and efficient, and the operator can use programmable function keys for a variety of recurring artillery problems. This computer is much more compact than the FADAC, and represents a level of computer capability between the capabilities of FADAC and



Volksarmee, 1984

PU-3M Computer for Technical Fire Direction

the battery computer system (BCS). It's probably one of the standard computers used in the Warsaw Pact, as the designator PU (*pribor upravlenya* or control device) is Russian, not German.

There's a particularly interesting story about Warsaw Pact armies' using commercial computers to modernize automated fire control systems. The Czechoslovakians have adapted the Sinclair Spectrum manufactured by the United Kingdom to perform as a battalion fire direction computer. This extremely low-cost, 64-kilobyte machine, copied throughout the Pact, calculates fire solutions and performs survey trigonmetric calculations.

The Bulgarians (certainly not known in the West for their high-level technology) have fielded a computer system that digitally links commanders and staffs of artillery batteries, battalions and regiments. The battery FDC computer produces individual gun solutions with accuracies comparable to those of our BCS and transmits the fire commands to a battery-powered gun display unit. The battalion FDC solves mass fire solutions, while the regimental FDC computer assigns targets based on a basic solution optimized for the range, system accuracy and munitions of all weapon types in the regiment. Even battery and battalion commanders have computers that maintain unit status and target files and are linked digitally with reconnaissance assets. Fire plans are transmitted to a computer at the supported maneuver commander's headquarters for approval and amendment.

Vremya, 1988

Battalion FDC: on left, probably a new communications device for a tactical command and control system similar to our VFMED and on right, new technical fire control computer.

This is a remarkable system by any army's standards, and Bulgarian troops have used it at least since 1985. Even more remarkable is the fact that, like the Czechoslovakian development, the Bulgarian system uses commercially available hardware. It's based on the Pravets-82, a Bulgarian-made computer that's similar to the Apple II. It remains to be seen if the rest of the Warsaw Pact will adopt this system, but the Bulgarian development can surely be held up as a model for the rest of her allies. Both the Bulgarian and Czechoslovakian developments underscore the importance of using off-the-shelf developments to introduce new technology for force modernization.

The Soviets themselves also have been observed recently using new automation equipment. The terminal shown in the center of the picture of a battalion FDC on this page is almost certainly a communications device for a tactical command and control system. As such, it could be compared to our variable format message entry device (VFMED). To the right is a new computer used for technical fire control. These devices represent a third generation of computer support for Soviet artillery operations.

Conclusion

We're on the threshold of a veritable revolution in military affairs. Contrary to what many of us have thought, the Soviets have never been very far behind technologically. Where they were correctly perceived to be behind, they may have been so by choice. In this way, they can avoid problems with unnecessary complexity or immature technology.

The Soviets have made up for whatever technological inferiority they've had with large numbers of somewhat-less-capable systems. In the past 15 years, the Soviets have increased the force ratio further in their favor and have done so with modern, highly capable weapons systems.

Today, the Warsaw Pact open press is filled with articles on precision-guided munitions, advanced automated command systems and semiautonomous weapons and reconnaissance platforms. While the articles refer to developments in "foreign" or "modern" armies, they undoubtedly represent just one of several efforts to prepare their officers for systems that are being fielded or are "just around the corner."

We do ourselves no favors by underestimating our potential opponent. While anecdotes about Soviet inept-ness abound, we can tell similar stories about all armies, and any honest soldier can personally remember numerous such incidents. The Soviet economy may be in trouble, but this has little or no bearing on the fact that the Soviets have made tremendous strides forward in fielding more technologically advanced weapons.

Our NATO artillerymen must face the rather unpleasant reality that their potential adversary is extremely well equipped. Our gunners must concentrate on being highly motivated and technically proficient and must pass these qualities on to their subordinates.

Detailed knowledge of Threat artillery is also important. The contents of articles such as this one are limited as to how much detail they can contain. Soviet vulnerabilities exist but are more appropriately discussed elsewhere as a topic for staff discussion led by the unit intelligence officer.

It's also incumbent upon the Army leadership to press for fielding of our own advanced weapons, command, target acquisition and support systems. Such moves will ensure that we will maintain whatever technological edge that remains and can close the gap in those areas in which we've fallen behind.

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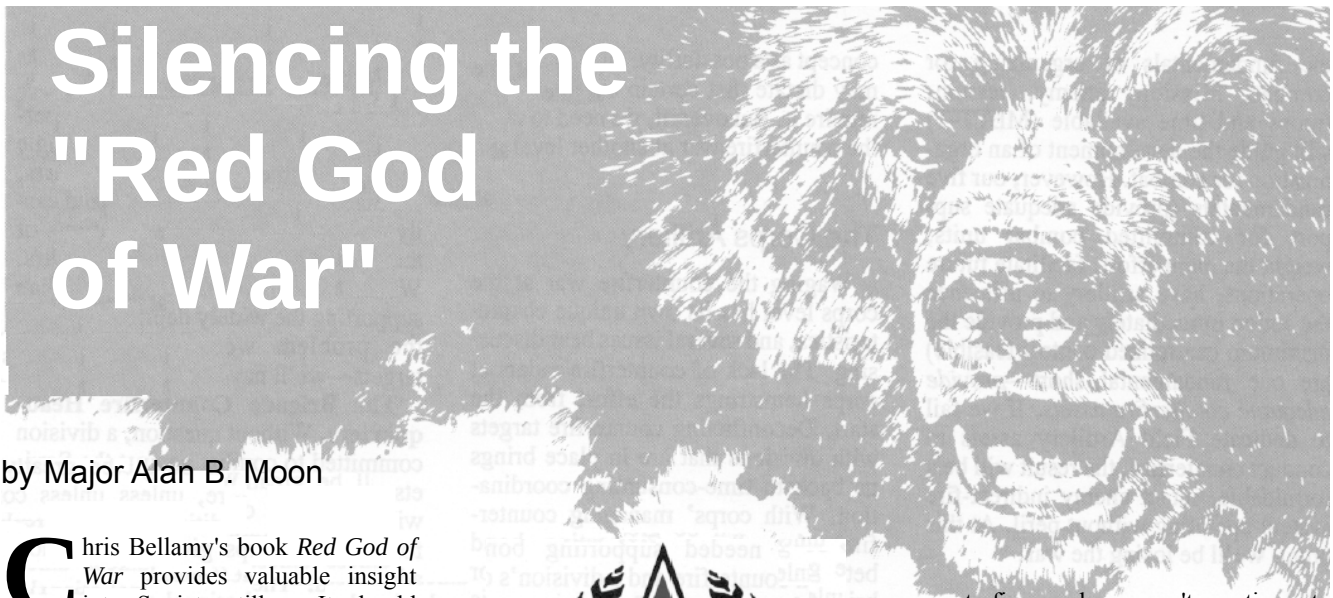
Silencing the "Red God of War"



by Major Alan B. Moon

Chris Bellamy's book *Red God of War* provides valuable insight into Soviet artillery. It should make us nervous about our ability to counter this Red God of War. The book is littered with examples of the awesome numbers of indirect-fire systems our potential foe can employ. Keying on these numbers, the book says we can expect to face 50 to 60 tubes per kilometer of front, but this often will grow to 250 to 350 tubes for the main effort. Further, Bellamy discusses in detail the Battle of Berlin where the Soviet 8th Guards Tank Army had an average of 325 tubes per kilometer for seven kilometers—one tube for every three meters of front.

By any measure, that's "serious" combat power. All of these facts should give us cause to reflect on how we conduct counterfire. To the pessimist, we can't "get there from here." To the optimist, that's a lot of targets. The reality is somewhere in between.

In sheer numbers, the strength of the Soviet indirect-fire systems is a strong argument for taking a "hard" look at how we, as fire supporters, conduct counterfire. To defeat the Red God of War, counterfire can't be relegated just to the Field Artillery, and artillerymen can't view it as part-time work. Instead, counterfire must be integrated into the concept of the operation and thus planned, coordinated and synchronized. Counterfire is combined-arms business.

A Combined-Arms Approach

Saying that counterfire requires a combined-arms approach isn't a Field Artillery "cop out." The fact is, the organic Field Artillery of a heavy division simply can't satisfy the requirements of deep, close and rear operations and still execute suppression of enemy air defense (SEAD) and counterfire without help. Even with a reinforcing Field Artillery brigade, we're trying to do the impossible.

The solution requires a major effort in the *decide* portion of the *decide, detect* and *deliver* sequence. We must decide in detail how we're going to wage counterfire. Specifically, we need to decide how counterfire fits into the scheme of fire support. At best, planning counterfire will require risk taking as we organize limited assets to meet competing requirements.

So what's the answer? Foremost, fire supporters can't tell maneuver commanders "We'll be right with you as soon as we settle this counterfire business." Our maneuver bosses won't stand for it, and rightfully so. Moreover, it won't do artillerymen any good to win the counterfire battle if Soviet maneuver forces are systematically destroying our division support area.

The dilemma is we can't commit the Field Artillery exclusively to counterfire, and we can't continue to conduct counterfire as an "additional duty." History shows we must dedicate ourselves to silencing the enemy's indirect-fire systems as part of the force fire support scheme. Counterfire can't completely "drive" the fire support effort—nor can it be a side issue. Instead, it must be built into the fabric of the fire support scheme of maneuver and embodied in the commander's scheme of maneuver and concept of the operation.

A combined-arms approach to counterfire involves Army aviation, electronic warfare (EW), Field Artillery and close air support (CAS). The idea is not simply to list enemy artillery as a high-priority target and tell everyone, "Go forth and do well." We must locate and attack counterfire targets selectively in a synchronized, effective manner.

Intelligence-gathering assets locate fire support command and control elements and enemy target acquisition assets (radars). Our EW jams fire support command and control nets, while attack helicopters, CAS and the Field Artillery destroy important counterfire targets. Everyone works in concert to silence the *right* counterfire targets at the *right* place and at the *right* time to gain maximum benefit. Counterfire is an integrated part of the battle, not a side show.

The Artillery Role

Focusing on our counterfire role will require revolutionary thought. Some old ways of doing business need a new look. Specifically, we need to review

the fundamentals of organizing for combat. Mission, enemy, terrain, troops and time available (METT-T) still guide the development of an organization for combat. However, our five fundamentals (provide adequate support for committed combat units, weight the main effort, facilitate future operations, have artillery to influence the action immediately and provide the maximum centralized control feasible) are one fundamental short—*provide adequate counterfire assets.* If we fail to dedicate Field Artillery assets to conduct counterfire, the result will be a formidable, intact enemy indirect-fire system operating without peril. At this point, we'll be losing the war.

The DS Battalion

I question the current practice of giving each direct support (DS) artillery battalion a countermortar Q36 radar. At the National Training Center (NTC), Fort Irwin, California, a DS battalion supporting a brigade with two maneuvering task forces while conducting survivability moves is busy indeed. Now, put that DS battalion in a "pitched" battle supporting three task forces and pile on 20 to 30 counterfire targets (a modest number) in an hour, and the result is predictable. The battalion can't "get there from here," expecially since enemy counterfire targets "deserve" our very best—destruction, not suppression.

There are other problems. When the Q36 radars of two flank DS battalions pick up the same target, who deconflicts? We must avoid gaps in counterfire coverage, and we must avoid double strikes. We need complete coverage of critical counterfire targets, and we don't have the bullets to kill an enemy artillery unit twice.

Currently, boundaries define counterfire responsibilities. One of our problems is we slow down our counterfire significantly with "endless" coordination. Worse, we can't just sit and trust to chance that our flanking DS battalion will strike the artillery that's pounding us. Of significance, the Q36 radar of a DS battalion must stop coverage when it displaces. This means the Q36 is operational only a small percentage of the time.

A solution to these and other issues is to pull the counterfire mission from the DS battalion. We should retain the concept as a possibility, since METT-T may dictate that certain circumstances require it. But overall, we need to wage the counterfire war at another level.

The Corps Artillery

Waging the counterfire war at the corps level has its own unique characteristics, and several issues bear discussing. The lack of counterfire radars at corps hamstrings the effort from the start. Deconflicting counterfire targets with divisions that are in place brings us back to time-consuming coordination. With corps' managing counterfire, the needed supporting bond between counterfire and a division's or brigade's scheme of maneuver is flimsy. However, corps does have a part to play in the counterfire business. Among others, it allocates the divisions' additional artillery, Army aviation and EW.

The corps' greatest direct contribution can be in two areas. First, corps can use its target acquisition assets to find and attack deep counterfire targets. Second, corps can destroy counterfire targets before the divisions must fight them. However, the bulk of the counterfire fight should not be fought by the corps, but by the division.

The Division Artillery

It's at the division level that we can put together a comprehensive counterfire system. At this level, we can decide how to allocate and commit attack helicopters, EW, target acquisition assets and artillery to support counterfire. In the division, we can plan, coordinate and conduct a combined-arms attack of enemy indirect fire support systems in concert with a scheme of maneuver.

Consolidating the command and control of the division artillery's counterfire radars has great potential. These five radars, two Q37s and three Q36s, can cover the typical division front twice with a range of up to 50 kilometers. No other target acquisition system at the division level has such deep and overlapping coverage.

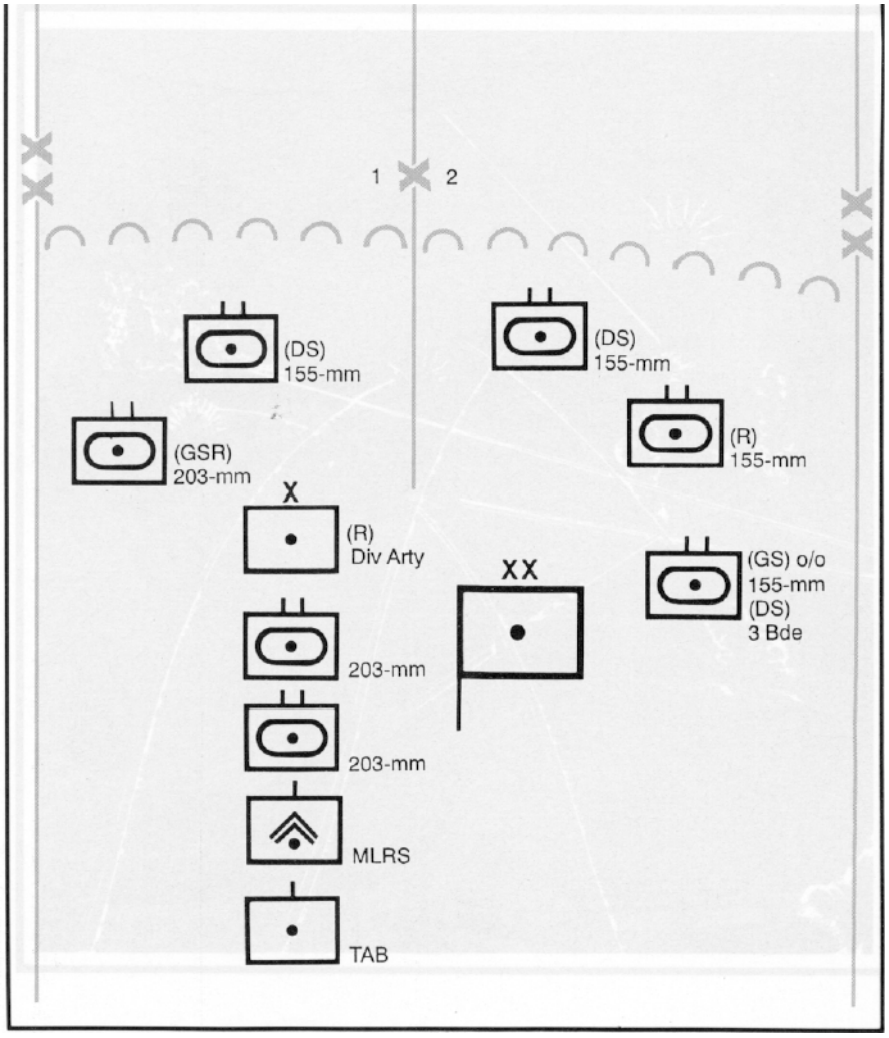
The Firefinder Radars. The radars' combined coverage permits us to plan in detail and synchronize the movement and cueing schedules. These schedules combined provide virtually continuous radar coverage while allowing the radars to move frequently, enhancing their survivability. The idea is for the radar to radiate in 20- to 30-second bursts during a 15-minute period, then displace. With a single headquarters controlling all five radars, we maintain optimal coverage and easily deconflict multiple acquisitions of the same target by different radars. With an effective communications plan supporting the widely deployed radars, the problem won't be acquiring targets—we'll have plenty.

The Brigade Counterfire Headquarters. Without question, a division committed to combat against the Soviets with only its organic Field Artillery will be greatly undergunned. Therefore, unless corps gives the division additional combat "muscle," fire support in general and counterfire specifically are going to be "very sporting affairs."

The additional combat muscle we can expect the corps to provide is usually a reinforcing Field Artillery brigade. With the addition of that brigade, the division then has the flexibility, if not the power, to organize artillery to meet operational demands. Although the size (three to five battalions) and composition (155-mm and 203-mm cannon or multiple launch rocket systems—MLRS) of the brigade is critical for detailed planning, its expected role in the division's counterfire fight remains constant. Importantly, the brigade adds one needed element—a command and control headquarters.

With the added combat power of a Field Artillery brigade, we can design a "typical" organization for combat to meet the counterfire threat. The first step is to make the brigade headquarters the counterfire headquarters. The number and types of firing units organized under the brigade's control can vary, depending on the assets available, threat and commander's intent. However, using the brigade headquarters as the counterfire headquarters ensures unity of effort and simplicity. The second step is to place the target acquisition battery (TAB) under the brigade's control.

On paper, a "typical" division artillery organized for combat might look like the Chart. In this example, the Field Artillery brigade came to the division with three 203-mm battalions and one 155-mm battalion. The division factored in METT-T and, based on the expected counterfire threat, organized the MLRS battery and TAB under



A Typical Division Artillery Organized for Combat with a Field Artillery Brigade as Counterfire Headquarters

the brigade's control. This example may generate discussion but does reflect the "six" fundamentals of organizing for combat. With the artillery organized for combat this way, the Field Artillery brigade and division artillery headquarters can plan in detail how to wage the counterfire war.

It's key to plan radar movements, cueing schedules, fire plans and artillery unit moves to conform to the scheme of maneuver. Fire plans call for short, violent counterfire programs, delivering a 10- to 15-minute pulse of destructive fires. The idea is to have a battalion mass high volumes of destructive fire in execution of a program, then displace. The brigade headquarters orchestrates the counterfire effort and moves radars and fire units to maintain a constant capability.

This approach to counterfire has advantages. Deconflicting counterfire targets is easy. Detecting an enemy unit's firing by our radars equates to authority to shoot back. Thus, boundaries don't hamper counterfire. Finally, the Field Artillery brigade represents a significant unified combat power that can maneuver its fires across the division front easily as the opportunities for striking enemy vulnerabilities present themselves.

The IPB Process. With the Field Artillery organized for combat as presented, we're still far from solving the counterfire dilemma. We can't kill all targets. The answer is to kill the right ones. We find the right ones through the intelligence preparation of the battlefield (IPB) and targeting processes.

During the IPB process, key members of the division staff and fire supporters identify general locations of enemy artillery to silence or destroy. We can expect those locations to be in the "crust" of enemy artillery directly affecting our main effort. The general location of this enemy artillery becomes the specific area from which the counterfire radars immediately generate targets and send requests for fire—a counterfire "kill zone." All other radar sightings become "combat intelligence" that we engage only if assets are available. We concentrate geographically on the critical portion of the Soviet artillery crust. Most importantly, we must forward *all* radar sightings to the division intelligence system to confirm or deny the IPB process and adjust the kill zone.

Conclusion

Even with the Field Artillery's role in the counterfire effort firmly established, we still must integrate it into the rest of the combined-arms team's efforts. The maneuver commander decides what role EW and attack helicopters play. He also decides which intelligence-gathering assets will be tasked to get targeting information on enemy counterfire radars and sound-flash elements. In summary, counterfire will affect all battlefield systems, and those systems, directly or indirectly, have a role to play in the counterfire war.

The challenges of a potential European battlefield are many, and no where are the stakes higher than in counterfire. Fire supporters and maneuver commanders need to commit themselves to making counterfire a prime factor in planning combat operations. By making counterfire a fundamental part of organizing artillery for combat and treating counterfire as combined-arms business, we can selectively shape and silence the Red God of War.

Major Alan B. Moon is currently enroute to the Combat Maneuver Training Center, Hohenfels, West Germany. He has served as Executive Officer of the 1st Battalion, 82d Field Artillery; the Division Assistant Fire Support Coordinator; and as Commander of C Battery, 1st Battalion, 77th Field Artillery, all in the 1st Cavalry Division, Fort Hood, Texas. In the 1st Battalion, 41st Field Artillery (Pershing), West Germany, Major Moon served as the Battalion S3 and S4 and commanded the Headquarters and Headquarters Service Battery.

Joint Counterfire in the Fulda Gap

by Major Michael C. Brown

The first major joint operation of the next European conflict, which may well determine its outcome, is the counterfire battle. Before hostilities begin, the Army and Air Force must establish all procedures for the joint planning and coordination of counterfire operations.

Within V Corps, counterfire is a top-priority mission. We must destroy the enemy's fire support assets and disrupt his command and control systems to allow friendly maneuver forces to *win* the AirLand Battle. To accomplish this, V Corps integrates surface-to-surface fires (cannon and multiple launch rocket system—MLRS) and air-to-surface fires (helicopter and close air support aircraft) with electronic warfare and target acquisition assets, both ground and air.

What Are We Up Against?

To better understand the importance of the counterfire battle, you must understand the potential threat facing V Corps. Anyone who has been stationed within NATO knows the meaning of the term "target-rich environment." Threat artillery systems have increased in numbers and sophistication over the years. Motorized rifle units from division to battalion and tank units from division to regiment have organic fire support. The Threat quickly can allocate additional assets organic to fronts and armies to form army, divisional and regimental artillery groups (AAGs, DAGs and RAGs). The Threat doctrine plans call for attacking our artillery to achieve fire superiority on the ground.

Once it achieves superiority, the Threat artillery plays a critical role in a combined-arms concept called ***maneuvering by fire.*** In the offense, it uses maneuver by fire to suppress strongpoints, repulse our counterattacks and cover an attacking unit's flanks. In the defense, the Threat uses it to repel and destroy NATO attacking formations, support its own counterattacks and seal gaps in its defense. It's apparent that our success depends on our ability to reduce Threat artillery assets.

What Do We Have?

The vast number of Threat systems prevents us from fighting an artillery war of attrition. Though outnumbered, our situation is not hopeless. Our challenge is to plan and fight jointly, use improved tactics and survive and deliver a devastating blow to the enemy.

Fielding MLRS and Firefinder systems in greater numbers has enhanced our ability to win the counterfire battle. The "shoot and scoot" tactics of MLRS, along with its firepower, allow us to position it close to the forward line of own troops (FLOT) and range deeper into the enemy territory. We can set up quick-fire channels from the Firefinder radar to cannon units to speed reaction time. The division artillery and Field Artillery brigades must monitor this channel to keep abreast of ammunition expenditure and the tactical situation and, if necessary, divert the target attack to another means.

As we modernize the current M109 howitzer and Firefinder systems and supplement them with more MLRS launchers, we'll enhance our survivability and increase our effectiveness on target. This will allow all the ground-counterfire units to use the same shoot and scoot techniques as MLRS.

In the air, using joint air attack teams (JAATs) and target acquisition systems gives an added dimension to the battle. Combining various allied aircraft (F-16 and Tornado) in a single attack may cause the enemy air defense system operators to "hesitate" for a few seconds before engaging us because they need to identify and deconflict targets, allowing

the aircraft to accomplish their mission. Using airpower in the counterfire battle also provides the Corps Commander a pinpoint destruction capability.

How Can We Win?

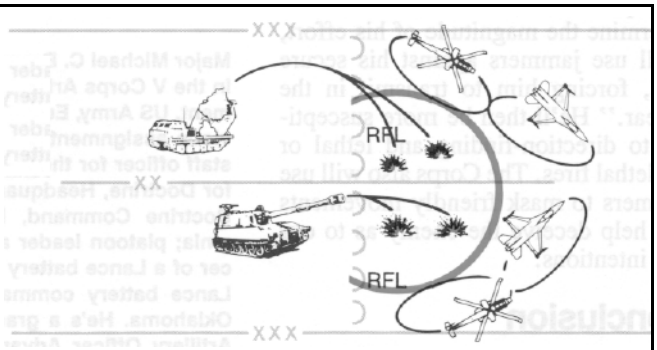
Corps can take a number of actions to defeat the Threat artillery. We can prepare and organize for combat before the battle begins and find and destroy the enemy with careful coordination and effective use of joint assets.

Study the Battlefield Before the War

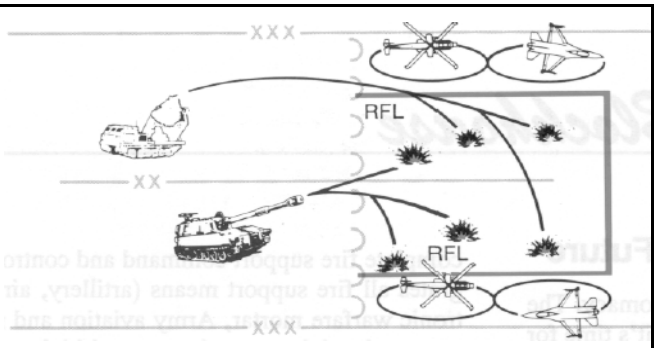
Threat artillery has identifiable weaknesses. Its maneuver forces tend to use most of the forward terrain, which limits the number of position areas available for the artillery to occupy. Analysis can determine the majority of the primary and alternate Threat artillery positions. The number of systems that will be deployed forwardly will absorb a large amount of the remaining real estate.

V Corps conducts a continual, thorough intelligence preparation of the battlefield (IPB). Army and Air Force intelligence and fire support personnel jointly study the IPB to determine where the initial Threat artillery positions will be and the best weapons systems available to use against them. We keep the locations and targeting information on file in the tactical fire direction system (TACFIRE) for subsequent engagement.

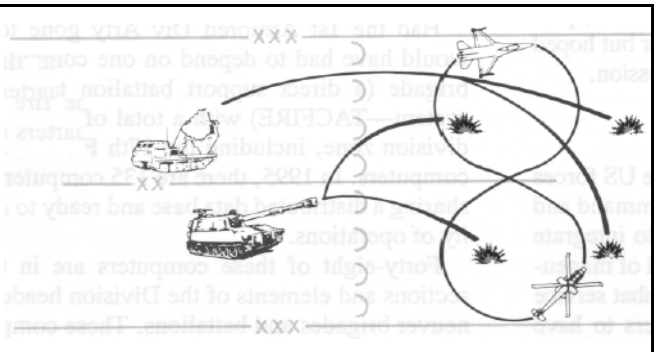
Scenario 1: Artillery attacks targets located forward in the center of the sector. Attack helicopters and fixed-wing aircraft strike the enemy flanks and rear. (RFL is the restrictive fire line.)



Scenario 2: Artillery attacks targets in the center of the sector. Helicopters and fixed-wing aircraft attack flanks.



Scenario 3: Artillery attacks initially across the entire Corps front. Air assets also will attack those targets as they displace to alternate locations.



Based on the Corps Commander's guidance, the Corps Fire Support Coordinator or his designated representative selects the best method of engaging the enemy.

Organize for Combat

Friendly task organization and positioning of fire support assets must correspond to the mission and commander's intent. The counterfire battle involves the entire artillery with the Corps. Command and control is a corps responsibility with the divisions, augmented by Field Artillery brigades, executing the fire missions. Assigning standard tactical missions to Field Artillery units is the most effective tool to organize for counterfire operations. It's also at the corps level that air assets are allocated (CAS) or assigned (Army aircraft).

Joint participation in the fire support coordination process reduces the time required to achieve results. Deconflicting targets, assigning areas of responsibility and determining weapons employment must be planned and coordinated, preferably before hostilities begin. A division facing the brunt of an attack will be weighted with counterfire assets. In addition, the priority of fires and target acquisition means must support the commander's objectives.

Find the Enemy

Finding the enemy is the greatest counterfire challenge. Before hostilities begin and based on our analyses, we carefully watch enemy units moving into their initial positions. Once located, we target them and put them in priority. When hostilities begin, Corps will use air- and ground-based target acquisition assets to verify the identity and refine the location of targeted enemy units.

The Corps' targeting approach requires analysis and common sense. Targeteers in the targeting cell process data passed from collection assets. We use knowledge of Threat artillery tactics and common sense to refine the data and produce enemy locations. We are far better off engaging a "fair"

target location now rather than waiting for a "good" target location later. The target may move before we can engage it.

Destroy the Enemy

Once Corps intelligence collection assets or the counterbattery radars confirm the presence of Threat artillery, the division and corps artilleries can engage it or use air attack and (or) jamming assets. If we plan to use ground and air assets simultaneously, we can divide the battle into fire sectors for ground and air assets. This division of effort will allow us to "see" more deeply, have better target accuracy and attack faster with more rounds per target. The success of this phase of the counterfire battle is contingent on fire control measures and agreed-upon procedures. The coordination of assets and assignment of sectors of fire must be prearranged. We may not have time to coordinate once the war starts.

Use Electronic Warfare

Electronic warfare can contribute to the counterfire battle. When electronic countermeasures (ECM) are integrated as nonlethal fire support, Army and Air Force jamming assets become combat multipliers.

In offensive operations, we will employ jammers initially in an electronic warfare support role. This role is to reconnoiter the enemy's command, control and fire support communications nets. Once we force him to move out of his initial positions with lethal fires, he must use radio communications and is susceptible to ECM operations. By jamming, we then can disrupt his ability to use the electromagnetic spectrum effectively.

In defensive operations, intelligence assets act to defeat the enemy's ability to surprise us. Once we detect him and determine the magnitude of his effort, we'll use jammers against his secure nets, forcing him to transmit in the "clear." He'll then be more susceptible to direction-finding and lethal or nonlethal fires. The Corps also will use jammers to mask friendly movements and help deceive the enemy as to our true intentions.

Conclusion

We'll fight the counterfire battle using lethal and nonlethal systems that also are needed elsewhere on the battlefield. The fire support community must continue to educate maneuver commanders on the importance of winning the counterfire battle. These commanders must resist the temptation to re-dedicate these critical counterfire assets before completing the counterfire battle.

Fire support assets exist to support the scheme of maneuver, allowing the commander more freedom of action. But first we must win the counterfire battle to provide that support.

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View from the Blockhouse

FROM THE SCHOOL

AFATDS and Counterfire—The Future

The year is 1995, and things look bad for diplomacy. The world has "gone to hell in a hand basket," and it's time for the military to earn combat pay. The 1st Armored Division Artillery (Div Arty) and the rest of US Army, Europe, have moved forward to their general defense plan positions, prepared to do what everyone has always practiced for but hoped would never happen—defend NATO against aggression.

Using AFATDS

But the 1st Armored Division and the rest of the US forces have a new force multiplier: the Army tactical command and control system (ATCCS), an automated system to integrate information to allow timely command and control of maneuver, fire support, intelligence, air defense and combat service support. These systems allow the US commanders to have all the information necessary to fight the AirLand Battle.

Fire support is represented by the advanced Field Artillery tactical data system (AFATDS)—a misnomer because it's a complete fire support command and control system. It integrates all fire support means (artillery, air, offensive electronic warfare mortar, Army aviation and naval gunfire) to engage the right target (automated high-value target analysis) at the right time (maneuver commander's criteria) at the right place (critical-event oriented).

Had the 1st Armored Div Arty gone to war earlier, it would have had to depend on one computer per maneuver brigade (a direct support battalion tactical fire direction system—TACFIRE) with a total of eight computers in the division zone, including the 17th Field Artillery Brigade's computers. In 1995, there are 135 computers in the zone, all sharing a distributed data base and ready to assist in continuity of operations.

Forty-eight of these computers are in the fire support sections and elements of the Division headquarters and maneuver brigades and battalions. These computers will allow fire support elements (FSEs) to compute their own maneuver-oriented fire plans while Field Artillery tactical operations centers (TOCs) concentrate on counterfire plans.

If the need arises, the computers with the FSEs, and fire support sections (FSSs) can communicate directly with the howitzer improvement program (HIP) howitzer or multiple launch rocket system (MLRS) firing elements. This capability ensures continuous fire support for the maneuver commander. Because the computer running the AFATDS software is common to the rest of the Army, if the FSE computers fail, the maneuver commander can immediately reallocate computers from other locations, using a priority system similar to that used for radios, to run the fire support software. Survivability of fire support is ensured.

But what does this fire support software do to support the counterfire battle? Quite a bit. Since AFATDS is easier to train on, the Total Force is better prepared at any moment to use this system to support the Division Commander's war plans. A much-expanded version of the maneuver commander's guidance allows the fire support coordinator (FSCOORD) to tailor fire support to the maneuver concept of operation.

The AFATDS' phased approach to war-fighting allows the FSCOORD to further tailor fire support to the needs of any stage of the battle. Giving priority of fires to enemy artillery in the first few minutes of the battle and then automatically shifting to enemy command and control elements is a "snap." Is it absolutely tied to H-hour? No, it's flexible—the maneuver commander's call. Want to automatically shoot a mix of dual-purpose improved conventional munition (DPICM), white phosphorous and family of scatterable mines (FASCAM) antipersonnel munitions at enemy artillery in phase one and then shift to straight DPICM in phase two? No problem. Need to engage up to *740 targets in one hour in a brigade sector?* Consider it done. Just make sure you have enough firing units and ammunition.

The coordinating draft of *Airland Battle Future-Heavy,* dated 15 October 1988, requires the division to "Conduct counterfire operations with either organic or supporting weapons against the regimental artillery groups (RAGs) and divisional artillery groups (DAGs) in its area of operations to reduce their effectiveness by 50 percent within 30 minutes (time starts from the initial engagement by either lethal or non-lethal means of the first Soviet artillery battalion)." At the same time, the division fire supporters must destroy 50 percent of the combat vehicles of at least three Soviet regiments (see the Chart).

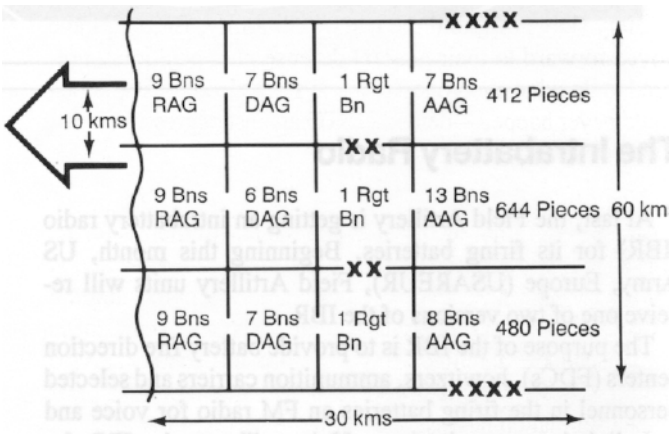
AFATDS completely automates the function of matching high-value targets to firing assets. Does this mean AFATDS is in complete control? No! AFATDS is only executing, in an automatic mode, those functions you want it to. Want human intervention on all fire missions? Six different intervention points are available. But if your Field Artillery brigade is counterfire headquarters and facing odds of 7 to one, then you can expect AFATDS' mission processing to match or better the total input rate from all your radars.

But what about the mechanics of this AFATDS—will it get the right information to the right shooters at the right time? Yes. AFATDS doesn't maintain an artillery target intelligence (ATI) file like TACFIRE. All inputs are sensor inputs, whether they come from forward observers (FOs), radars or intelligence and electronic warfare (IEW). Each sensor input is compared against the high-value target analysis matrix to determine if it's to be considered a target. If it isn't important enough to be a target, the system checks to see if someone else needs the information. If not important enough or not needed, it's dropped out of the system, freeing up the data base and saving ammunition. Or, even before sensor inputs are considered, they may be passed directly to another agency, based on target type. This may be the case with enemy artillery targets. You can pass them directly to the counterfire headquarters for consideration—no more endless looping with messages of interest.

So, the right information is at the right headquarters for use. What happens if the headquarters needs to displace—who takes over? There's more flexibility with AFATDS in continuity of operations. The software is modular; it consists of five semi-independent modules: fire support planning, fire support execution, movement control, Field Artillery mission support (personnel, maintenance and logistics) and technical fire direction. You load and run only those modules you need or can afford to run.

The Div Arty headquarters and the Field Artillery brigade TOC each have three computers, counting the commander's computer. One computer might be sent forward with the jump TOC and run only the fire support execution and movement control modules while the rest of the headquarters displaces. When the rest of the headquarters is in position, the other computers can hook into the local area network (LAN) and pick up the planning and Field Artillery mission support responsibilities. Thus, the Div Arty and Field Artillery brigade can be active simultaneously, each fighting its share of the war.

Scenario: At the point of the main effort, the Soviets concentrate fires from 1,056 tubes and rocket launchers. These forces are in support of a Soviet Army main attack breakthrough.



A US division faces this counterfire threat.

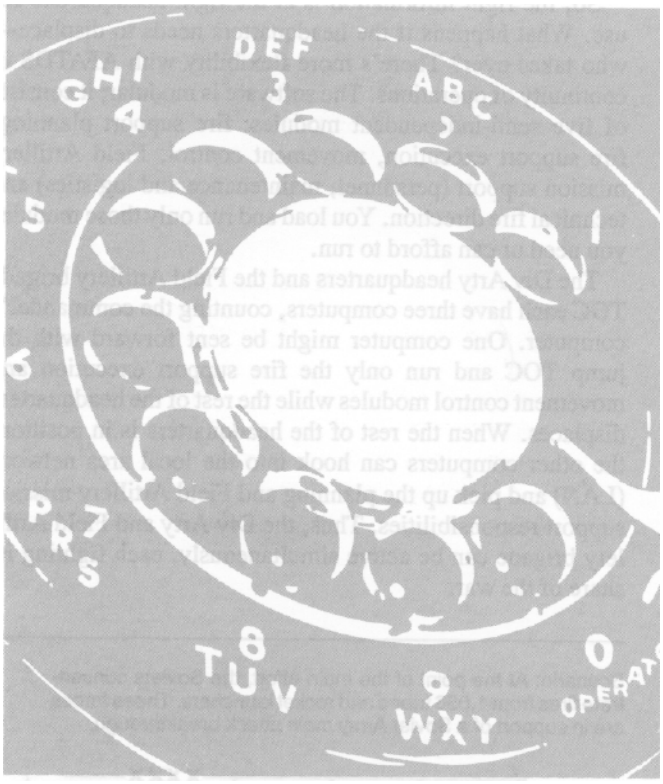
If the Div Arty is destroyed, what does the Field Artillery brigade do to take over? First, all subscriber tables are exactly alike. The brigade goes in, "calls" itself the Div Arty and proceeds to fight the battle. It was already receiving unit updates from the Div Arty and from the maneuver control system (MCS). If the brigade is missing portions of the target data base, it can query the all sources analysis system (ASAS) for any type of sensor input it needs to continue the fight. Ammunition status, to include what's in units and the ammunition supply points (ASPs), is available from the combat service support control system (CSSCS).

Coming Back to 1989

For years we've been promised AFATDS software only to have another delay announced. Recently, the concept evaluation software was demonstrated to the Training and Doctrine Command (TRADOC) Commander, and he remarked, "There's a pony in the barn." We finally have the finished product for soldiers to evaluate in March and April 1989.

Is this "pony" ready to run to the field? Not yet. After the concept evaluation, we'll need another two years to improve and fix the software. A year of intensive testing will follow before III Corps, Fort Hood, Texas, becomes the first owner of Block I AFATDS software—a true warhorse for the "Phantom Corps."

If units have questions, write the TRADOC System Manager—AFATDS, US Army Field Artillery School, Fort Sill, Oklahoma 73503-5600 or call AUTOVON 639-5719 or commercial (405) 351-5719.



Unit Training Hotline Changes

The Field Artillery School's Unit Training Hotline number changed, effective 15 March, to AUTOVON **639-5004** or commercial **(405) 351-5004.**

Soldiers use this 24-hour-a-day service to ask questions on skill qualification test (SQT) development, soldiers manuals (SMs), military qualification skills (MQS) manuals, Army training and evaluation program mission training plans (AMTPs), artillery ammunition standards in training commission (STRAC) and training extension course (TEC) and Army correspondence course program (ACCP) lessons. During non-duty hours, please state your name, AUTOVON or commercial telephone number, unit and then your question. For less time-sensitive questions relating to unit training, you may write to the Commandant, US Army Field Artillery School, ATTN: ATSF-DTD, Fort Sill, Oklahoma 73503-5000.

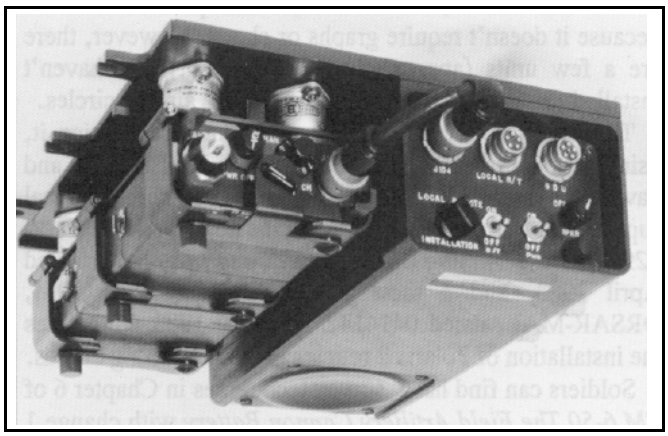
The Redleg Hotline is still in existence, and soldiers may ask about any artillery-related question or service. The Redleg Hotline also takes questions about the National Training Center (NTC), Fort Irwin, California, and the Joint Readiness Training Center (JRTC), Fort Chaffee, Arkansas. You may reach the Redleg Hotline by calling AUTOVON **639-4020** or commercial **(405) 351-4020.**

The Intrabattery Radio

At last, the Field Artillery is getting an intrabattery radio (IBR) for its firing batteries. Beginning this month, US Army, Europe (USAREUR), Field Artillery units will receive one of two versions of the IBR.

The purpose of the IBR is to provide battery fire direction centers (FDCs), howitzers, ammunition carriers and selected personnel in the firing batteries an FM radio for voice and (or) digital communications. Units will use the IBR for internal command, control and communications and, more importantly, to establish a digital communications link between the battery computer system (BCS) and the howitzer gun display unit (GDU).

For more than two decades, the Field Artillery School has explored methods of passing fire commands from the FDC to each howitzer section, developing many new ideas and experimenting with various radio systems to provide intrabattery communications. With the selection of the single-channel ground and airborne radio system (SINCGARS)-V family of radios as the IBR, the search is finally over.



The PRC-68 and OG-174 Interim Intrabattery Radio System

The fielding of SINCGARS to the active Field Artillery force has begun in Western Command units. Others will receive them beginning in FY 90 with fielding scheduled to be completed no earlier than the end of FY 96. As a result, the School is trying to lessen the impact of the long waiting period by providing an interim IBR for USAREUR and continental United States (CONUS) artillery units.

One version of the interim IBR involves the integration of the AN/PRC-68 (small unit transceiver) with the OG-174/VRC (amplifier power supply unit). After a OG-174/VRC is mounted in the self-propelled howitzer or FDC vehicle, the AN/PRC-68 is mounted inside it. The OG-174 allows the radio to operate on vehicle power and provides the added capability of an external loud speaker. The AN/PRC-68 and the OG-174 will be the interim IBR for USAREUR and CONUS light infantry divisions and separate brigades.

The other version of the interim IBR, the AN/GRC-160 (low-power radio), mounts internally in the M109 howitzers and FDC vehicles and will be the interim IBR for the CONUS heavy division artillery units. The School's fielding strategy for the interim IBRs is as follows:

Europe: The Communications and Electronics Command bought the OG-174/VRCs to integrate them with the AN/PRC-68s now used in USAREUR. The OG-174s are being shipped to USAREUR beginning this month. This will give USAREUR Field Artillery forces a complete IBR capability.

CONUS Heavy Divisions: The School has requested through the Training and Doctrine Command that CONUS M109 units be issued AN/GRC-160 radios and installation kits as they become available from Western Command when SINCGARS is fielded there.

CONUS Light Infantry Divisions and Separate Brigades: The School also has requested the OG-174s and AN/PRC-68s in Europe be reallocated to the light infantry artillery units and separate brigades when these USAREUR assets are replaced by SINCGARS, beginning in FY 92.

The objective IBR and the interim IBRs will work with the VIC-1 intercom, BCS and GDU. The SINCGARS, and AN/PRC-68s with OG-174s have successfully proved their ability to transmit and receive voice or digital traffic in a field environment. The AN/GRC-160 won't support digital communication between the BCS and GDUs when the BCS attempts to transmit data to two or more GDUs.

The SINCGARS is being fielded in Western Command. The rest of the active force will receive it beginning in FY 90.

The School recognizes that the current intrabattery communications net structure in the firing battery won't support the intrabattery radio adequately. In accordance with *TC 6-50 The Field Artillery Cannon Battery* (formerly FM 6-50), dated 29 September 1988, doctrine depicts one battery command voice and digital net to support command and control and fire direction communications. The mixture of command and control (voice) and fire direction (digital) on one net will be disruptive. Consequently, the School is staffing internally a doctrinal change to the battery communication net structure, proposing separate nets for voice and digital communications.

With the introduction of the IBR, the Field Artillery has a new and responsive means of performing command and control in its firing batteries. It will ensure we can support the dynamic intrabattery communications requirements of the 3X8 employment and howitzer improvement program (HIP) concepts.

If units have questions, contact the Training and Doctrine Command System Manager for Fire Support Command, Control and Communications (TSM—FSC^3), Field Artillery School, at AUTOVON 639-6418 or 5607 or commercial (405) 351-6418 or 5607.

Hasty Survey Update

A group of senior officers from the Field Artillery School recently observed a rotation at the Joint Readiness Training Center (JRTC), Fort Chaffee, Arkansas. During the visit, one of the issues discussed was Field Artillery units' not using hasty survey techniques during field operations. This has also been noted during most after-action reviews at the National Training Center, Fort Irwin, California. Units prefer to "float the needle" and shoot off a magnetic azimuth rather than take the time to perform a simultaneous-observation, Polaris 2-reticle or Polaris-Kochab method to gain a more accurate direction. Since direction is the most critical element of survey control, it makes sense to determine the most accurate direction possible.

The most preferred method to obtain a direction is simultaneous observation because it establishes a common azimuth. Polaris-Kochab and Polaris 2 reticle are good techniques to use when communication is restricted or being jammed. Of the two, Polaris 2 reticle is the preferred method because it doesn't require graphs or charts. However, there are a few units (approximately 25 percent) that haven't installed the Polaris 2 reticle in their M2A2 aiming circles.

To install the Polaris 2 reticle, units must requisition it, using national stock number (NSN) 1240-01-152-8516, and have their intermediate repair maintenance shops (general support) replace the old reticle with the new one. The *TM 9-1290-262-24P Aiming Circle M2W/E and M2A2W/E,* dated April 1983, and a message, Commander, ARRCOM, DRSAR-MAL, dated 041414Z February 1983, authorizes the installation of Polaris 2 reticles in M2A2 aiming circles.

Soldiers can find hasty survey techniques in Chapter 6 of *FM 6-50 The Field Artillery Cannon Battery* with change 1 and (or) Chapter 5 of *TC 6-50 The Field Artillery Cannon Battery,* recently distributed. Units should direct any questions about hasty survey to the Cannon Division, Gunnery Department, Field Artillery School, at AUTOVON 639-5409 or commercial (405) 351-5409.

TOE System Change

To build tables of organization and equipment (TOEs) that begin with a common base and grow toward a fully modernized objective, the Vice Chief of Staff of the Army directed TOEs be innovatively changed. The living TOE (LTOE) system is designed to make change easier and to encourage modernization in unit packages. To this end, a TOE now comes in three parts—a base TOE, incremental change packages (ICP) and an objective TOE. The base TOE has no modernization equipment. Incremental change packages are the building blocks from which the objective TOE is constructed. Each ICP has all the equipment necessary to field a system. For instance, the AN/TPQ-36 (Q-36) ICP contains the vehicles, camouflage nets and radios we must add to an AN/MPQ-4 (Q-4) radar section to configure it for the Q-36 radar. It also deletes those items used only with the Q-4 radar. The objective TOE represents a fully modernized TOE at that point. However, the objective TOE continues to change as Department of the Army approves new items of equipment for inclusion in TOEs.

You can identify LTOEs by the "L" in the sixth position of the standard requirement code (SRC), for example, 06302L000. These TOEs supercede the J-edition TOEs most unit modified tables of organization and equipment (MTOEs) are built from now. They include updated doctrine as well as new equipment requirements.

Specific Items of Interest

Aviation Brigade Fire Support Structure. The fire support sections (FSS) for the aviation brigade, cavalry squadron and its ground troops and the attack helicopter battalions (AHBn) are now in the headquarters and headquarters battery (HHB) of division artillery TOEs. All divisions have an aviation brigade FSS consisting of a major, a sergeant first class and two specialists. For each AHBn in the division, there's a FSS with a captain and sergeant first class. The Chief of Staff of the Army directed this section contain only two people because of personnel strength constraints. The cavalry squadron FSS in heavy divisions and the air reconnaissance squadron FSS in airborne and air assault divisions have a captain, a sergeant first class and two specialists. However, the light division air reconnaissance squadron FSS has only three personnel; it lacks the second specialist. The two cavalry troop fire support teams (FISTs) in the heavy divisions and the ground-troop FIST in the airborne division each have a lieutenant, staff sergeant, specialist and private first class.

Eight-inch Howitzer Extractor. The extractor atomic projectile H4196 is no longer authorized for inclusion in TOEs. Units retaining a requirement for this device must order it as a special tool, paying for it with unit funds, using *TM 9-1100-204-20P Organizational Maintenance and Repair Parts and Special Tools List for M454 Atomic Projectile and M455 Training Atomic Projectile* (reprinted with Basic included C1-6) as authority. The national stock number (NSN) is 1110-00-864-2259.

HEMTT Ring Mount. The ring mount for the heavy expanded mobility tactical truck (HEMTT) is *not* a TOE item. Units can order it using NSN 1005-00-701-2810. The part number is 1161-4953. It's a Class 2, nonexpendable item, costing $2,716.

A Counterfire Concept for Light Divisions

by Major Thomas J. Costello

The introduction of the light infantry division (LID) into the Army's force structure has provided a new dimension of capability for rapid deployment worldwide to meet a variety of contingencies. The LID, configured to deploy in its entirety in some 500 C-141 aircraft sorties, can respond quickly to demands from across the "spectrum of conflict."

Obviously, we didn't achieve this capability without cost. The most significant cost is the austerity of the division's design. A typical LID mission statement reads as follows: "Rapidly deploy as a light infantry combined-arms force to defeat enemy forces in a low-intensity conflict and, *when properly augmented*, fight and win in a mid-to high-intensity conflict" (emphasis added). The LID is able to sustain combat operations in any low-intensity conflict, but operations in the middle and high ranges of the spectrum offer special challenges. For the light artilleryman, a unique challenge thus far inadequately addressed by current doctrine is the counterfire challenge.

"Light" Counterfire Problems

The typical response to questions about light counterfire is that in low-intensity conflict it will pose no challenge, while in any more severe test, the corps augmentation will solve the problem. We in the 10th Mountain Division (Light) Artillery find this response unsatisfactory for a number of reasons.

- The escalation from low- to mid-intensity in a future war could occur more quickly than our ability to respond, leaving the LID in a fight exceeding its design criteria but nonetheless ongoing.
- Certain contingency missions for some light divisions place them in a theater that will be engaged in mid- or high-intensity conflicts. Although the anticipated missions don't place the LID on today's forward edge of the battlefield (FEBA), tomorrow's missions could bring such a need.
- Higher priority requirements could drain scarce corps assets from their intended mission of augmenting a LID, in which case it must make the most of its organic weapons and equipment.

These organic weapons and equipment in a counterfire battle are not impressive. The structure of a typical LID Artillery is shown in Figure 1. The general support (GS) battery is organized and equipped to operate as two separate four-gun platoons. To enhance the division artillery's (Div Arty's) capability, a target acquisition detachment (TAD) is being designed and fielded for the light divisions. This corps unit, which is to be stationed with its supported Div

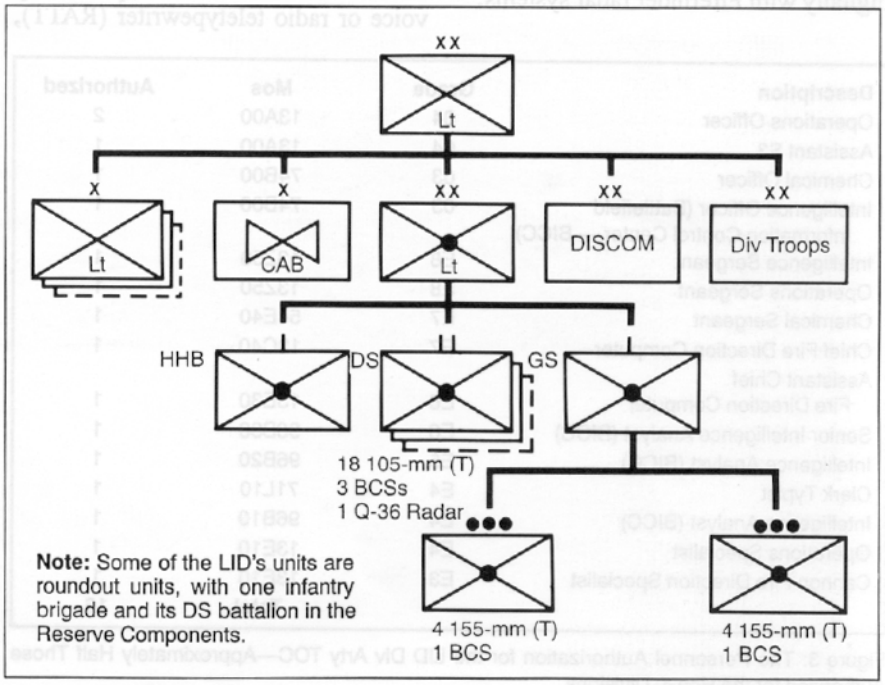


Figure 1: A Typical LID Artillery

Arty, will significantly enhance the LID's ability to execute the counterfire battle successfully. Its structure is shown in Figure 2.

Additional augmentation, in the form of a reinforcing Field Artillery brigade, would add welcome firepower to the division commander's arsenal, but one inescapable fact must remain foremost: no augmentation or reinforcement relieves the division commander of the responsibility to plan and fight the counterfire battle. Meeting this responsibility offers some unique challenges.

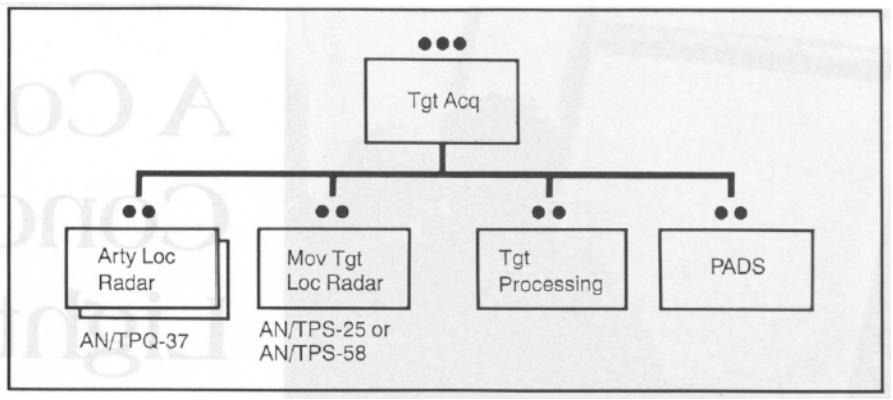


Figure 2: Proposed TAD to be Stationed with the Division Artillery

Communications Challenges

The austere design of the LID is reflected in the communications equipment authorized. The Div Arty tactical operations center (TOC), the doctrinal focus of the counterfire effort, is authorized only four FM radios: two of these are committed to internal Div Arty nets (command/intelligence and operations/fire) and two to division nets (division command and division intelligence). The two Div Arty FM nets are already heavily loaded with voice traffic, even without the significant volume of traffic associated with counterfire.

The FM net load is complicated by the lack of any digital capability at battalion or higher levels. Each firing battery in the direct support (DS) battalions and each platoon of the GS battery have the battery computer system (BCS), which can communicate digitally with Firefinder radar systems.

A soldier of the 1-103d FA (Rhode Island ARNG) receives fire commands on his section chief's assembly, one of the few digital links in the LID.

Using this capability to its fullest advantage, unfortunately, presents some command and control dilemmas. Target intelligence, schedules and fire mission data all must be passed by voice or radio teletypewriter (RATT), neither of which offers the advantages of digital communications.

Description	Grade	Mos	Authorized
Operations Officer	04	13A00	2
Assistant S3	04	13A00	1
Chemical Officer	03	74B00	1
Intelligence Officer (Battlefield Information Control Center — BICC)	03	74B00	1
Intelligence Sergeant	E8	13Z50	1
Operations Sergeant	E8	13Z50	1
Chemical Sergeant	E7	54E40	1
Chief Fire Direction Computer	E7	13C40	1
Assistant Chief Fire Direction Computer	E6	13E30	1
Senior Intelligence Analyst (BICC)	E6	96B30	1
Intelligence Analyst (BICC)	E5	96B20	1
Clerk Typist	E4	71L10	1
Intelligence Analyst (BICC)	E4	96B10	1
Operations Specialist	E4	13E10	1
Cannon Fire Direction Specialist	E3	13E10	1
		Total	**16**

Figure 3: The Personnel Authorization for the LID Div Arty TOC—Approximately Half Those Authorized for the Heavy Divisions

Force Structure Challenges

Austerity in communications is matched by austerity in personnel. The personnel authorization for the light Div Arty TOC is shown in Figure 3. This is approximately half of that authorized for a mechanized or armored division artillery, and yet the light Div Arty has the same doctrinal responsibilities for operations, fire control, targeting and counterfire. It's easy to see from this simple comparison why counterfire is often placed in the "too hard" box.

Again, the chronic shortage of personnel is compounded by the lack of an automated fire planning or fire control capability, such as a light tactical fire direction system (LTACFIRE) or the advanced Field Artillery tactical data system (AFATDS). While these automated systems promise future solutions, we must "make do" with what we have for the foreseeable future. We must conduct 100 percent of our fire planning, targeting, operations and fire control manually.

Arrival of the TAD will provide some relief. Its processing section (shown in Figure 2) will work in the Div Arty TOC and provide the trained personnel to perform a critical function that we now must take "out of hide."

Light Counterfire Tactics and Techniques

The unique blend of new and old in the LID (particularly the partial digital capability at firing-battery level in counterpoint to the manual processing required at battalion and Div Arty) mandates a "hard" look at better ways

of doing business. The 10th Div Arty takes the counterfire mission seriously, devoting considerable effort to producing a viable counterfire capability within the current force structure. In many instances the tactics and techniques that have emerged are not new, but are those that have stood the test of time.

Allocation of Radars

One of these venerable techniques is the estimate of the situation and consideration of the factors of mission, enemy, terrain, troops and time available (METT-T). A second is a variation of the organization of Field Artillery assets for combat. In this case, however, the assets are not howitzers, but radar sets. Some of the METT-T factors that influence the Div Arty commander's decision about radar allocations are in Figure 4. When examining these factors, he keeps in mind that the traditional considerations for organizing artillery for combat also apply to allocating radar assets.

Decentralized Control. In a low-intensity conflict against an enemy lacking sophistication and firepower, the counterfire mission would primarily focus on enemy mortars and, possibly, a limited number of cannon and rocket artillery. The Threat is such that the counterfire mission could be decentralized at the brigade level, with the organic Q-36 radar's reporting directly to and being controlled by the DS battalion TOC. The Div Arty role in this situation would be limited to ensuring comprehensive coverage of the battlefield; augmenting the battalion Q-36 capability with Q-37 coverage provided from the corps TAD, if present; and providing weight to the main effort, if one develops, by positioning additional assets as required. In a nonlinear low-intensity-conflict battle, augmentation would be required to provide 6,400 mil coverage, since the three Q-36 radars can cover only 4,800 mils at full sector scan. The Div Arty would, as in other situations, handle calls for fire beyond the range of the DS battalions by passing the mission to the GS battery.

In a mid-intensity conflict, even with augmentation, the LID will face an enemy having artillery assets equal to or greater than its own. The difference between these two scenarios is largely a matter of degree; most employment considerations are the same, so few distinctions need to be made.

Mission	Low-, Mid- or High-Intensity Peacekeeping, Conventional or Counterguerrilla Offensive or Defensive
Enemy	Artillery Order of Battle Opposing Systems ● Mortars ● Cannon ● Air ● Multiple Rocket Launchers (MRL) ● Caliber ● Range Direction-Finding Capabilities Other Radio-Electronic Combat Capabilities
Troops	Reinforcing Artillery Assets Availability of TAD Competing Demands for GS Battery ● Counterfire ● Special Munitions Capability - Family of Scatterable Mines (FASCAM) - Copperhead - Dual-Purpose Improved Conventional Munition (DPICM) - Rocket-Assisted Projectile (RAP) ● Extended Range ● Reinforcing Fires ● Rear-Area Combat Operations (RACO)
Terrain	Nature of Battlefield ● Linear ● Nonlinear Geographical Spread Versus FM Capability Sectors of Search Terrain Masking Radar Positioning
Time	Closure Time for All Division Elements Into Deployment Area Arrival Time of Reinforcements and Augmentation Assets

Figure 4: The Div Arty commander's allocation of radar assets for combat is based on METT-T.

Members of the 2-7th FA march-order their Q-36 radar antenna.

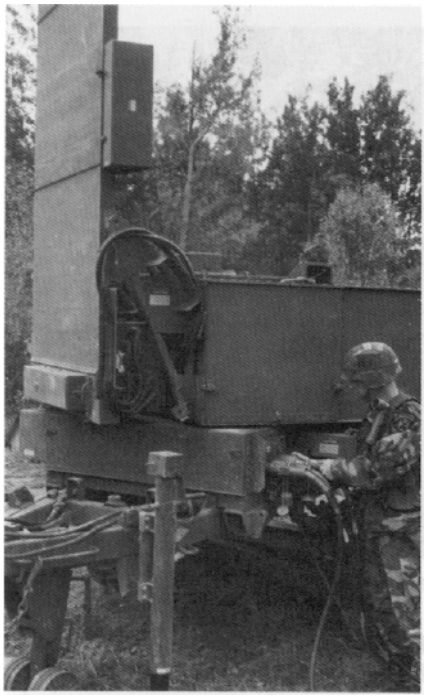
Centralized Control. As the type of conflict moves along the spectrum from low intensity to something higher, the need to centralize control of the radar assets increases correspondingly. The emissions from the Firefinder system make it extremely

vulnerable, while its capabilities make it a high-value target.

Careful positioning can reduce some of the unwanted emissions, but survival of this precious asset against any enemy with a direction-finding capability will hinge on carefully controlled emission patterns and cueing, frequent moves and smart terrain-radar positioning. To cover the battlefield with three organic Q-36 radars or with the three Q-36s and two Q-37s from the corps TAD, we must coordinate their positioning and movements above battalion level. Thus, the Div Arty TOC enters as a key player.

Any mid- or high-intensity battle necessitates centralized control of all the radar assets in the Div Arty. Doing so assures we can position the radars to cover the battlefield, have them cue on a common schedule (based on an authoritative time "hack") and coordinate their moves to permit continuous coverage. Careful cueing, combined with the impressive capabilities of the Firefinder system, offer possibilities for comprehensive coverage and increased survivability.

Radar Capabilities. The system capabilities offer communications advantages to the LID by allowing the planner to limit the flow of target intelligence from any one system to the essential level, which eliminates



The Q-36's ability to establish nine zones can reduce the redundancy of information processed at the Div Arty TOC.

duplications and minimizes the flood of information. This technique can best be described as careful zone management.

The Firefinder can establish and retain up to nine distinct zones in its memory. These zones can be any combination of four types:

- *The censor zone (CZ)* instructs the on-board computer to ignore any fires generating from that zone.
- *The call-for-fire zone (CFFZ)* instructs the computer to generate a fire mission on any source of fires from that zone. This is sometimes referred to as the priority zone, and when programmed to do so, the radar can transmit digitally the fire mission generated from the zone to a BCS.
- *The artillery target intelligence zone (ATIZ)* instructs the computer to produce a grid and altitude for any source of fires emanating from that zone, but not to generate a fire mission. The target grid then is passed as intelligence.
- *The critical friendly zone (CFZ)* is used to designate areas of particular value to the friendly forces. The computer uses the impact prediction function to determine if a hostile trajectory will impact in one of these zones. If it will, the computer immediately generates a fire mission in retaliation to minimize the threat to friendly forces.

An additional capability of importance, particularly in a manual target-processing operation, is the variable sector of scan capability of the Fire-finder. The operator can control his sector of scan from 225 to 1,600 mils. With careful zone management, this capability helps the planner tailor the coverage of the battlefield and minimize overlap, eliminating duplication and enhancing survivability.

We can enhance radar survivability by using zones and, more importantly, by assigning narrower sectors of search to each radar. The reduced radiation produced by the narrow sectors lessens the probability of the enemy's detecting the radars and complicates his direction-finding efforts.

Radar Deployment Order. We easily can establish and promulgate the limits of the search sectors and the location and dimensions of the various zones by using the radar deployment order, a form designed by the Target Acquisition Department of the Field Artillery School, Fort Sill, Oklahoma (Figure 5). In most cases, it is a simple matter to establish zones that conform to the maneuver graphics, simplifying overlays and enhancing understanding of responsibilities. As the form indicates, we can define each zone by a maximum of six grid points, allowing it to assume virtually any geometric shape. Tying the zone to the appropriate fire support coordinating measures, such as the coordinated fire line (CFL), further integrates the radar coverage into the fire support plan and facilitates attacking target at all levels.

Target Processing

The Div Arty TOC remains the doctrinal focus of the counterfire effort. Here, too, time-tested techniques have proven their validity.

Counterfire Reference Grid. Although the counterfire reference grid (CRG) has fallen into disuse with the advent of careful zone management, it's still a useful tool to provide a common frame of reference, and the 10th Div Arty uses it. While ammunition constraints might preclude our attacking every target in a reference grid (as was once the doctrinal solution to the counterfire problem), the grid can focus our attacks yet doesn't require so much effort that it becomes counterproductive.

Standard Firing Chart. A second venerable tool is the standard firing chart we use with the crater-ray overlay. While the crater-ray overlay facilitates comparing suspected target locations with the terrain, it isn't precise enough to locate specific targets. We plot crater rays on a standard firing chart using a range-deflection protractor and transfer suspected targets generated by two intersecting rays to the target-indicator overlay. We then compare the same terrain with the crater-ray overlay but can locate targets more precisely.

Target Record. We record target information on DA Form 4695 Target Card as we receive it from observers or radar target, shell or intelligence spot reports. We then process the information essentially as outlined in *FC 6-20-10 Fire Support Targeting* (May 1985). The distinction in the LID's counterfire targeting isn't how we internally process information in the TOC, but rather how we employ the division's scarce resources.

(MAY BE CLASSIFIED WHEN FILLED IN)

(1) Section: (TPS-25/Q-36/Q-37)		(2) Mission:			
(3) Location: (Primary)			(Alt/Sup)		
(4) Search Zones	///// Left /////	//// Right / ///	////// Min /////	///// Max /////	
(a) Primary AZ	(1)	(2)	(3)	(4)	
(b) Alternate AZ	(1)	(2)	(3)	(4)	
(5) Emission Limits	(a) Time		(b) # Tgts		
(6) Cueing Agency (By Call Sign, in Order of Priority)	(a)	(b)	(c)		
	(d)	(e)	(f)		
(7) Reporting Channels	(a)		(b)		
(8) Status	(a) Up:	(b) Down:	(c) Moving:		
(9) Zones/Grid Points	//				

	(1)	(2)	(3)	(4)	(5)	(6)
(a)	/	/	/	/	/	/
(b)	/	/	/	/	/	/
(c)	/	/	/	/	/	/
(d)	/	/	/	/	/	/
(e)	/	/	/	/	/	/
(f)	/	/	/	/	/	/
(g)	/	/	/	/	/	/
(h)	/	/	/	/	/	/
(i)	/	/	/	/	/	/

(MAY BE CLASSIFIED WHEN FILLED IN)

Figure 5: The Radar Deployment Order

The Counterfire Concept

The unique blend of capabilities and limitations inherent in the LID force structure present what can be a maddening dilemma to the Div Arty commander, especially when facing an enemy with some degree of sophistication. The digital capabilities of the radar and the firing batteries lend themselves to a direct link, thus maximizing the advantages of digital communications systems while speeding the target engagement process.

With no digital communications in its command and control structure, the Div Arty could decentralize totally and remove the TOC at each level from the command and control process—hardly desirable. Alternatively, maintaining a degree of command and control requires the use of FM voice and, therefore, abandons the advantages of digital transmission. The 10th Div Arty contends the answer lies somewhere in between.

The Div Arty commander's counterfire concept maximizes the use of the GS battery (and any reinforcing Field Artillery) to fight the counterfire battle. He implements his concept in several ways.

Linking Radars

Essentially, the counterfire battle links one radar (either a Q-36 or, preferably, a Q-37 of the TAD, if available) to each platoon of the GS battery. A position and azimuth determining system (PADS) party is dedicated to each radar-firing platoon team to provide survey support for the frequent moves anticipated for survival.

Through zone management and clearly delineated commander's attack criteria, targets identified for immediate attack are passed to the associated firing platoon digitally with a mission-fired report passed from the platoon to the Div Arty TOC by voice after the fact. This offers the advantages of firing on the target as rapidly as the system will allow and passing the information necessary to maintain command and control, ammunition management and current intelligence as the situation permits.

While we still must use FM voice at some point in the process, this point is after we attack the target. Since the information is less time-sensitive than that for a fire mission, we can wait until the net is clear enough to pass it. The radar section passes targets not meeting the criteria for immediate attack by FM voice to the Div Arty TOC for review and possible scheduling.

Because the Firefinder system can't distinguish the caliber or type of threat weapon, we must determine targets for immediate versus later attack by location. The commander thus emphasizes our using critical friendly, call-for-fire and artillery-target-intelligence zones.

If the GS battery is linked to the Q-37 systems of the TAD, the Q-36 sections can remain under the control of the DS battalion. The sections support the maneuver commander by focusing their efforts against mortars, an enemy system posing the greatest threat to the frontline units. By establishing Q-36 zones extending out to the maximum range of the opposing mortars, the system, in effect, identifies the "mortar belt."

Using the Maximum Range Line

Another capability of the Firefinder is its establishing a maximum range line, which makes artillery targets further from the forward line of own troops (FLOT) "invisible" to the Q36 radar operator, since the Q-37 systems are searching for them. Again, the goal is to ensure comprehensive coverage, rapid target engagement and clear demarcation of responsibilities, all without overloading a system that has limited capabilities. (A graphic portrayal of this concept is shown in Figure 6.)

We can't accomplish this separation of responsibilities by using the Div Arty operations-fire net because it quickly becomes overloaded and breaks down. The Firefinder has two FM radios and can link directly with its

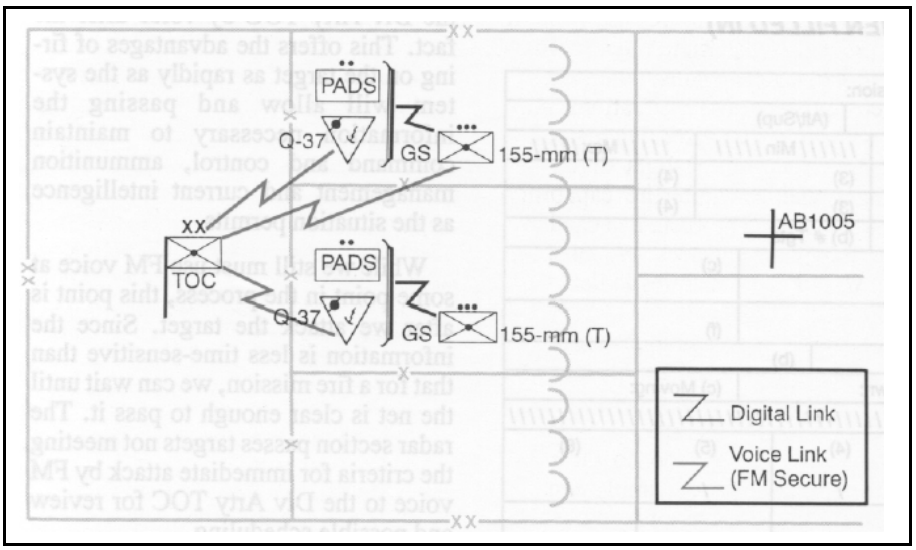


Figure 6: The Firefinder radar establishes a maximum range line, making targets farther from the FLOT "invisible" to the Q-36 radar operator since the Q-37s are searching for them.

associated fire unit (when one is established) while operating in a second net as directed.

The shortfall is in the Div Arty TOC, which sorely needs a fifth radio to establish a Div Arty counterfire net (currently "taken out of hide"). The Div Arty TOC operates on this counterfire net with the two platoons of the GS battery and the two radars linked to them. The other radars also operate on this net, when directed, to facilitate passing artillery target intelligence. The TAD will provide this radio with a dedicated net when it's fielded.

The Concept Test: Ocean Revenge I

The 10th Div Arty has tested some of these concepts to validate and develop our procedures and to develop others, along with the counterfire portion of our tactical standing operating procedures (TACSOP). In an exercise named Ocean Revenge I, we teamed up with the 1st Battalion, 103d Field Artillery, Rhode Island Army National Guard.

Conducting the Exercise

The exercise paired two firing elements of the 103d, each with its own BCS-capable fire direction center (FDC), with the Q-36 radar sections of the 1st and 2d Battalions, 7th Field Artillery, the 10th Div Arty's two Active Component DS battalions. The exercise was devoted exclusively to counterfire, with 100 percent of the missions conducted by radar. To eliminate the need for human observers, the radar sections used the field-exercise mode to generate targets and the friendly fire mode to observe the missions.

Mission data was sent via FM digital to the firing elements (which simulated the operations of the GS battery platoons) while target intelligence was passed via FM voice to the Div Arty TOC, an operating procedure already described. To fully exercise the TOC, a control cell passed artillery target intelligence (such as target indicators, confirmed targets obtained through intelligence channels or crater reports from front-line observers) over the doctrinal FM nets. The intent was to stress the system and shift the TOC's operation to levels of intensity approaching or exceeding what might be expected in a mid-intensity conflict.

Learning Lessons

The experience of this brief exercise taught the Div Arty several valuable lessons:

- Conducting a full range of functions with the level of manning currently authorized is a formidable challenge.
- The absence of automation, which could help TOC personnel execute many of the routine functions, is an almost insurmountable complication to an already difficult process.
- A dedicated counterfire net is absolutely essential. We used one during this exercise with only the radars, firing platoons and Div Arty TOC operating on it. The volume of traffic on this net was significant, even though the exercise was dedicated exclusively to counterfire. To the TOC's surprise, it discovered the other doctrinal nets also were busy with intelligence and various other traffic, though none of the division-level or DS battalion command posts were participating in the exercise. It was immediately evident that if the traffic on the counterfire net had been added to the traffic on the other nets, the system would have "broken." This lesson was so clear that the 10th Div Arty has submitted a modified table of organization and equipment (MTOE) request to add the

During Ocean Revenge I, an M198 howitzer of the 1-103d FA sends the ideal response to any enemy weapon system—rapid counterfire.

fifth radio and establish a formal counterfire net in light divisions.

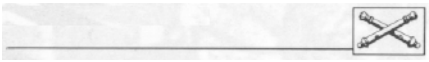
- Cueing schedules and coordinated radar moves can be made to work. The Q-36 radar, despite its state-of-the-art technology, requires significant time to move and re-establish. We clearly need centralized control of the radar sections since that's the only way we can cue and move to ensure continuous coverage and reasonable survivability.

Conclusion

Counterfire is, and will remain, the doctrinal responsibility of the Div Arty commander. In this, the light division is no exception.

Despite the pervasive assumption that the LID will fight only in low-intensity conflicts against an unsophisticated enemy, future situations may well dictate otherwise. Disregarding the importance of the light divisions' having a viable counterfire capability "wishes away" a problem that can have devastating consequences. We must develop workable procedures to deal with the problem.

The tactics and techniques shared in this article are not necessarily conclusive. Doctrinal development is everyone's responsibility, and as "light" doctrine emerges, so too do the most effective techniques for implementing it. If the 10th Div Arty procedures and approaches to counterfire spur a doctrinal debate, then we'll have contributed to finding a viable counterfire concept for light divisions.



Major (P) Thomas J. Costello has been the S3 of the 10th Mountain Division (Light) Artillery since its reactivation at Fort Drum, New York, in May 1987. He also has served as the S3 and Executive Officer of the 2d Battalion (M198), 31st Field Artillery, 101st Airborne Division Artillery, Fort Campbell, Kentucky. Major Costello is a graduate of the Field Artillery Officer Advanced Course, Fort Sill, Oklahoma, and the Command and General Staff College, Fort Leavenworth, Kansas.

The NBC Battle Run "Tropic Thunder Style"

You just cleared an ambush where you lost two-thirds of your battery. Your vehicle and two howitzers with prime movers are all that remain. You contacted battalion, and they instructed you to move to the rear area to get replacements and refit.

There has been heavy fighting along the route you must take to the rear. The enemy is known to have chemical munitions and already may have used them. In addition, your maneuver forces are on the offensive, and you must be prepared to support those operations with fires while enroute.

This sounds like a Redleg's worst nightmare, yet this fictitious scenario set the stage for a challenging training event for the soldiers of A Battery, 7th Battalion, 8th Field Artillery, 25th Infantry Division (Light) Artillery "Tropic Thunder," stationed in Hawaii.

Faced with conducting the annual nuclear, biological, chemical (NBC) battle run and in an effort to integrate and combine training, we decided to stray from the normal NBC battle run and tailor it specifically to the Field Artilleryman. Instead of having our soldiers move through the woods in a wedge formation encountering NBC hazards (conventional infantry style), we put them in a situation they might encounter in actual combat.

Evaluation

We divided the battery into three groups to evaluate it more thoroughly. We evaluated the entire battery, including the leadership. The battery commander and the first sergeant led the first group with their vehicle. The executive officer and the chief of firing battery led the second with the battery operation center (BOC) vehicle and the fire direction officer and the gunnery sergeant lead the third group with the fire direction center (FDC) vehicle.

To evaluate the readiness of each of our sections and to emphasize section-chief-level leadership, we evaluated the battery as sections, not as individuals.

Battle Run Conduct

As the first group prepared to depart on the battle run, the other two groups participated in concurrent training. Shortly after the first group's departure along the battle-run route, at a designated point an emergency call for fire was relayed to the lead vehicle. This event forced the group to pull off the road (again at a designated point) and conduct an emergency mission, a "hip shoot."

As each section pulled into it's respective position, it found itself in an obviously contaminated area. This is where the NBC evaluation began, and it followed a logical sequence. Ever-present was the fire mission the section had to accomplish, as well as the prescribed NBC common tasks. After the fire mission, the group had to move to a decontamination point, wash down its vehicles and exchange its mission-oriented protective posture (MOPP) gear. The battle run ended with the section's reacting to a nuclear explosion. We repeated the sequence for the second and third groups.

Conclusion

Our soldiers met this innovative and challenging alternative to the usual NBC battle run with enthusiasm and a competitive spirit. Challenging the leadership at every level, particularly at the section level, is of vital importance and must be a high priority, particularly for leaders assigned to light divisions. Combining this priority with highly motivated soldiers resulted in a very successful NBC battle run, "Tropic Thunder" style.

Michael A. Sharp
1LT, FA
XO
C Btry, 7th Bn, 8th FA

Redleg Recollections

Dear Redlegs,

I really enjoyed my trip back to old Fort Sill. So many people were so cheerful and treated me like an old friend, although I had never seen them before. I'm taking this opportunity to visit with you a few minutes and tell you why I know that the Artillery Center has the best artillery school in the world.

I think we held our own against the Germans in World War I. But in World War II, the artillery of the 2d Infantry Division was remarkable and gave me a vision of what artillery could do.

The 1st Division, which had fought in Africa, Sicily and Italy, landed on Omaha beach on D-Day. The 2d Division landed on D + 1.

They fought side by side until August 16 when the German Army broke down. We fought our way in with the other divisions as fast as we could. When we had advanced about 40 miles, we came to Hill 192. It was some 600 feet high and heavily wooded. The Germans had flown in their elite parachute troops to defend it and make it appear impregnable. They were all in front of the 2d Division, although our two flanking divisions advanced as we did.

The two flanking divisions were authorized to fire 30 rounds per gun; the 2d Division was authorized unlimited ammunition. General George P. Hayes was really thrilled with the unlimited ammunition. Some days he had been authorized as few as six rounds per gun. He fired about 24,000 rounds on Hill 192, arranging with the infantry for signals to raise the barrage every 50 yards (site adjusted). When the infantry crawled up closer, they would fire another signal. Slowly they reached the top and started down the south side. We took the Hill in one day. The Germans couldn't stay there without being killed or wounded.

Then we began to plan to use the artillery to destroy the enemy and save the infantry to locate the enemy and wait for the artillery to destroy him. It surely worked well. It seemed that General Hayes worked the time-on-target barrage perfectly. Regardless of where our guns were positioned, he could make 48 shells explode together. The Germans began to dread that. Their troops would think they were hidden until a time-on-target barrage came down on them.

We captured a German memorandum that told about an American sergeant from the 23d Infantry Regiment who worked through the infantry line, located a German battery and radioed back to our artillery to destroy the battery. Then he repeated his calls until he had destroyed four batteries. From his radio signals, the Germans tracked him down and took him prisoner. The German colonel's note said, "If they [the Americans] can do it, we can do it [deliver effective countefire]."

The greatest test our artillery ever had was in the second day of the Battle of the Bulge. We were so busy, we hardly knew what was going on until it was over. On December 12, our orders told us to break the Siegfried Line between Krinkelt, Belgium, and Wehlerscheid, Germany. We had to attack north, northeast and on December 16, our 9th Infantry entered Wehlerscheid. We didn't know we

were through the Line; we thought we were still in it. The Germans wasted the first day of the battle, but on the 17th, a German corps struck toward Krinkelt, with its 1st and 12th Armored (called Panzer) Divisions and its 277th Volksgrenadier Division. The Germans put their armored troops in front. We didn't attack that way.

As they came in, our artillery just shot them to pieces. You can't see a man in a ditch, but you can see a tank rolling along a road. When the action slowed down, the Germans realized they had lost 67 tanks in that little village of about 10 families and gave up the attack. In just three hours, they had suffered a terrible defeat.

While that was going on up front, some German infantry crossed the river (really a creek) at Buellingen and came up behind our artillery, apparently to take the 2d Division Headquarters. There was a rush to get every clerk and sergeant out to repel the attack. I think what saved us was our artillery, especially our 155-mm cannon. Our soldiers wheeled some of their guns around 180 degrees and shot the Germans in the back, and the Germans "beat it" back across the river. After that, they didn't come back on the north side. In my imagination, I could hear the German infantrymen cursing their artillery for shooting them in the back.

I have written too much, but I want to tell you another case. After the Bulge was over, we started a 38-day battle to reach the Rhine. It was really tough, but the closer we got to the Rhine, the weaker the German defense.

One day about mid-afternoon, our 38th Infantry was approaching a town. A reporter interviewing the colonel said, "I suppose you are anxious to start the attack." The colonel said, "No, I am not." The reporter said, "I thought you were anxious to get it over with." The colonel said, "I have 3,000 good men in this regiment. When I attack, that means some of them will be killed and five times that many will be wounded. I'm not anxious to lose them; but if the General says attack, that's what we'll do."

There was no pressure or rush. The 38th Infantry (far back) surrounded the town and moved in closer as dark approached. Then the colonel sent in a message: "You are completely surrounded and hopelessly outnumbered; will you surrender now or shall the artillery begin firing?" A short time later the Germans replied, "We shall surrender now." We used our artillery to scare the enemy into surrendering and save our infantry. The enemy knew our artillery could destroy them.

The above approach did not apply at Brest. Our 8th Corps went from Normandy around to Brittany to capture Brest. But we could not get artillery ammunition, so it had to be an infantry battle. Eventually we took Brest anyway, but in many ways our infantry took an awful beating.

You can depend on your artillery to destroy the enemy.

I wish you constant success.

Sincerely,

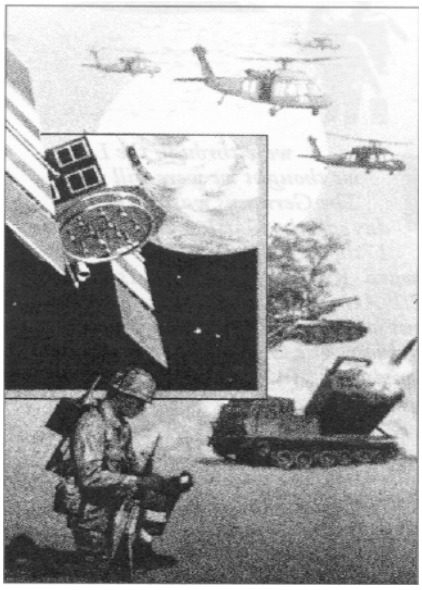
Homer S. Reese

COL (R), FA
Heavener, OK

Editor's Note: Ninety-three-year-old Colonel Reese wrote this letter to the Chief of Field Artillery in September 1988. He served in World Wars I and II and was the G4 of the 2d Infantry Division during the Battle of the Bulge. Colonel Reese retired in 1946.

Navigation for the Future: **The Global Positioning System**

by Captain Gregory C. Hoscheit



Remember the time that, due to unforeseen circumstances, you were suddenly uncertain of your location? Perhaps you were leading a convoy in the morning fog, regrouping after a night insertion or occupying featureless terrain without survey. Worst of all, perhaps it was in daylight on familiar terrain, and between talking on the radio, plotting new positions and reviewing the tactical situation, you lost track of the turns your driver had made.

Now imagine you had a small, portable device that continuously gave your location within a 10-meter circular error probability (CEP). Imagine it could determine your speed to .4 kilometers per hour and your direction of travel. Unlike some inertial reference systems such as the position and azimuth determining system (PADS), you wouldn't have to stop periodically to allow it to correct azimuth accuracy. Though the device couldn't give you an azimuth, you could easily carry it and wouldn't be limited to using it in terrain PADS could traverse.

Or how about if this device could tell you the direction to go whether you were on foot or in a land vehicle, aircraft or ship? You could tell it the grid you want to go to, and it could give you continuous directions on how to get there. For example, it might tell you to go left 500 meters and then forward three kilometers. What if it constantly corrected its directions to compensate for your circumventing terrain obstacles or changing your route because of battlefield requirements.

Think what it would be like if an advance party could carry this device, and a battery or platoon could occupy positions immediately with great accuracy in any part of the world in any weather condition. The device would complement PADS and the modular azimuth positioning system (MAPS) to provide highly responsive, accurate artillery fires in remote areas of the world. (This device wouldn't replace a map or diminish the need for map-reading skills, but it would help the soldier accomplish his mission.)

Imagine that this device is tied to the universal time coordinate (UTC) and always is accurate to .0000005 seconds. (UTC is the atomic time standard maintained by the US Naval Observatory and the British Royal Observatory.) Greenwich Mean Time is extremely close to UTC, and this device would provide accurate time transfers. You easily could mass supporting fires with everyone on the same time standard, to include naval and close air support (CAS).

The Device

Science fiction? No longer, thanks to the Navstar Global Positioning System (GPS). During the last five years, we've completed the research and development phase for seven Block I satellites. We've built most of the operational Block II satellites, and like other satellite systems, we're waiting for the limited number of launch vehicles to put them in orbit. The first launch is scheduled for early 1989. Every six weeks, we'll launch another satellite until we have a constellation of 21 Block II satellites and three spares.

The GPS will provide worldwide, all-weather, highly accurate three-dimensional navigational and timing information for the military. Civilians now are using GPS for positional accuracy. For example, commercial enterprises use GPS to control their vehicles.

During 1989, the Army will distribute a limited number of user sets for training and development. However, units can expect to start receiving the GPS equipment in 1992.

How GPS Works

The new satellites have four atomic clocks to assist the navigation payload. The key to navigational accuracy is highly accurate time measurements to determine distances. The GPS receiver's clock is synchronized to the satellite's clock. The satellite sends a time-tagged digital pattern to the user set, and the GPS receiver measures the time the signal took to arrive from the satellite.

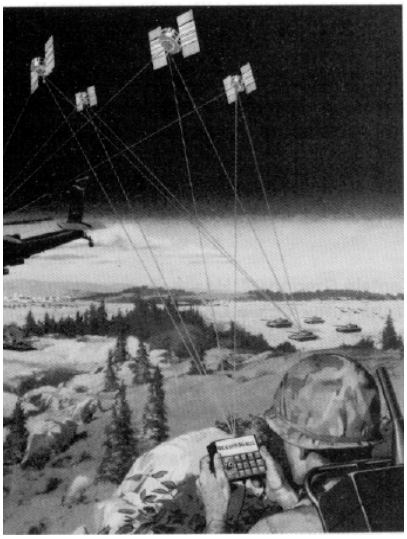
Since radio transmissions travel at the speed of light, we can convert this time difference into a distance to the satellite. The GPS receiver knows the exact location of the satellite and, with additional satellites, can triangulate a position. The accuracy of the timing signal is so important that three nanoseconds

(three billionths of a second) equates to one meter. Like a radio station, the satellite continuously broadcasts these signals, and anyone with a GPS receiver set can use the data to determine a location.

Usually, we must compute the value of four variables to determine a precise three-dimensional location. These are north-south and east-west directions, the altitude and any time error. With four of the satellites in the proper geometric configuration in view at all times, the GPS receiver solves these problems, much as one would compute the unknown values in four simultaneous equations, only much faster.

The highly accurate timing signal is sent in a digital transmission and is called a "P" code. In wartime, the P code will be encrypted to prevent the enemy from confusing our receivers with false signals. The satellite also sends a coarse acquisition (C/A) code that civilians use to navigate and the military uses to acquire the P code or navigate.

The message on the P code is transmitted so fast that it's difficult to acquire alone. The C/A code is easier to receive and synchronizes the user set to pick up the P code. An additional security feature also provides for the deliberate introduction of positional errors on these codes to prevent unauthorized use of GPS. Authorized military and civilian user sets have the algorithm to decode these errors.



ARINC Research Corporation

GPS Missions: Reconnaissance, Targeting, Navigation, Survey, Command and Control, Rendezvous. Search and Rescue and Tactical Approach and Landing

Field Artillery and GPS

For the past five years, the Field Artillery School, Fort Sill, Oklahoma, has been active in testing and developing the Navstar GPS manpack vehicular (M/V) and the SLGR user units. The School has just completed a successful test on the MAPS hybrid (MAPS/GPS). This system is an electronic integration of the MAPS and the GPS M/V. The GPS initializes and (or) updates the MAPS automatically or on command.

In anticipation of a fast-moving battlefield and "Shoot and Scoot" tactics, the Field Artillery recognizes the need for dependable position navigation (POS/NAV) systems and has identified a requirement for two different versions of GPS.

The first requirement is for a very accurate, medium-size set (10 to 12 pounds, 10 meters CEP horizontal and a 10-meter PE elevation). Sets will be issued to the survey sections of the division artillery headquarters and headquarters batteries, the cannon and MLRS battalions; MLRS, Lance and separate cannon batteries and the target acquisition batteries or detachments. They'll complement PADS by establishing the initialization and update points for PADS when survey control is not available from other sources (e.g., the Defense Mapping Agency (DMA) or the Corps of Engineers Topographic Units).

The second GPS requirement is for a cheaper, less-accurate SLGR M/V, (less than 5 pounds, 30-to-35-meter CEP horizontal and a 20-meter PE elevation). These sets are for the light forces fire support team

The MX 1502 Geoceiver Satellite Surveyor, the GPS user set commercial companies are using now.

(FIST) headquarters, combat observation lasing teams (COLTs) and ammunition resupply sections in all Field Artillery units.

Both GPS systems will have the dual capability of being vehicle-mounted and manportable. The School will begin receiving a limited number of M/V sets in 1989 for training and development.

This month, GPS M/V is undergoing an initial operational test and evaluation (IOT&E) at Fort Huachuca, Arizona, and the SLGR is soon to be tested at Yuma Proving Ground and Fort Huachuca. Further testing probably will be conducted on the SLGR by the Field Artillery at Fort Sill.

If units have questions, contact Jerry D. Holstein in the Office of the Training and Doctrine Command System Manager for Target Acquisition and Support Systems (TSM—TA/SS), Field Artillery School at AUTOVON 639-2953 or commercial (405) 351-2953.

GPS User Equipment

The GPS system may sound complicated, but it is not. GPS has been under development since 1979. Though all satellites are not yet operational, the performance of the satellites in orbit has been excellent. However, the performance of the GPS receivers and the cost of incorporating the required technology have slowed the GPS development.

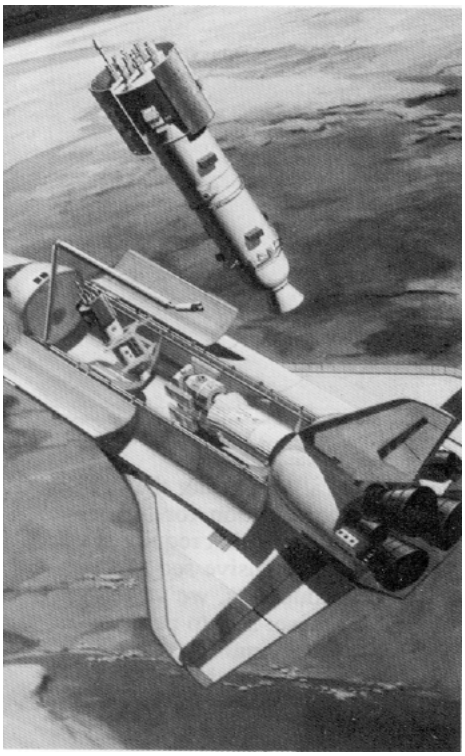
Fortunately, as with calculators and computers, the costs have been dropping dramatically. Fueling the drop is the intense competition for the many civilian applications that require small, reliable and inexpensive sets. In addition to cost reductions, we've reduced the size of the user sets to pocket size, weighing two pounds (still to be tested), and with the development of more efficient computer chips, the size and price certainly will shrink more.

A major factor in the cost of the user sets is the time they take to process the information from the four satellites.

The satellites send their precise location and an almanac with the location of the other satellites. This speeds the search and lock-on of other satellites after the first one has been acquired.

Fast moving aircraft, such as F16s and B1s, must process the data simultaneously to determine a location. With the speed of today's aircraft and their ability to maneuver rapidly, positional information from five seconds ago is meaningless, especially in low-level flight. For this reason, we've developed sophisticated user sets with five channels so the GPS receiver can process the information from the visible satellites simultaneously.

Land forces move at a relatively slower pace. Therefore, the requirement for simultaneous processing of the satellite transmissions is not as critical. Soldiers performing some Army functions can use cheaper, less sophisticated sets. For example, the small, lightweight GPS receiver (SLGR) may have fewer channels, so the receiver must process the information sequentially. This results in a longer time initially to determine a location, but once we establish a position, we can determine any change in location in real-time



Rockwell International

The Space Shuttle in low earth orbit releases two NavStar GPS satellites with propulsion stages attached.

to within about a 30-meter accuracy.

For those needing greater accuracy, there are additional techniques for increasing the accuracy of the GPS recievers. We can increase the accuracy of the military P code to less than one meter, using a technique called differential GPS (DGPS). Basically, a mobile receiver is emplaced on a known location and transmits corrections to other user sets in the area. The corrections are determined from the difference in what GPS signals the location should be and the known position. This technique has been particularly beneficial in surveying remote areas, and surveyors have reported accuracy to within less than one meter.

Survivability

Despite the many peacetime applications, a military system must be survivable to be useful in war. To ensure survivability of the space segment, we've hardened the new satellites against nuclear explosions and laser attacks. Furthermore, the satellites are unlikely anti-satellite (ASAT) munition targets because of the high altitude (10,900 nautical miles) and the size of the constellation. The commands sent to satellites also are encrypted, preventing the Threat from sending unauthorized commands to the satellites.

Though the receivers aren't jamproof, the satellites' transmitters are. The signals from a satellite are in a very high frequency, and the receiver antenna searches for signals from the satellites only in the known directions to the satellite. It would take a jammer with a strength in megawatts within a few kilometers to jam just one satellite transmission, and this jammer wouldn't be able to jam the transmitters of the remaining satellites in view. Also, the GPS user set is passive, which means it gives off minimal radiation that's unlikely to compromise the user's position.

The remaining security concern would be for the control facility at the Consolidated Space Operations Center in Colorado Springs, Colorado. In the event of a catastrophe, the satellites are designed to degrade gracefully. This allows the user to continue using the navigational information for about two weeks if no communication with the satellites is restored. Future satellites will have this capability extended to 180 days.

The Future

The GPS will revolutionize the military and civilian sectors within the next decade. Though not completely developed, the system already is tied to our tactical and strategic defenses for limited operations. If properly used, GPS will greatly enhance the Field Artillery's ability to provide accurate and timely fires throughout the world in support of AirLand Battle.

In addition to determining positions and precise times for delivering artillery fires, combat support vehicles also could carry the GPS receiver with an attached transponder. The transponder would give the driver his position and also periodically emit the location to the logistics operations center (LOC). The LOC would always know the location of the support vehicles, providing command and control for the many isolated vehicles roaming the battlefield. We could put similar equipment on other critical vehicles to update the commander on the vehicle's location, or we could transmit locations using usual communications means.

The applications of GPS are limited only by the user's imagination. Our sister branches also will use this system. For example, the Air Defense Artillery may use GPS with the Patriot missile system and Aviation with the Black-hawk helicopter and other aircraft. The Air Force will use GPS with its aircraft and the Navy with its fleet and missiles. The GPS is here to stay and will benefit every leader on the battlefield.

Captain Gregory C. Hoscheit is assigned to the Army Space Command and is attached to the Air Force Space Command as a Satellite Operations Officer with the Global Positioning Satellite System, Falcon Air Force Base, Colorado. He's a 1988 graduate of the Air Force's four-month Undergraduate Space Training Course, Lowry Air Force Base, Denver, Colorado. Captain Hosheit commanded B Battery, 1st Battalion, 18th Field Artillery, in West Germany. He also has served as an assistant operations officer, battalion and battery fire direction officer and a company fire support officer in West Germany.

Counterfire — A Partnership Approach

by Lieutenant Colonels Eric C. Deets and Richard D. West and Captain Lawrence M. Perecko

In the beginning, the Red Artillery held our infantry and armor forces hostage, not allowing them the freedom to maneuver to defeat the Warsaw Pact forces, as they knew they could. The Commander turned to the artillery and said, "Deliver me from this enemy artillery so my brave forces can achieve their objectives." And the Div Arty [Division Artillery] tried. But lo, it also was supporting the close and deep battles. With its best effort "maxed," it could barely hold the enemy artillery at bay. The Div Arty yearned for a partner to help it in this mighty effort.

The 1st Armored Div Arty did, in fact, try to fight all the fire support battles. It trained on the tactical fire direction system (TACFIRE) until soldiers talked digitally in their sleep. It pared its tactical operations center (TOC) down to a single, 5-ton expandable truck to facilitate survivability. It established a record of 12 minutes for setting up digital communications with at least one subscriber and FM voice. The Communications Platoon streamlined the radio teletypewriter (RATT) nets to allow a jump capability. The single expandable TOC meant the duty officer could see and hear the counterfire battle while he monitored the myriad of other details of a Div Arty at war.

To confirm that the Div Arty could support the Division, an external Army training and evaluation program (AR-TEP) was arranged with evaluators coming from the 210th Field Artillery (FA) Brigade and Division Headquarters. The fire support element (FSE) and five Firefinder radars from B Battery, 25th FA, "drove" the scenario. After three days, the verdict was delivered: "Yes, you can pass a level-one ARTEP, but it takes a 102 percent effort by some of the best-trained soldiers in Europe. Can you promise to deliver that effort during the heat of battle with casualties mounting in the midst of the fog of war?" The Div Arty needed a better solution.

The 1st Armored Div Arty always had a good relationship with the 17th FA Brigade—it always talked about the 17th's sharing the workload. But all the Brigade actually provided was a force artillery headquarters when the Div Arty was moving or out of action. At any one time, one "0-6" FA headquarters was silent on the battlefield. After the ARTEP and seeing the results of the first series of combined operations at the NATO Combat Maneuver Training Center at Hohenfels, West Germany, the Div Arty and Brigade got serious about finding a way to fight the counterfire and all other battles without overloading either headquarters.

The Partnership

To improve planning and execution of the artillery's tasks, the Div Arty and 17th Brigade divided responsibilities for the tasks between the two headquarters. The Div Arty, still the force artillery headquarters, retained overall

responsibility for fire support for the Division and specific responsibility for the close support and interdiction roles. The FA Brigade took responsibility for counterfire. The units under the Brigade now are active in the Brigade TACFIRE for counterfire. The units under the Div Arty, with the exception of the target acquisition battery (TAB), are active in the Div Arty TACFIRE to execute the close support and interdiction roles. This division of responsibilities allows each headquarters to concentrate on a specific task and improves the overall ability to plan and control execution.

1st Armored Div Arty and 17th FA Brigade Counterfire Initiatives

- Divided the force artillery FA tasks.
- Designated the reinforcing Brigade as the counterfire headquarters.
- Synchronized the force artillery TACFIREs and communications.
- Centralized management of radars, thus providing better coverage and enhancing radar survivability.
- Linked Q-36 radars to counterfire battalions.
- Provided counterfire liaison to maneuver brigade TOCs.
- Provided FA Brigade S2 and LNO to Division TOC.
- Provided more effective and responsive fire support to maneuver forces without increasing personnel or equipment.

Target Acquisition

In the past when the Div Arty controlled the TAB, radar command and control was decentralized by attaching a radar to each direct support (DS) battalion supporting a committed maneuver brigade. This radar belonged to the maneuver brigade commander—lock, stock and barrel. When he asked that it radiate to locate artillery affecting his units, he didn't expect to be told, "It isn't our radar's turn to radiate." As a result, the DS battalions moved and positioned the radars with little concern for how the other radar assets were employed. The radar coverage supported only the maneuver brigade's operation and did not, necessarily, support the Division's overall operation.

The Div Arty S2 and the counterfire section planned to try to keep coverage over the entire division zone and to take up slack with the Q-37 radars in zones where radars were moving or down for maintenance. Under our force artillery fire support concept, the FA Brigade operationally controls (OPCON) the TAB with two Q-37 radars linked directly into the Brigade TACFIRE. The three Q-36 radars link into two 8-inch battalion TACFIREs for communications and fire mission processing. Yet, the FA Brigade Headquarters still controls the radars. By making the TAB OPCON to the FA Brigade, command and control of all radars is centralized under one headquarters and provides the Brigade a major source of counterfire targeting information. Elements of the processing section still remain with the Div Arty TOC to help in operations and to be prepared to reassume the counterfire mission.

The FA Brigade controls where the radars position themselves, when they move and when they cue. This way the FA Brigade can optimize radar coverage, reduce target duplication and provide better counterfire support to the Division. Equally important, the centralization decreases radar cueing time and, as a result, enhances radar survivability. The two Q-37 radars link directly to the FA Brigade TACFIRE, cover the entire Division sector and overlap the flanks.

Command and Control

To facilitate command, control and coordination of the counterfire task and the radar assets, the FA Brigade TOC structure is modified. Under this counterfire concept, the operations and intelligence sections combined into one section called the Operations/Intel Cell, much like the one-truck Div Arty TOC previously described. An additional section, called the Counterfire Cell, controls the radar assets and performs the counterfire functions. The Operations/Intel Cell performs the same functions previously performed by the TOC.

Counterfire Cell. The Counterfire Cell consists of the Brigade counterfire officer, a variable-format message entry device (VFMED) operator and three TAB personnel for each shift (day and night). The TAB personnel consist of an officer, NCO and radio and telephone operator (RTO) responsible for helping the counterfire officer control the radars, develop fire plans and process counterfire missions. The Counterfire Cell has a VFMED and two radios mounted in what used to be the intel van. It is responsible for radar command and control, including positioning, orienting, cueing and clearing positions and fires. Furthermore, the Counterfire Cell manages the radar priority zones and develops fire plans.

Liaison Officers. The FA Brigade uses counterfire liaison officers (CFLNOs) at the maneuver brigade TOCs to coordinate and control counterfire. Because the 8-inch battalions are directly involved in the command and control of radar assets, the battalions have the additional responsibility of providing the maneuver brigades a liaison officer with a vehicle and two radios. These liaison sections are the same sections usually sent to the reinforced artillery battalion when it's assigned a reinforcing mission.

As in the past, the liaison officers' duties include providing information on the current friendly and enemy situation and reporting changes in the forward line of own troops (FLOT) or coordinated fire line (CFL). At the same time, these liaison officers better serve the counterfire mission by providing the FA Brigade a link to maneuver for clearing radar positions and fires short of the CFL. They must identify the needs and plans of the maneuver force and establish radar priority zones to support the maneuver operation.

In a like manner, the FA Brigade Headquarters also sends its liaison officer and S2 to the Division TOC. The Brigade LNO is in the FSE, and the S2 (with his counterpart from Div Arty) is in the Division All-Source Intelligence Center (ASIC). Equipped with a VFMED, the LNO provides the FA Brigade information on division-level plans.

The S2 serves as an alternate source of targeting information, which is particularly important before the battle begins and before the radars are turned on. Further, he coordinates fire support measures, serves as a backup for clearing positions and fires and provides continuity of operations for the Division FSE during displacements.

By providing these liaison sections to the maneuver brigades and Division TOC, the FA Brigade can establish a direct link between the maneuver

forces and the counterfire headquarters. This link provides more timely information and helps make counterfire more responsive to the needs of the maneuver commander.

Communications

A major challenge under this concept is the integration of command, control and communications (C3). While retaining enough flexibility to change priority of fire support tasks during battle, counterfire must fit in the overall concept of the force artillery. The force artillery commander passes the Division Commander's guidance to the two artillery headquarters. The targeting cell at the ASIC establishes target priorities for the force artillery's units and targeting agencies.

Targeting Agencies. Referring to Figure 1, the targeting agencies depicted on the right provide information to plan and execute the close support and interdiction tasks. The majority of these agencies are observers with actual "eyes on the ground," who can provide real-time or near-real-time information with detailed target descriptions. The agencies on the left provide information to plan and execute counterfire.

The FA Brigade's targeting agencies include the Division and Corps ASICs (the FA Brigade is tied into Corps Artillery by pulse code modulation—PCM), the TACFIRE ATI files, the Division and counterfire liaison officers and the Firefinder radars. Although the information provided by these agencies doesn't contain the same detail about target descriptions, it's timely and the primary source of counterfire targeting information.

Radars. The way the FA Brigade receives this information from the radars differs depending on where the target is acquired and the type of radar that acquires it. If a target is acquired within one of two radar priority zones, it generates an automatic request for fire. The two types of radar priority zones that generate a fire mission are the call-for-fire zone (CFF) and critical-friendly zone (CFZ).

The call-for-fire zone is in front of friendly forces and over the enemy force. Targets acquired firing out of this zone generate a priority-two fire mission request.

A critical-friendly zone is over our critical elements, as identified by the maneuver commander. Targets acquired that are firing into these zones generate a priority-one fire mission request.

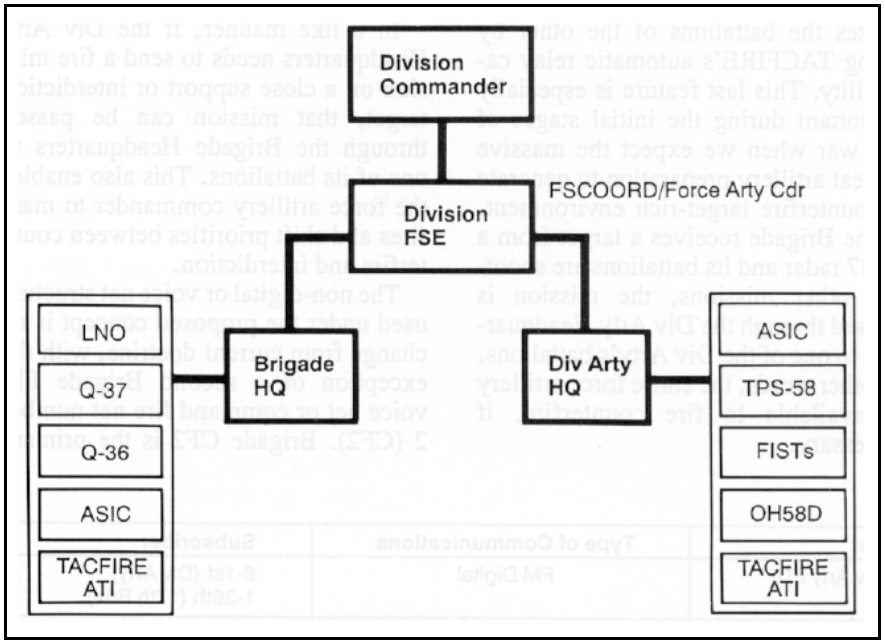


Figure 1: Force Artillery Command and Control

Targets outside either of these two zones generate an ATI:CDR (coordinate report). In other words, they don't automatically generate a fire mission in TACFIRE. By the designation of these zones through the counterfire liaison officer, the maneuver commander directly influences the counterfire priorities in his sector.

Fire mission requests and coordinate reports are transmitted differently depending on how the targets are acquired. In the case of the Q-37 radar, the radar is in direct communication with the FA Brigade and passes the target information digitally to the Brigade TACFIRE. In a fire mission, TACFIRE immediately and automatically transmits the fire mission to the selected firing unit—either the multiple launch rocket system (MLRS) unit or a cannon battalion, if MLRS isn't available.

In a coordinate report, the TACFIRE computer reviews the target and determines if it meets the pre-established attack criteria entered in the TACFIRE. If the target *does* meet the criteria, TACFIRE automatically generates a fire mission and passes it to a battalion. If it *doesn't* meet the criteria, the target is stored in TACFIRE's ATI files for future use.

In the case of a Q-36 radar, the radar communicates directly with one of the 8-inch battalions. When the radar acquires a target, either a fire mission or coordinate report is transmitted digitally to the battalion TACFIRE computer. In a fire mission, the battalion shoots it. In a coordinate report or if the battalion is not available to fire, the target is passed up to the Brigade TACFIRE. The Brigade TACFIRE then goes through its tactical fire mission processing and stores the target data or selects another battalion to fire the mission.

When the FA Brigade receives targeting information from a source other than the radars (such as the Corps ASIC), the process of determining whether or not to shoot the target is done manually at the Counterfire Cell. If the target is to be engaged, a fire mission is passed to a battalion digitally using the VFMED in the Counterfire Cell or by voice. Otherwise, we put the target into the ATI files using the VFMED.

Proposed Net. Finally to bring it all together, our force artillery communications structure allows us to pass information between the two O-6 headquarters and provide continuity of operations. Under this concept, both headquarters use the same digital frequencies (see Figure 2).

This net structure offers several advantages and performs two major functions. First, information is shared between the two headquarters continuously using TACFIRE message of interest (MOI) processing. But more importantly, each headquarters accesses

the battalions of the other by using TACFIRE's automatic relay capability. This last feature is especially important during the initial stages of the war when we expect the massive Threat artillery preparation to generate a counterfire target-rich environment. If the Brigade receives a target from a Q-37 radar and its battalions are shooting other missions, the mission is passed through the Div Arty Headquarters to one of the Div Arty's battalions. In other words, the entire force artillery is available to fire counterfire, if necessary.

In a like manner, if the Div Arty Headquarters needs to send a fire mission on a close support or interdiction target, that mission can be passed through the Brigade Headquarters to one of its battalions. This also enables the force artillery commander to mass fires and shift priorities between counterfire and interdiction.

The non-digital or voice net structure used under the proposed concept is no change from current doctrine, with the exception of a second Brigade FM voice net or command fire net number 2 (CF2). Brigade CF2 is the primary net for controlling counterfire and issuing instructions to the Q-37 radars and liaison officers. When digital communications are operational, CF2 is used primarily to pass non-formatted instructions and to clear radar positions and counterfire. Clearing fires through Div Arty or maneuver brigade fire support officers (FSOs) used to take 15 to 30 minutes. But by using CF2 to pass information to the CFLNOs, we can clear fires in less than five minutes. When digital communications go down, CF2 is the primary means of receiving and passing targeting information. Other communications channels used to pass information between the two headquarters include the Brigade's and Div Arty's FM voice nets, RATT and voice and digital PCM.

With this communications structure (Figures 2 and 3), we improve our ability to disseminate information and transfer control from one headquarters to another. This communications structure also provides the force artillery redundant communications capabilities and improves its ability to maintain continuous operations and support our maneuver forces.

Net	Type of Communications	Subscriber
Div Arty FD1	FM Digital	6-1st (Div Arty) 1-36th (17th Bde)
Div Arty FD2	FM Digital	2-1st (Div Arty) 2-77th (17th Bde)
Div Arty FD3	FM Digital	3-1st (Div Arty) 1-18th (17th Bde)
TAB CI (FD4)	FM Digital	(2) Q-37 Radars
Div Arty MSU	FM Digital	4th Bde FSO A/94th MLRS (Div Arty) AFSO MSU (Div Arty/17th Bde) Bde LNO Metro (17th Bde) Metro (Div Arty)

Figure 2: Revised FM Digital TACFIRE Net Structure

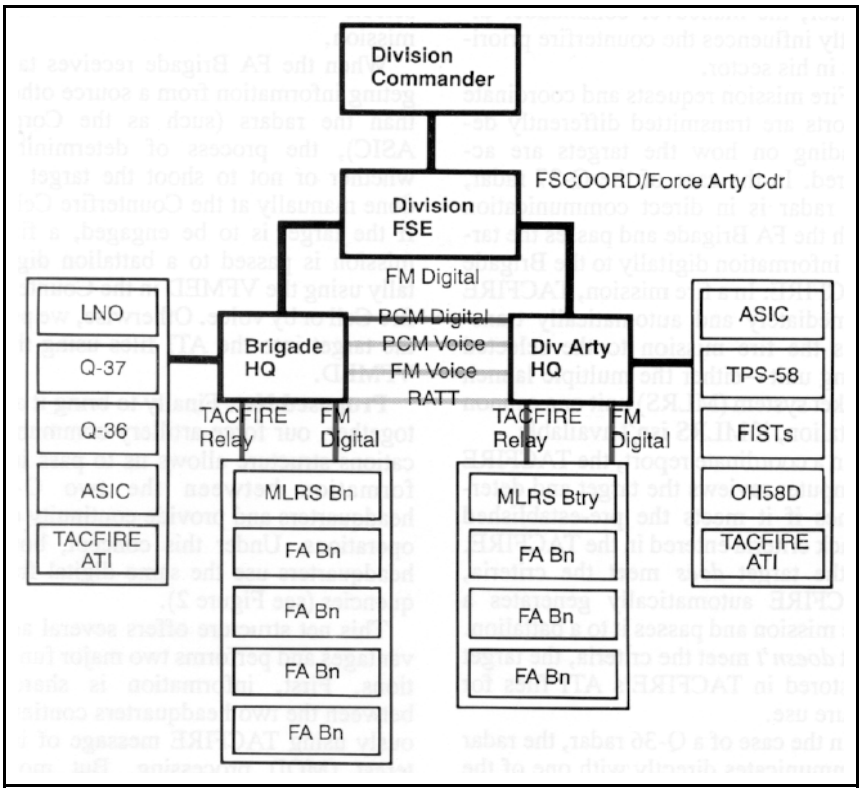


Figure 3: Force Artillery Command and Control

Conclusion

This article has described a robust counterfire structure and process we believe reduces the artillery threat and allows our armor and infantry the freedom to maneuver. Should every Div Arty TOC train to conduct the counterfire battle alone? Yes! Div Arty owes that to the Division in case the FA Brigade is committed elsewhere. But, when the FA Brigade is available, we should take the partnership approach.

Lieutenant Colonel Eric C. Deets is the Training and Doctrine Command System Manager for the Advanced Field Artillery Tactical Data System (TSM—AFATDS), Field Artillery School, Fort Sill, Oklahoma. He served as Executive Officer and S3 of the 1st Armored Division Artillery and Assistant Fire Support Coordinator for the Division in West Germany. Lieutenant Colonel Deets' other assignments include action officer in operations research, systems analysis, Office of the Joint Chiefs of Staff, Washington, D.C.; S3 of the 6th Battalion, 37th Field Artillery, Republic of Korea; and S3 of the 1st Battalion, 77th Artillery, Fort Hood, Texas.

Lieutenant Colonel Richard D. West is Executive Officer and former S3 of the 17th Field Artillery Brigade, West Germany. He's a graduate of the US Military Academy, West Point, where he later served as an instructor. Lieutenant Colonel West holds a master's degree from the University of Colorado and is a graduate of the Command and General Staff College, Fort Leavenworth, Kansas. He served as a battalion S3 in the Republic of Korea and as the S3 of VII Corps Artillery, West Germany.

Captain Lawrence M. Perecko is the Counterfire Officer for the 17th Field Artillery Brigade. He's a Distinguished Military Graduate of the College of William and Mary Reserve Officer Training Course, Williamsburg, Virginia, and a graduate of the Combined Arms and Services Staff School, Fort Leavenworth, Kansas. Captain Perecko has served as a fire support officer for a 155-mm battalion and as battery commander in the 1st Battalion, 36th Field Artillery, both in West Germany.

Redleg News

ITEMS OF GENERAL INTEREST

PERSCOM News

Soldiers who have questions about the following information should call the Field Artillery Enlisted Branch Team, Total Army Personnel Command (PERSCOM), Alexandria, Virginia, at AUTOVON 221-0304 or commercial (202) 325-0304. (PERSCOM was formerly known as the Total Army Personnel Agency—TAPA.)

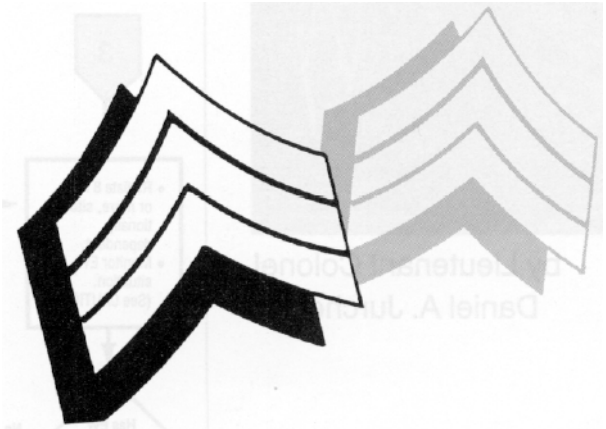
PLDC and BNCOC Prerequisites

Soldiers looking forward to wearing sergeant's stripes will soon have to be primary leadership development course (PLDC) graduates. Effective 1 October, all soldiers being recommended for promotion to sergeant will be PLDC graduates.

Soldiers who completed a resident primary NCO course (PNCOC), primary leadership course (PLC) or NCO academy course before 1 October 1976 already meet the PLDC requirements. Those who completed the basic NCO course (BNCOC), excluding Army Medical Department (AMEDD) BNCOC, before 1 January 1986 also meet the requirement.

Effective 30 September, soldiers on a promotion standing list who are not PLDC graduates will be removed from the list. Therefore, an interim change to AR 351-1 Individual Military Education and Training, soon to be published, will adjust PLDC training priorities as follows: through 30 September, the PLDC training priority will be (1) specialists and corporals on the promotion list to sergeant, (2) sergeants who have not attended PLDC and (3) specialists and corporals whose commanders intend to recommend them for promotion to sergeant. Effective 1 October, the priorities will change to (1) specialists and corporals whose commanders intend to recommend them for promotion to sergeant, (2) sergeants who have not attended PLDC and (3) specialists and corporals who are filling NCO leadership positions.

Those soldiers whose primary military occupation specialty (PMOS) has a BNCOC must graduate from it to be listed in the zone of consideration for the 1990 sergeant first



class or advanced NCO course (ANCOC) selection boards. A list of those MOSs that are not subject to the BNCOC prerequisite will be released in 1990, along with the zones of consideration for sergeant first class and ANCOC. The new priority for attending BNCOC is (1) staff sergeant by time in grade (TIG) and (2) sergeant(P) by promotion points.

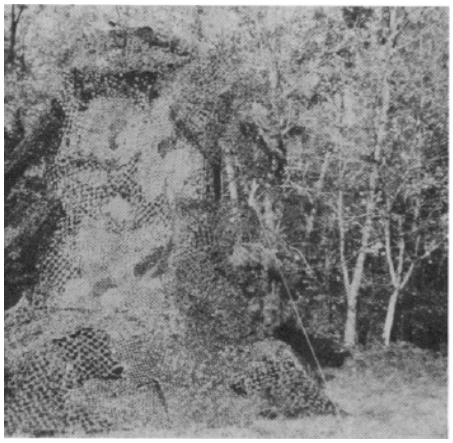
If soldiers have questions about the PLDC and BNCOC prerequisites, contact Sergeant First Class W.L. Looking-land at PERSCOM.

Selection for USAR or NG Positions in CMF 13

The Field Artillery has positions open for active duty soldiers in US Army Reserve (USAR) and National Guard (NG) units. These are full-time manning (FTM) positions filled by Field Artillery Branch and are available for soldiers in MOSs 13B40, 13Z50, 13C40, 13E30, 13F40 and 82C40. Soldiers who meet the assignment criteria listed in AR 614-200 Selection of Enlisted Soldiers for Training and Assignment, Paragraph 8-51 (part of the *Department of the Army Enlisted Ranks Personnel Update*), may submit DA Form 4187 Personnel Action to volunteer for Reserve Component duty. Branch gives priority for FTM positions to soldiers from overseas long tours.

Master Sergeant Donald R. Givens, PERSCOM, can answer questions about USAR and NG positions available to soldiers in CMF 13.

Foxy Firefinder



by Lieutenant Colonel
Daniel A. Jurchenko

Field Artillery Target Acquisition (TA) = Firefinder. This simple statement is patently obvious and monumentally important to us and our adversaries.

We've put all our "target acquisition eggs" into the Firefinder "basket." This has created employment challenges for our TA planners and operators. Even more importantly, it has opened a window of vulnerability because our adversaries need only to concentrate on defeating our one TA sensor—Firefinder. This article proposes employment doctrine for Firefinder radars that will mitigate the negative effects of a one-sensor TA system and help to close the vulnerability window.

Employment doctrine for Firefinder has been slow in evolving. The TA community has concentrated on the technical aspects of employing the system, primarily because the application of new technologies has dramatically changed target acquisition capabilities.

Firefinder employment doctrine has solidified in two areas. The first is related to the radar's vulnerability and survivability. The second is related to when you use the radar—cueing.

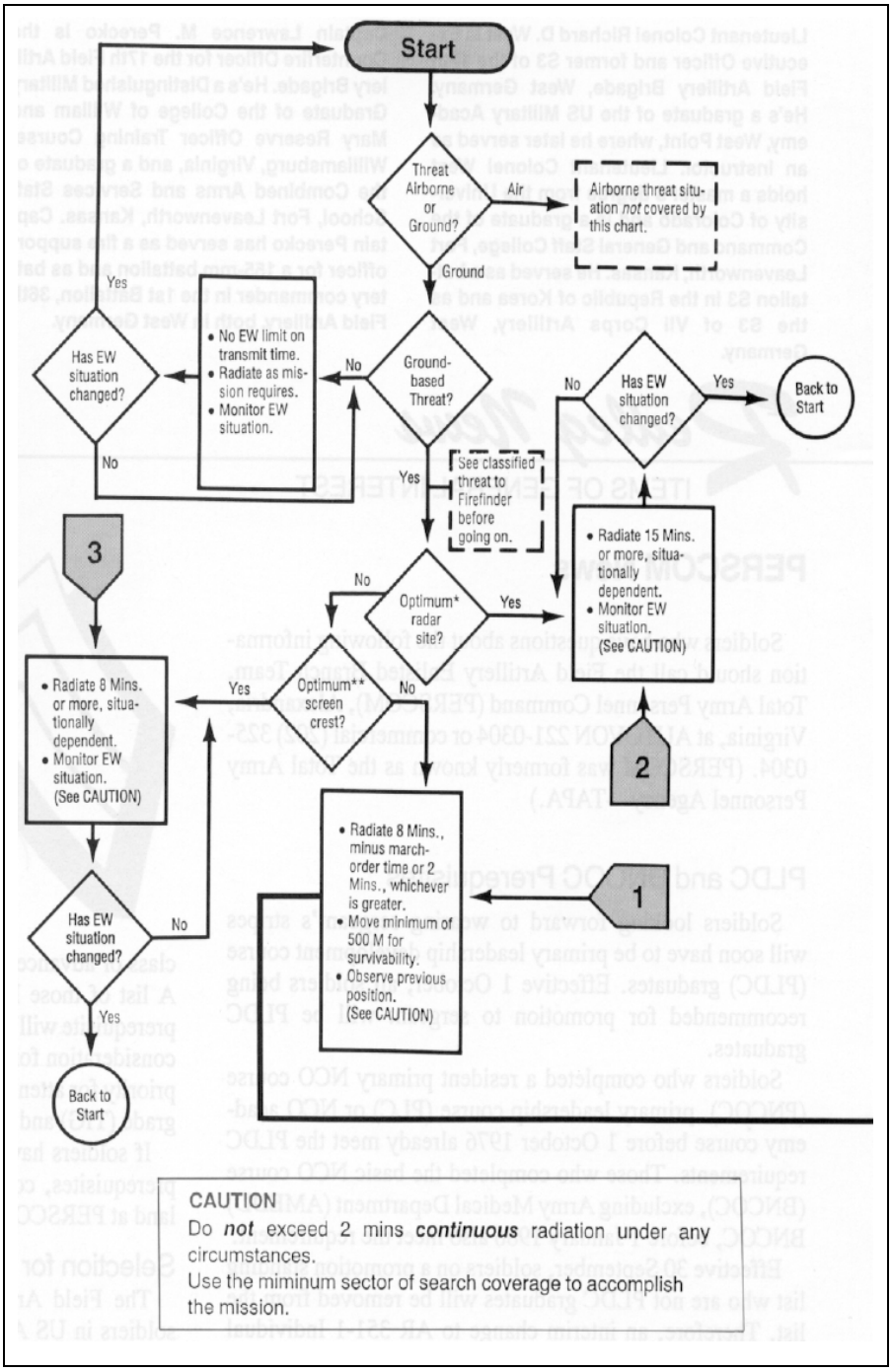


Figure 1: Real-Time Cueing Decision Matrix for Firefinder Survivability

Vulnerability

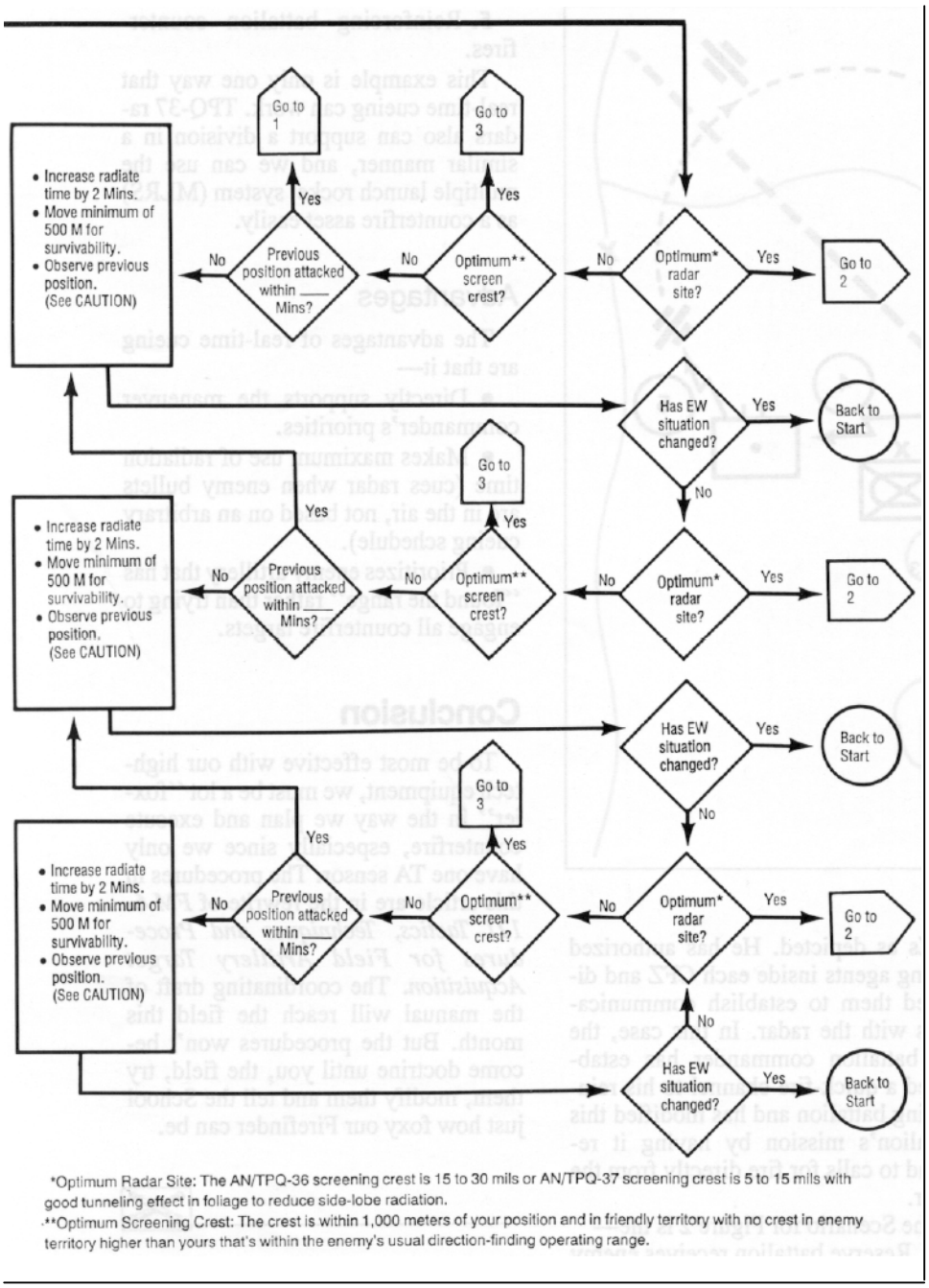
The most important aspects to Firefinder's vulnerability is when to radiate and for how long. Though radiation time is critical, it's not the only vulnerability consideration. The cueing decision matrix for Firefinder survivability makes some sense of all the variables that impact on the problem (see Figure 1).

The Decision Matrix

The purposes of the decision matrix are to—

- Minimize movement.
- Maximize radiation time consistent with the Threat.
- Learn about the enemy's electronic warfare (EW) capabilities through conservative techniques.

Characteristics of the decision matrix are—



● It's mission, enemy, terrain, troops and time available (METT-T) driven.

● The radiation time builds with situational experience.

● It includes adequate appreciation of screening crest and tunneling.

● The radiation time is dynamic (based on the Threat encountered), not arbitrarily static.

The decision matrix is applicable along the entire spectrum of combat, from low- to high-intensity conflict. It allows us to tailor radiation time to a specific threat. It modifies the arbitrary two-minute radiation restriction, which many consider the survivability benchmark.

Two-Minute Radiation Time

I challenged the two-minute radiation time restriction with the Threat Division of Combat Developments, Field Artillery School, Fort Sill, and the Field Artillery Branch of the Foreign Science and Technology Center, Charlottesville, Virginia. Except in the worst possible scenario with the Threat's operating under ideal conditions, Firefinder radars don't have to restrict their cumulative radiation time to *two minutes followed immediately by a move.* (You still must limit radiation time to two minutes of *continuous* radiation at any one time.) The Threat's ideal conditions would be a direct line of sight from his collector to our radar, no screening crests or tunneling, maximum Firefinder search sector and all his equipment working perfectly with well-trained soldiers.

This is not to say that the enemy can't locate Firefinder in two minutes, but that we must account for the factors in the decision matrix before we can determine if it's feasible. The fact is, we've never tested Firefinder against a realistic EW Threat. No empirical data exist on the Threat's ability to locate Firefinder accurately and in a timely manner.

This will change early next year when the School tests Firefinder at Fort Hood, Texas, using the III Corps' EW assets as technology surrogates for the Threat's. The data from the test probably will modify the decision matrix and lend universal credibility to its use.

Real-Time Cueing

When and how to radiate Firefinder (situational versus random cueing) is often misunderstood. I contend that situational or "real-time" cueing is the most effective way to use Firefinder's capabilities.

Real-time cueing is radiating at a critical time in the battle to acquire the enemy targets most disruptive to the commander's scheme of maneuver.

In real-time cueing, we must first—

● Understand the maneuver commander's priorities and intent.

● Prioritize for firing the locations of the enemy artillery that are affecting the commander's intent.

● Appoint cueing agents (e.g., forward observers, aerial observers, fire support officers (FSOs), etc.).

● Establish quick-cueing communications channels and quick-fire channels.

Real-Time Cueing Example

The best way to explain real-time cueing is to study the example depicted in Figure 2. This situation shows a TPQ-36 attached to a direct support

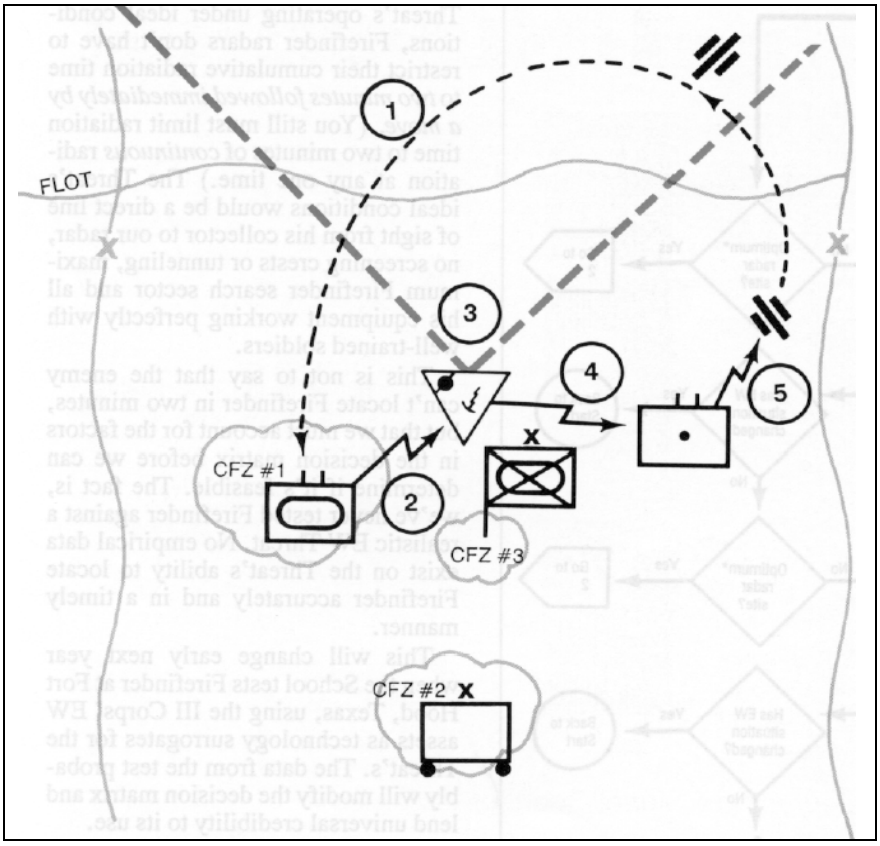
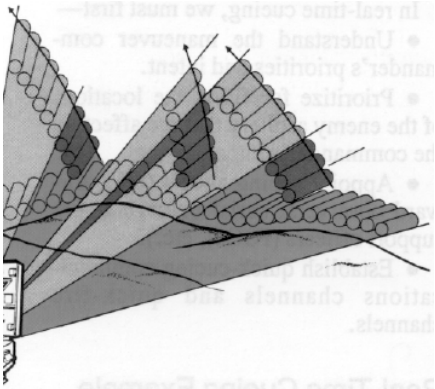


Figure 2: Real-Time Cueing

(DS) artillery battalion in support of a maneuver brigade that's in the defense.

The brigade commander gave his priorities for the prevention of enemy artillery effects to his reserve (critical friendly zone 1—CFZ #1), his combat trains (CFZ #2) and his tactical command post (CFZ #3). Accordingly, the DS battalion commander directed the attached Q-36 radar to set up three CFZs as depicted. He has authorized cueing agents inside each CFZ and directed them to establish communications with the radar. In this case, the DS battalion commander has established a quick-fire channel to his reinforcing battalion and has modified this battalion's mission by having it respond to calls for fire directly from the radar.



The Firefinder sends out tracking beams, determines a hostile weapon location and predicts the projectile's impact point.

The Scenario for Figure 2 is the—

1. Reserve battalion receives enemy artillery fire.

2. Authorized cueing agent (the maneuver battalion FSO) in conjunction with the maneuver battalion commander determines the enemy fire is having a negative impact on our forces, and the FSO cues the radar.

3. Radar fires its transmitter and determines the location of enemy artillery. Since CFZs are already established, the radar determines which enemy guns are firing into CFZ #1, using its impact-prediction capability, and prioritizes these targets in its target cue.

4. Radar sends the targets in FM; RFAF format to the reinforcing battalion as a priority target.

5. Reinforcing battalion counterfires.

This example is only one way that real-time cueing can work. TPQ-37 radars also can support a division in a similar manner, and we can use the multiple launch rocket system (MLRS) as a counterfire asset easily.

Advantages

The advantages of real-time cueing are that it—

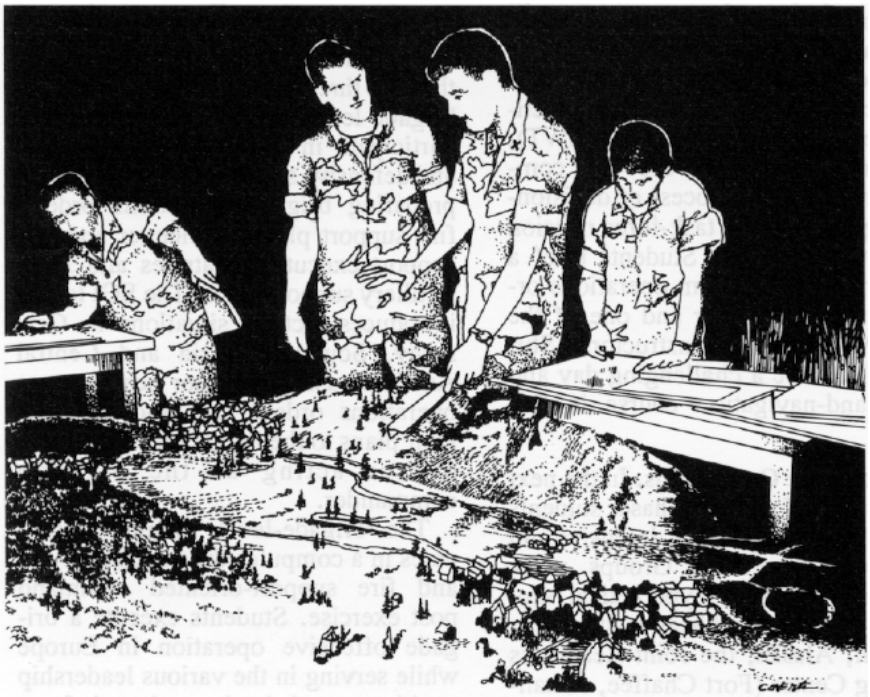
- Directly supports the maneuver commander's priorities.
- Makes maximum use of radiation time (cues radar when enemy bullets are in the air, not based on an arbitrary cueing schedule).
- Prioritizes enemy artillery that has "found the range" rather than trying to engage all counterfire targets.

Conclusion

To be most effective with our high-tech equipment, we must be a lot "foxier" in the way we plan and execute counterfire, especially since we only have one TA sensor. The procedures in this article are in the rewrite of *FM 6-121 Tactics, Techniques and Procedures for Field Artillery Target Acquisition.* The coordinating draft of the manual will reach the field this month. But the procedures won't become doctrine until you, the field, try them, modify them and tell the School just how foxy our Firefinder can be.

Lieutenant Colonel Daniel A. Jurchenko is Chief of the Radar Division, Target Acquisition Department, Field Artillery School, Fort Sill, Oklahoma. The design of the decision matrix in this article is the combined efforts of the Author and Chief Warrant Officers Gordon M. Baxendale and Walter T. Hammack of the Radar Division. Lieutenant Colonel Jurchenko has served as the Battalion Executive Officer, 2d Battalion, 12th Field Artillery, Fort Sill; and commanded Headquarters and Headquarters Battery, 1st Battalion, 13th Field Artillery, and G Battery (Target Acquisition), 333d Field Artillery, both at Fort Stewart, Georgia. He assumes command of 2d Battalion, 2d Field Artillery, Fort Sill, in June.

Small Group Instruction at the Field Artillery School



by Colonel Felix Peterson, Jr., and Lieutenant Colonel Charles A. Morris

The face and the pace of the Field Artillery Officer Advanced Course (FAOAC) has changed. The familiar sight of tactics instructors with stacks of vu-graph slides has been replaced with an innovative concept—small group instruction (SGI). The SGI was implemented in FAOAC Class 2-89 that reported in February.

SGI

What is SGI, and how does it differ from traditional instruction? SGI is not new. Various sections of the educational community have been using SGI since the early 1970s, and the US Army Field Artillery School (USAFAS) has used small group methods for several years. In the purest sense, SGI means using group process techniques to take advantage of the social and psychological forces inherent in small groups that can stimulate learning.

In SGI, the responsibility for learning still rests with the individual student, but maximum learning occurs when a group has a common goal for learning, a reasonable degree of cohesiveness, norms favorable to learning and patterns of effective communication. Permanent groups already have these ingredients. However, in instructional situations where students meet for short periods, the SGI leader (instructor) must develop the required structure and stimulate the processes of the group. He also evaluates the students' progress.

You reduce the instructional effectiveness of SGI when groups exceed 20 students. The USAFAS limits the groups to 16 students, ensuring a variety of student backgrounds for each. For example, a typical SGI group may consist of Field Artillery soldiers from heavy and light divisions and from US Army, Europe, (USAREUR) and the continental US (CONUS), as well as soldiers from our sister branches, the Reserve Components and Allied countries.

The FAOAC prepares officers for battery command; fire support positions at battalion and brigade levels; and staff positions at battalion, brigade and division artillery levels.

To provide a maneuver war-fighting perspective to our combined-arms instruction, Infantry, Armor and Aviation students spread throughout the small groups attend FAOAC. The USAFAS has a reciprocal agreement to provide Field Artillery officers for the advanced courses of our sister branches.

The School has two teams of 12 SGI leaders and uses the regimental system to provide cohesion and consistency during the course. (See the article "US Field Artillery School Reorganization," February 1989, for an explanation of the new regimental system.)

Course Content

The FAOAC is a 20-week course for Active Component officers and a 13-week, four-day course tailored for the Reserve Component officer who can't afford the time to attend the entire course. However, some Reserve Component officers will attend the complete 20-week FAOAC.

Phase I—Technical

The first eight weeks generally consist of technically oriented or equipment-intensive classes taught in groups of approximately 48 students. Subject matter includes ballistic theory and manual gunnery techniques, computer literacy (students are issued their own personal computers), supply and

maintenance management procedures at the unit level and the Nuclear and Chemical Target Analysis Course (NC-TAC), for which graduates receive the 5H additional skill identifier.

Phase II—SGI

The heart of FAOAC is the SGI phase when students learn how to fight, lead and train. During this 12-week phase, the SGI leader assures students learn leadership and war-fighting skills to be unit commanders, battalion or brigade fire support officers and battalion, brigade and division artillery staff officers.

Tactics. During the first four weeks of the SGI phase, the group discusses the fundamentals of AirLand Battle doctrine, the composition of US Army organizations and their missions, basic maneuver principles, fire support fundamentals, principles for training, small unit leadership, the intelligence preparation of the battlefield (IPB) and Threat organizations and doctrine. This block culminates in an extensive tactical exercise without troops (TEWT), allowing students to use the commander's estimate process of decision-making to analyze a task-force mission on Fort Sill terrain. Students brief a company and (or) team operations order to the SGI leader and one of the USAFAS maneuver instructors. Students also have a challenging day and night land-navigation course in this phase.

Task-Force Operations. In the next three weeks of the SGI phase, students learn battalion task-force defensive and offensive operations. Groups work through a series of hypothetical scenarios, both light and heavy, situated in Fort Sill, Alaska, the Joint Readiness Training Center (Fort Chaffee, Arkansas), Central Europe and the National Training Center (Fort Irwin, California). Students participate as members of the task-force staff and prepare operations orders, fire support plans and operation graphics, based on orders from higher headquarters and the SGI leader's guidance. Each group briefs its products to the SGI leader or a senior officer acting as a brigade commander. Then, students war-game their plan to determine its feasibility.

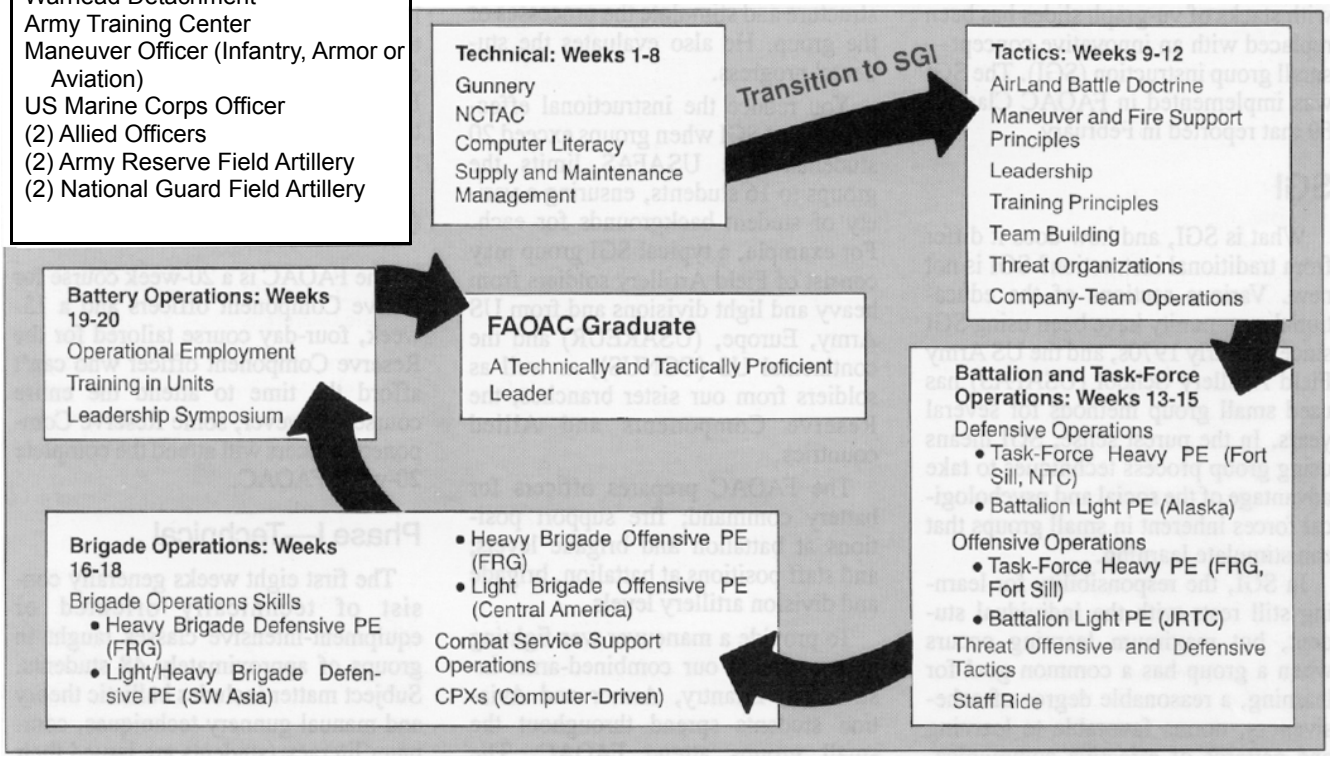
Brigade-Level Operations. During the next three weeks, the focus shifts to brigade-level operations. The students participate in a number of offensive and defensive scenarios as staff groups, preparing brigade operations orders, fire support plans, maneuver and fire support execution matrices and Field Artillery support plans. The SGI leader introduces tactical situations in Germany, Southwest Asia and Central America, using a higher headquarters operations order. The students brief their plans to the SGI leader or a senior officer acting as the division commander.

The brigade-level training culminates in a computer-driven, maneuver-and fire support-oriented command post exercise. Students execute a brigade offensive operation in Europe while serving in the various leadership positions at brigade and task-force headquarters.

Battery Operations. In the final two weeks of FAOAC, the SGI leader further reinforces war-fighting skills while exposing students to the leadership and training demands of an officer's

Typical SGI Group of 16 Students

- Heavy Division Field Artillery (OCONUS)
- Heavy Division Field Artillery (CONUS)
- Light Division Field Artillery
- Missile and Rocket
- Corps Artillery
- Division, Division Artillery or Brigade Staff Experience
- Warhead Detachment
- Army Training Center
- Maneuver Officer (Infantry, Armor or Aviation)
- US Marine Corps Officer
- (2) Allied Officers
- (2) Army Reserve Field Artillery
- (2) National Guard Field Artillery



FAOAC 20-Week Instruction

SGI Leaders the Best

The key to the success of SGI is the group leader. The School's goal is that each SGI leader be a major or promotable captain and have completed a successful command, served as a battalion or brigade fire support officer, attended the Combined Arms and Services Staff School and, in the case of the majors, have attended Command and General Staff College, Fort Leavenworth, Kansas. Waivers to these qualifications will be granted by the Assistant Commandant on a case-by-case basis.

In addition to Army Field Artillerymen, SGI leaders will include Marine Corps and Allied officers to provide the joint and combined perspective to the instruction. For the first two FAOAC classes, the Allied SGI leaders will come from the United Kingdom and Canada.

Leader Training

A comprehensive training program for the SGI leader lasts 17 weeks and has three phases. In phase I, the SGI leader learns the systems approach to training (SAT) and the fundamentals of classroom instructional techniques at the USAFAS Instructor Training Course. During phase II, the leader learns about

small group theory and how to facilitate group team building and learning. He also becomes proficient in communicative skills and computer literacy. Phase III is the subject-matter-expert phase. In this phase, the SGI leader builds his "smart" book and learns or refreshes technical or tactical information.

Leader Qualifications

The first two leader groups of the FAOAC classes have the qualifications to act as mentors for our future Field Artillery Battle Captains, based on recent promotion and school selection statistics: 100 percent of SGI leaders eligible were selected for promotion to major and 71 percent already are graduates of or have been selected for the Command and General Staff College.

To assure the success of the Field Artillery School's small group instruction, the Total Army Personnel Command (PERSCOM), Alexandria, Virginia, has given the program priority for *100 percent fill* with fully qualified officers.

first command. Subject matter in the how-to-command and how-to-train phase focuses on the Uniform Code of Military Justice, training management, soldier and family support programs and a leadership symposium with corps and division commanders as guest speakers and senior commanders and command sergeants major as panel members.

RC Course

One of the goals of the restructured FAOAC was to integrate the Reserve Components (RC-FAOAC) into the course. The 13-week, four-day course is offered three times a year and, like the 20-week course, has two phases. The RC officers attend nine days of gunnery instruction in the traditional classroom atmosphere before their SGI phase. Next, the students integrate into the ongoing FAOAC and participate in the SGI phase, as described.

Other FAOAC Training

The FAOAC includes an extensive capabilities exercise presented by units of III Corps Artillery and the US Air Force to demonstrate fire support on the AirLand Battlefield. Students have the unique opportunity to observe the destructive power of a variety of fire support systems. The fires of four to six Field Artillery cannon battalions mass on a simulated Threat target array and later shift to engage the moving force. The capabilities of various munitions, Field Artillery weapons, close air support aircraft, attack helicopters and target acquisition systems also are demonstrated.

During FAOAC, the School sponsors a 16-hour training program for commander's spouses to develop command-team leadership skills. Specific topics include stress management, family support groups, community assistance agencies, group development, customs and courtesies and an orientation for a permanent change of station to Germany.

Conclusion

The FAOAC changes will provide officers with improved war-fighting, training and leadership skills for the combined-arms team. They'll be tactically and technically proficient, have sharpened their problem-solving and decision-making skills and demonstrated their leadership skills in a variety of instructional situations. They'll understand the necessity for team building and know how to accomplish it. They are our Battle Captains for the Field Artillery of the future.

Colonel Felix Peterson, Jr., is Deputy Director of the Directorate of Training and Doctrine and Coordinator of the SGI Committee for the Field Artillery School, Fort Sill. He commanded the 5th Battalion, 3d Field Artillery, West Germany; B Battery, 3d Battalion, 82d Field Artillery, in Vietnam; and A Battery, 1st Battalion, and Headquarters and Service Battery, both in the 33d Field Artillery in US Army, Europe. Colonel Peterson is a Senior Service College Fellow, doing his research at the Joint Center for Political Studies in Washington, D.C., and has a master's degree from the University of Oklahoma.

Lieutenant Colonel Charles A. Morris commands the 5th Battalion, 30th Field Artillery (Provisional), which provides leadership and command and control for Officer Advanced Course (OAC) students at the Field Artillery School, Fort Sill, Oklahoma. He's responsible for the Battalion's activation and the concurrent implementation of SGI in OAC. Lieutenant Colonel Morris served as Executive Officer for the 2d Battalion, 42d Field Artillery, West Germany, and commanded B Battery, 1st Battalion, 12th Field Artillery, Fort Sill. He's a graduate of the Marine Corps Command and General Staff College, Quantico, Virginia, and has two master's degrees.

Right by Piece

NOTES FROM UNITS

A Primer on a Simple, But Effective Training Device

Scenario

Place:	1st Armored (AR) Division Headquarters (HQ), Commanding General's (CG's) Conference Room
Time:	Late 1986
Event:	Leadership after-action review (AAR) for the first iteration of the 1st Armored Division's exercise Ironstar at the NATO Combat Maneuver Training Center, Hohenfels, West Germany.

CG: *FSCOORD [Fire Support Coordinator], why can't we have a simulator for the howitzers as we do for tanks (Hoffman device) and armored personnel carriers (antitank weapons effect system cartridge)? The howitzer crews should be able to do a minimal amount of individual and section training.*

FSCOORD: *Sir, we just don't have a howitzer training round in the inventory that's also a noise and light emitter.*

CG: *By the next IronStar, FSCOORD, your task is to have a simulator round for the howitzers that trains the crew and allows soldiers in the vicinity of the guns to hear them firing. In addition, if the howitzers are going to be on the battlefield, they must have MILES [multiple integrated laser engagement system]. There are no free rides in IronStar.*

So began the series of events that led up to Operation Iron Primer. The CG's task wasn't easy to accomplish. The Division Artillery commander tasked the S3 to supply a list of devices and (or) pyrotechnics we could try. The 6th Battalion, 14th Field Artillery, (now 6th Battalion, 1st Field Artillery) became the test unit for every conceivable approach.

The project involved the entire Division. Master gunners from the tank battalions offered help in trying to modify MILES and the Hoffman device to fit the howitzers. Infantrymen offered the TOW or Dragon simulators with the M113 MILES. (The 1st Armored Division did use the M113 MILES on its howitzers and ammunition vehicles in the next IronStar). The 7th Army Training Command, Grafenwoehr, West Germany, looking forward to training the NATO Combat Maneuver Training Center, joined the effort.

With all the help, the Division Artillery staff created a system trainer for the entire Field Artillery chain—from the guns through the fire direction centers (FDCs), to the battalion and Division Headquarters and, finally, to the Corps ammunition supply points (ASPs). We could correct several problems noted during the first IronStar with an ammunition system trainer. These problems were—

- Howitzer sections didn't always follow through on "dry" fire missions. At 0430 hours, who was to tell if all the guns were firing?
- Battalion operations or FDCs tended to "shoot" more ammunition than they had on hand, leading to poor accounting of ammunition.
- FSCOORDs and fire support officers (FSOs) weren't required to prioritize fires because they had "almost" unlimited ammunition.
- Ammunition sections from the firing batteries and service battery didn't receive realistic training that tied directly to the outcome of the force-on-force battles.
- Division Support Command (DISCOM) and Corps weren't able to train to realistic standards when it came to handling volumes of ammunition. The Field Artillery consumes more than half the ammunition by weight in a division.

We tried the system trainer during the next IronStar with resounding success. Operation Iron Primer centered around the common primer we all use for separate-loading ammunition. At $1.89 a round, it doesn't sound like an expensive item. But 60,000 primers—20,000 for each direct support (DS) battalion—can put a dent in anyone's budget. After we explained to the Department of the Army (DA) why we needed the primers, it approved our experimenting with the primers as long as we provided feedback. The system consists of—

1. Primers color-coded to represent high explosive (HE), dual-purpose improved conventional munition (DPICM) and Copperhead rounds. Each primer "equals" one projectile.

2. Green and white 3x5 cards to represent the propellant charges. A full-service round is represented by one primer and one card. After firing each round, the section chief tears the card in half and deposits it in a fuze can.

3. Fire unit (FU) observers in each platoon confirm that fired primers match fire missions processed. After daily battle, we accounted for the fired primers in detail and forwarded the results to the Division Artillery S3. We then checked the total number of primers fired against our fire mission records. Most significantly, we found a difference between what a battalion thought it fired and what its platoons actually fired (by primer count); we had a command and control disconnect. (These FU observers also have other tasks, as outlined in my article "The Counterfire Battle—The Missing Element in Today's Training," which appeared in the April 1988 ***Field Artillery.)***

4. Flex pallets to represent the "bulk" of ammunition for ammunition haulers and handlers.

5. Ammunition (primers, cards and canisters) prestocked at Division and Corps ammunition points. The reinforcing battalion received the majority of its ammunition from the Corps ASPs. DISCOM and the Corps ammunition units were active players in all following IronStars.

After-action reports indicated—

1. Howitzer crews liked having some audio-visual feedback on missions.

2. The ammunition sections were able to deliver ammunition from an ASP located at general-defense-plan (GDP) distances to platoons spread across Hohenfels in all weather and at all times of day. They could deliver the ammunition if someone could tell them when and where it was needed.

3. Battalion staffs initially weren't able to handle the additional workload associated with "real" ammunition. They couldn't forecast where it would be needed and couldn't manage ammunition during the battle. In addition to the added workload associated with ammunition, the DS battalion at IronStar had to—

- Plan and coordinate for and employ the reinforcing battalion on the ground with it at Hohenfels.
- Fight the force-on-force battle (one task force), plus a synchronized command post exercise (CPX) battle (one task force).
- Fight a realistic counterfire battle.
- Conduct all staff action to handle large numbers of casualities and losses of equipment. (All artillerymen and tracked vehicles were equipped with MILES.)

Is Iron Primer worth it? Yes! The 1st Armored Division has continued this unique training for all succeeding Iron-Stars, gladly paying the cost of the primers in exchange for the added realism and enhanced total system training. This total-system approach led to a daily AAR for the force artillery. We fed all information to a committee comprised of operators, fire supporters and logisticians from the 1st Armored Division and the 17th Field Artillery Brigade. We cross-checked information to determine the impact of each action on the outcome of battle. Finally, we conducted the force artillery AAR with the leadership of the DS and reinforcing battalions before the task-force AAR, thus allowing fire supporters to describe accurately what went well and what needed work.

Eric C. Deets
LTC, FA
TSM—AFATDS
Field Artillery School

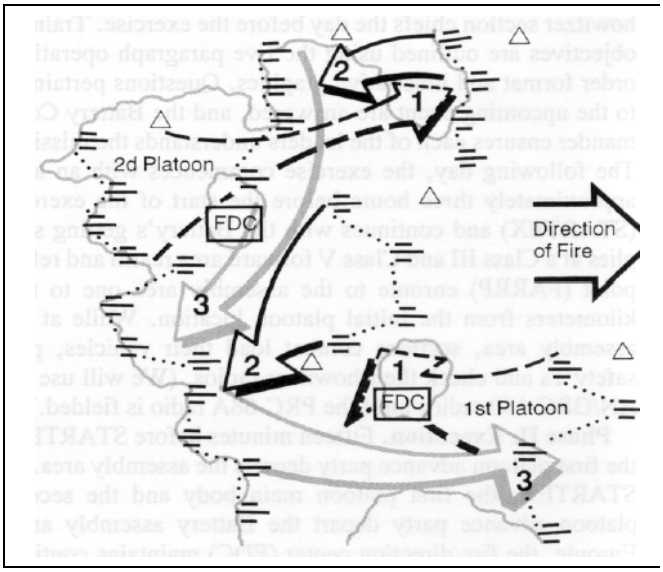
The Artillery "Shell Game"—Training to Survive

"Quadrant 463!!!...End of Mission, March Order!!!" Sound like a hasty displacement? Not quite—these are the planned commands heard on a live-firing point at the Grafenwoehr Training Area, West Germany, where the latest developments in 3X8 operations are put to the test. The Cobra gunners of C Battery, 2d Battalion, 1st Field Artillery, have taken the lead in executing the fast-paced, maneuver-oriented firing scheme known as the 1st Armored Division Artillery repositioning technique (Iron DART). Battery C has applied this concept to the somewhat restrictive training environment at Grafenwoehr and renamed it Training-DART or T-DART.

T-DART

The T-DART rapidly shifts firing platoons around a series of adjacent firing points at Grafenwoehr (see the Flow of the T-DART Scheme). The training is structured to emphasize a continuous rotation of platoons around preplanned firing positions to confuse the enemy's counterfire assets, much like the old con man's "shell game." By the time the enemy can acquire the firing platoon's location as a counterartillery target, the platoon has displaced to another location. The main objectives of this technique are to increase the battery's survivability and to force enemy artillery to give away its location by firing at "empty targets."

Primary factors in the execution of T-DART are speed and agility. Platoons fire quickly to avoid a lengthy stay in a given position, usually march ordering immediately after the end of a mission and displacing in five minutes. Total time "on the spades" shouldn't exceed 20 minutes. Close coordination, well-practiced convoy discipline and rehearsed battle drills provide the platoon the agility it needs to play "the shell game." Getting in and out of tight positions and executing short-notice lateral movements in synchronization



Flow of the T-Dart Scheme: Platoons continually rotate around preplanned firing positions to simulate movement to confuse the enemy's counterfire assets.

with the maneuver forces demands such agility and challenges the initiative of the platoon leadership as well.

The T-DART technique was devised in part to respond to requests from the soldiers in the Battery. If they weren't expecting to fire a great deal of ammunition, they wanted to move more during training. The rapid movement between firing points was easy to orchestrate, but firing a safe round from each howitzer within 18 minutes (the 1st Armored Division Artillery standard) became the real challenge for the leaders. Before firing, the soldiers must complete tasks such as safety computation, distribution of safety Ts, communication with the observers, boresight checks, posting of safety tape and prefiring checks. However, they can accomplish some of these tasks before occupying the firing point. With advance planning by the platoon leader and fire direction officer, the Battery can emplace survey control and compute and distribute safety Ts before occupation.

With two of the most time-consuming tasks completed, quick movement, occupations and, most importantly, rapid firing become the focal points of training. Soldiers are motivated to improve the occupation time by becoming more and more efficient at their individual jobs, fostering a healthy spirit of competition among sections and platoons.

One platoon must be able to process and fire missions at all times while the other is moving. Such frequent displacements on the well-dispersed firing points at Grafenwoehr sharpen the unit's occupation skills and provide a realistic method for training the way the 1st Armored Division plans to fight.

The Exercise

An average T-DART exercise employs both platoons in a 3X8 configuration for about four hours during the firing event. For planning purposes, T-DART is divided into three phases—preparation, execution and after-action.

Phase I: Preparation. This phase begins with an extensive briefing and discussion of the T-DART concept with the howitzer section chiefs the day before the exercise. Training objectives are outlined using the five paragraph operations order format and illustrative graphics. Questions pertaining to the upcoming event are answered, and the Battery Commander ensures each of the leaders understands the mission. The following day, the exercise commences with an alert approximately three hours before the start of the exercise (STARTEX) and continues with the Battery's getting supplies at a Class III and Class V forward area rearm and refuel point (FARRP) enroute to the assembly area one to two kilometers from the initial platoon location. While at the assembly area, sections combat load their vehicles, post safety Ts and check their howitzer radios. (We will use the AN/GRC-160 radios until the PRC-68A radio is fielded.)

Phase II: Execution. Fifteen minutes before STARTEX, the first platoon advance party departs the assembly area. At STARTEX, the first platoon main body and the second platoon advance party depart the Battery assembly area. Enroute, the fire direction center (FDC) maintains continuous radio contact with the forward observers who generate time-driven calls for fire to challenge the skill and responsiveness of the platoon. A typical sequence may proceed as follows.

The first platoon occupies a firing point and fires an initial volley in 18 minutes. When this volley is complete, the platoon FDC transmits a code word to the Battery Commander, who then directs the second platoon to move to its initial position approximately one to three kilometers from the first platoon. The second platoon similarly occupies the position, fires a volley and signals the other platoon to move to a subsequent position. Rotation of the platoons around the series of firing points continues until both platoons have completed four separate occupations and fired 16 or more rounds with each initial volley's being fired within 18 minutes of occupation.

During the exercise, the Battery First Sergeant controls the movement of ammunition carriers, simulating wartime Class V distribution. He usually directs the movement of half of the Battery's ammunition carriers, while the remaining two carriers on the firing point augment position security with .50 caliber machineguns. The advance party rarely remains with the main body after each platoon is laid and safed. Instead, it proceeds to the next location to prepare for the arrival of the main body in the next occupation.

Phase III: After-action. After-action reviews take place in a constructive manner to identify weak areas, suggest possible solutions to problems and refine strong points for future exercises. The Battery Commander publishes the lay, safe and fire times of each platoon for every occupation and emphasizes the high and low points of the exercise. All leaders are allotted time to voice their opinions and are encouraged to balance their criticism by giving one good point and one bad one.

Administration and Safety Requirements. We met the T-DART with careful planning and by training to a high level of proficiency on firing procedures before arriving at the live-firing ranges. Training a new gunner to lay his howitzer for direction shouldn't take place on a "wet" firing point where time and ammunition are too valuable.

To sharpen important skills, we drill extensively in the motorpool or a local training area in a "dry"-firing status. Battle drills at the individual and section levels, based on both performance and time standards, serve as the most effective tool in developing the battery for T-DART. Initially, sections train in a round-robin fashion on all the component skills that comprise an entire T-DART exercise. The same applies to the FDC and the communications, supply and mess sections. Each element of the Battery must train to execute its specific mission.

Land Management. Coordinating to use land is extremely vital to the successful T-DART. The Battery must have enough terrain to move its platoons constantly from firing point to firing point. However, as little as two nearby firing points or even one large position area is enough land to practice the respositioning technique. Methods to accomplish repositioning under these conditions include rotating firing points between the two platoons or simply reoccupying the same firing point.

The T-DART is a new tool to train all elements of a 3X8 firing battery the way we'll fight on future battlefields. By using T-DART, commanders can make training exercises challenging and enjoyable for their soldiers.

William Stuhldreher
1LT, FA
John R. Wallace
1LT, FA
2d Bn, 1st FA
1st AR Div Arty

FIREX 88: The Elephant Danced

At Dugway Proving Ground, Utah, on 22 June 1988, "the elephant danced" as I Corps Artillery battalions from all over the United States coordinated efforts for the massive "time-on-target" exercise. But it took a lot of training, planning and coordinating to get the elephant to dance.

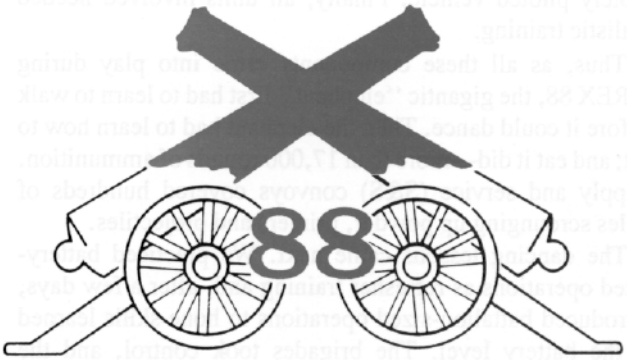
The fire exercise—FIREX—88 was the first attempt at coordinating several brigades of artillery in a peacetime effort since World War II as well as the largest live-fire exercise since that time. It involved almost 15,000 soldiers and airmen and millions of dollars of equipment. The major objectives of FIREX 88 were to—

- Mobilize, deploy and redeploy I Corps Artillery units.
- Stress the command and control of the fire support system.
- Synchronize Field Artillery fires with those of tactical air and Army Aviation.
- Burden combat service support (CSS) and tactical communications operations.
- Refine the Field Artillery role in rear-area operations.

Using a Korean scenario, participating units mobilized at their home stations and deployed by air, rail or ground to assembly areas in Utah. Next they moved into position at Dugway Proving Ground, Tooele Army Depot and Camp W. G. Williams with two divisions at Dugway and one at Camp Williams. Combat service support was provided by the 311th Corps Support Command (COSCOM), US Army Reserve. These units were positioned at Tooele Army Depot.

One of the unique concepts that developed during FIREX was the synchronization of Field Artillery fire with tactical air and Army Aviation. Planners worked closely with the Air Force and Army Aviation to coordinate the firing efforts. Dugway, with its unrestricted firing capabilities, proved to be one of the only ranges of its kind in the US where we can practice fire support and test and refine doctrine. Joint air attack team (JAAT) training was conducted twice a day during FIREX, using Cobras and "H" model helicopters from the 163d Air Cavalry Regiment, Montana Army National Guard, as well as A10, F15 and F16 aircraft.

The FIREX staff and the COSCOM engineer officer worked closely with the Utah National Guard's 115th Engineer Group to identify projects early in the planning stages. Fixed site and primary access roads were completed before the exercise, and support during the exercise included dust control and road upgrading. Several units were also able to participate in river crossing operations using the ribbon bridge assets from the Utah Engineer units.



Liaison teams from I Corps were deployed to the Field Artillery brigades' observation posts and to the rear battle. These teams worked with tactical fire direction system (TACFIRE) equipment, enhancing the capabilities of the unit by the intelligence exchange, fire planning, targeting data and overall fire support coordination. The teams also worked with the fire support element on target data exchange, intelligence, meteorological support and target acquisition coordination. They controlled the range and coordinated targets for attack by multiple launch rocket system (MLRS), cannon, attack helicopters and high-performance jet aircraft. The air liaison officers from the Air Force acted as the forward air controllers for fire support coordination.

The FIREX also tested rear operations. In fact, the training opportunities for participating units were as realistic as possible without actual combat. Rear-area objectives were to employ base defensive operations, including organization, procedures and communications; to provide adequate fire support coordination; to develop procedures for movement control, including air mobilization of Field Artillery units; to manage terrain effectively; and to develop adequate command and control to ensure effective coordination between base clusters. In addition, members of the 19th Special

Forces Group served as trainers, teaching those in the rear area such skills as defending perimeters, and as aggressors, testing those skills.

The I Corps Artillery operations "shop" faced some especially interesting challenges during FIREX. Coordinating the fires of 11 Field Artillery battalions with differing annual training goals and requirements was challenging. Add the joint attack of targets by fighter bombers, attack helicopters and Field Artillery fires in the same areas, and the job was extremely difficult. The S3 had to deal with the capabilities differences of Active Component fighter bombers, US Army Reserve air support operations centers (ASOCs), National Guard helicopters, Active, Reserve and National Guard artillerymen and test projects for smoke rounds and the remotely piloted vehicle. Finally, all units involved needed realistic training.

Thus, as all these components came into play during FIREX 88, the gigantic "elephant" first had to learn to walk before it could dance. Then the elephant had to learn how to eat; and eat it did—more than 17,000 rounds of ammunition. Supply and service (S&S) convoys covered hundreds of miles scrounging up powder, primers and projectiles.

The dancing lessons came next. We practiced battery-sized operations as refresher training and, after a few days, introduced battalion-sized operations to hone skills learned at the battery level. The brigades took control, and the elephant learned it could do more than shuffle.

Then, on the final day, the elephant danced. With members of Congress, Pentagon officials, VIPs from all over the US and a delegation of allied military attaches watching, I Corps Artillery coordinated its efforts to successfully complete its time-on-target shoot.

An 8-inch howitzer in action at FIREX 88, the largest live-fire training exercise since World War II.

Yes, the elephant danced at Dugway for all to see. And the show was very impressive.

Robert G. Miller
COL, NG
XO
I Corps Arty

101st's TSFO Training

"TSFO training today." How many times has a 13F soldier heard and come to dread these three words? He knows it'll mean another boring eight-hour shift in a hot building, and if lucky, he'll get to fire one mission. No Longer! A 13F soldier assigned to the 101st Airborne Division (Air Assault) can expect a stress-filled, challenging two-hour session where he will have battle noise, distractions and obscured vision while trying to put steel on target.

Like many divisions, the 101st conducts semiannual small-unit evaluations. In our Division Artillery, this has led to "master" competitions. Under the prodding of Sergeants First Class Richard Parker and William Houpt, the 13F master competition has evolved into a demanding, educational experience.

Master Competition

Currently, the competition has four parts. All soldiers must take a hands-on portion, a 12-mile road-march and compass course and a written test. Company fire support teams (FISTs) complete the training set fire observation (TSFO) portion. The team concept of the TSFO evolved in the brain of Sergeant First Class Houpt. He wanted to devise a scenario that tested the fire support team, not just the individual observers. This latest iteration of the TSFO test does just that.

The concept is simple. We get the company FIST to put its "game face" on. It isn't conducting a "canned" infantry Army training and evaluation program (ARTEP) or an artillery external evaluation. It's "going to war" with its unit. Once it gets the proper mind set, the exercise begins.

The first 15 minutes belong to the company fire support officer (FSO) and the senior evaluator. The evaluator plays the role of the maneuver company commander. He briefs the company FSO on the mission, the overlay and the fires portion of an attached battalion operations order (OPORD). The next 15 minutes belong to the company FSO. He briefs his personnel, transfers graphics and prepares his team for the battle.

Now fully 30 minutes into the scenario, the FIST can hear the first noises of the battle. Forward observers rush to occupy their positions (seats on different rows in the TSFO classroom), and the first target appears. (The actual TSFO slides used are not critical. For the first iteration we used slides of Fort Sill. The next will be another area.) At this point, the real pressure begins. The senior trainer takes on the job of platoon leader. He immediately begins to scream for fires on the enemy coming his way. At the same time, the noise in the TSFO gets louder and the target moves. The intent is to train as realistically as possible. We want to put the observer under stress. We want to see how he reacts when his "platoon leader" is screaming in his ear for rounds and the other observers are scrambling to submit spot reports.

The exercise continues for the next hour. Each observer is stressed. We demand continual spot reports, varying shell-fuze combinations and recording of targets—performance of every skill an observer must be proficient in to support his maneuver forces.

In the first scenario, we began with an adjust-fire mission and recorded it as a target. We immediately conducted a shift mission, followed by a call for fire for effect (FFE). After the FFE, enemy smoke blanketed the screen, and a close air support (CAS) mission occurred. Finally, we finished the scenario with an immediate suppression of enemy air defense (SEAD) mission and a firing of the final protective fire (FPF).

Evaluation

The beauty of the exercise is its flexibility. Any mission can be put into the scenario. You can add naval gunfire, night missions, battlefield air interdiction (BAI) fires and fire support coordinating measures to the exercise. It is limited only by the imagination of the operator-trainers.

We emphasize training the team as a whole during these exercises. Because we have score sheets, we can provide instant feedback to the team on how well it did the entire fire support job.

Interestingly, the same errors arising in the TSFO occurred on other evaluations. Initial target location continues to be a problem. Also, soldiers forget they are fire coordinators as soon as the noise and pressure begin. They don't send spot reports and don't coordinate other fire support assets.

Our TSFO master competition is a good training program. It takes some work by the trainers, but it provides two intensive hours of realistic system training for the company FISTs. This training technique, now being adopted by fire support NCOs in our direct-support battalions, has changed a boring, tiresome task into an exciting period of warrior preparation.

Brian T. Boyle
CPT, FA
Div FSE
101st Abn Div (AAslt)

War-Gaming OPFOR Artillery

In August, Sergeant John Brow of Headquarters and Headquarters Battery, 6th Battalion, 1st Field Artillery, created a computer program that allows the 1st Armored Division Artillery to add a greater element of realism to its simulation of opposing-forces (OPFOR) artillery at exercise "Ironstar." The exercise is the Division's continuing series of combined-arms maneuvers held at the Combat Maneuver Training Center at Hohenfels, West Germany.

While direct fires, such as those from tanks, are simulated with the multiple integrated laser engagement system (MILES), the fires plotted by the artillery are physically marked on the "battlefield" by trainers or controllers. It's more or less a battle on paper.

Using an existing prototype as a starting point, Sergeant Brow wrote a program that adds significantly to the realism of the "play," allowing the soldiers to war-game OPFOR artillery action more accurately than before. The OPFOR artillery simulation system automatically mimics the movements and fires of up to 10 Soviet artillery battalions. Damage caused by their "fires" can be programmed by the controller or figured automatically. Six to 10 people previously did this job.

For each "battalion," the display lists the number and types of rounds available, the vehicle, the personnel strength and whether the "unit" is on the move or firing. It also details Soviet doctrinal movement orders and fire missions. If linked to another computer terminal, the friendly forces artillery also can play, initiating counterfires, taking evasive action and so forth.

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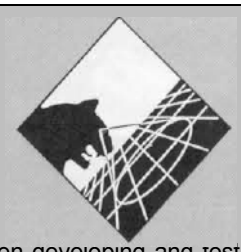
CATIES



The Army has been developing and testing a system that realistically simulates the effects (damage to personnel and equipment) of indirect fire. The combined-arms training integrated evaluation system (CATIES) uses a master computer, a series of antennas and player or vehicle detector devices triggered by radio frequencies.

Radio signals sent out from the master computer via a series of antennas will "paint" an area on the ground under a simulated artillery attack. Detector devices on personnel or vehicles within their "painted" area will then be activated, signaling damage or destruction. This system is projected for fielding at the National Training Center, Fort Irwin, California, in December 1989.

A variation of this system, the simulation of area weapons effects-radio frequency (SAWE-RF), is being considered for use at the Joint Readiness Training Center, Fort Chaffee, Arkansas, and the Combat Maneuver Training Center, Hohenfels, West Germany. The SAWE-RF system uses the global positioning system (GPS) to produce results similar to CATIES. However, instead of "painting" the area, an omnidirectional signal queries the detector devices. If a detector device is within the lethal, indirect fire effects area, it exercises its player routine and assesses the damage. Both CATIES and SAWE-RF are part of the Army's simulation of area weapons effects program and will complement the multiple integrated laser engagement system (MILES).