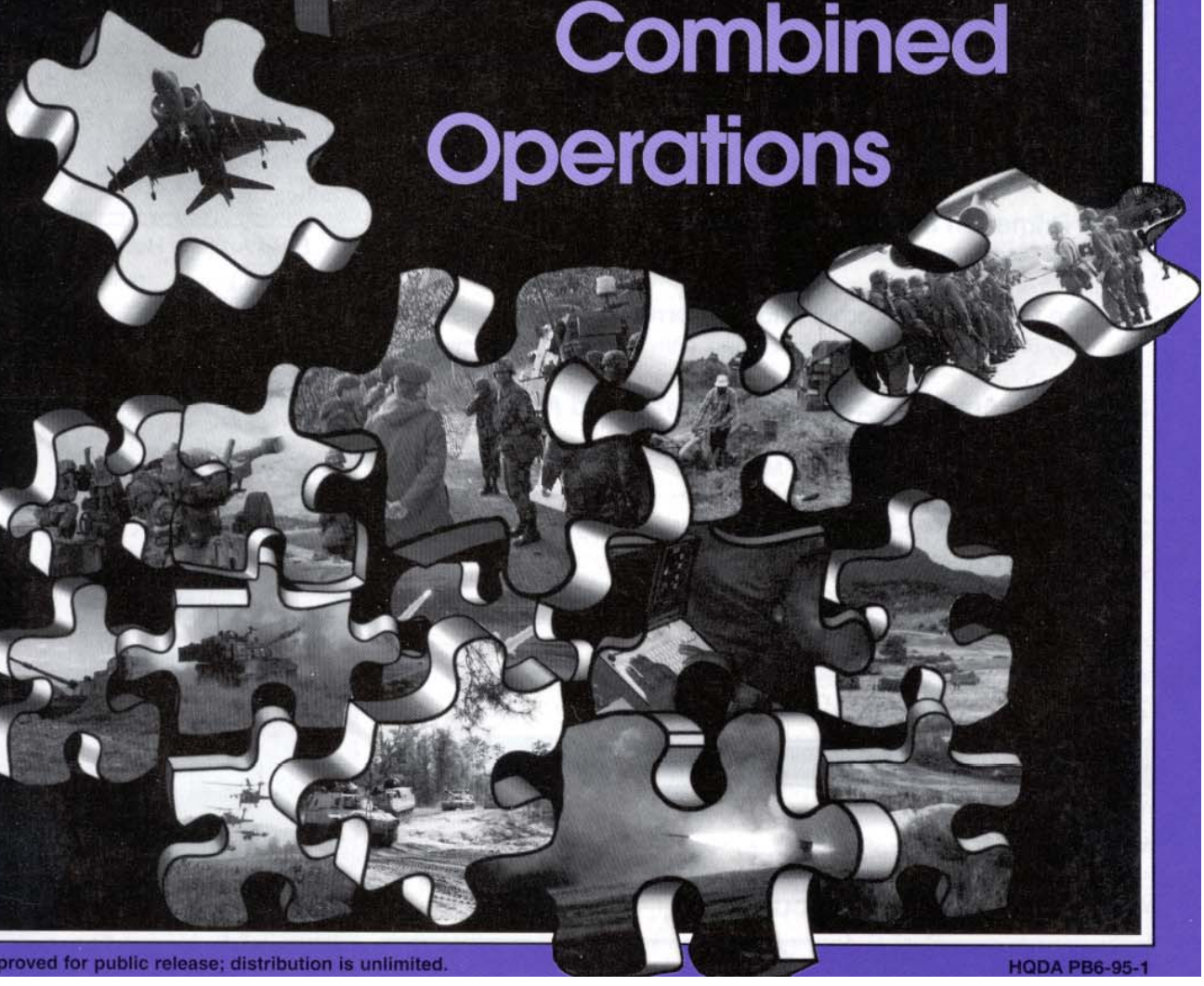
Field Artillery

A Professional Bulletin for Redlegs

February 1995

Joint and Combined Operations



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INTERVIEW

ARTICLES: Joint and Combined Operations

DEPARTMENTS

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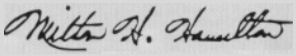


MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army
07896

John A. Dubia
Major General, United States Army
Field Artillery School Commandant

Acting Editor:
Patrecia Slayden Hollis

Art Director:
Donna J. Covert

Assistant Editor:
Joanne Alexander Brown

MAJOR GENERAL JOHN A. DUBIA

Combined Operations Future

In the 21st century, America's armed forces will conduct combined operations—serve as part of a multinational team—as a matter of course. To fight with this force of the next century means rethinking our fundamental concepts of interoperability.

Post-Cold War world politics will profoundly complicate combined operations in the future. America's formal military alliances face a tough task: developing a common approach to the proliferation of regional issues confronting the modern world. That's only part of the problem. Many regional issues fall outside the scope of our formal alliances. With increasing frequency, we've participated in international military operations requiring an ad hoc coalition of forces, often assembled with little notice or preparation. In this environment, we have little opportunity to workout all the details of combined operations in advance.

The key to fighting with fires in future combined operations rests in how we design Force XXI—the Army of the 21st century. Future fire support must be incredibly versatile to account for the different training, capabilities, equipment, politics, culture, doctrine, logistics, intelligence assets and languages of multinational forces. We can build this versatility into the future fire support system, but only if we've got the essential materiel, organizational and doctrinal tools for the task.

High-Tech/Low-Tech Technology. Our future fire support systems must leverage technology to ensure interoperations with both high-tech and low-tech coalition systems—in other words, use high-tech/low-tech technology. In the past, standardization of common components, weapons, supplies and technical procedures was our primary means of ensuring interoperability. Today, the proliferation of state-of-the-art technology offers nations almost infinite modernization options. While we continue to work closely with our longstanding allies to ensure standardization where possible, we face the real possibility that in the next century we may have to fight side-by-side with nations whose technological capabilities cover a broad spectrum. We'll have high-tech partners whose systems are significantly different than ours. We'll also have low-tech allies who employ outdated weapons and equipment. The number of nations we'll work with and the rapid pace of technological change guarantee that standardization *alone* won't be enough.

High-tech/low-tech technology will help bridge the gap. It can provide an embedded means to interface with other nations' fire support systems, regardless of their capabilities. One solution may be to develop an enhanced universal data modem for each system to provide instant connectivity among non-compatible systems. High-tech/low-tech technology could solve many complex problems facing commanders of combined forces with highly disparate capabilities.

Future Battle Staffs. We've also got to think about combined operations as we design the organizational structure of Force XXI. For example, liaison teams have been key to coordinating combined operations. Liaison teams, however, are a 20th century solution that won't solve 21st century problems. On future battlefields, we'll conduct high-tempo, non-linear operations that will triple the battle space commanders operate on today. Teams physically moving around that battle space probably won't be fast or survivable enough to facilitate the exchange of high volumes of accurate, real-time multinational combat information.

Force XXI needs battle staffs that can harness information without the physical liaison of forces. Information age technologies will move volumes of data across the battlefield and analyze and display them virtually instantaneously, significantly enhancing our capability to fight with fires in combined operations.

Battle staffs, for example, could have software that automatically translates language and operational graphics among multinational forces. Staffs could be able to quickly down-link data bases with information on the capabilities, organization and doctrine of other national forces. Clearing fires could be improved significantly by allowing staffs to rapidly access data to identify friendly troops with different equipment. Commanders could employ the situational awareness provided by their staffs to attack the right targets at the right time—regardless of which member of the combined force needed the fires.

The Demands of Doctrine. Our emerging Force XXI doctrine will also significantly shape the way we fight in future combined operations. A key dynamic of this doctrine is the concept of depth and simultaneous attack. By attacking opponents simultaneously throughout the battle space, we'll speed the enemy's defeat. To overwhelm an enemy with depth and simultaneous attack, commanders will employ joint operations—Naval, Air Force and Army fire support systems fighting in one synchronized fight. As our land component commander's battle space expands, the fight will extend to the air and naval forces of other nations as well. Future fire supporters, for example, may find themselves coordinating the employment of long-range, precise Army tactical missile (ATACMS) fires in tandem with the air assets of several nations—simultaneously.

Fighting with all the services of other nations will require harmonizing doctrinal differences. Each country's doctrine is unique, influenced heavily by national character and values. Our first task is to understand and appreciate doctrinal differences. Only then can we begin the process of maximizing each nation's contribution to the combined team.

Combined training and developing common doctrinal terms and procedures can help facilitate this process. But most important, the fire support coordinator (FSCOORD) must thoroughly understand Force XXI doctrine and have the vision, determination, patience and flexibility to harmonize our doctrine with that of our partners in a combined force.

From Desert Storm to Haiti, from private to general officer, in operational environments as diverse as one can imagine, Field Artillerymen are serving with the military of other nations. We're mastering this way of war, and we must continue this effort as we reshape ourselves to meet the challenges of the future.

MLRS Doctrine and TTP—Getting It Right

In his article "Beyond Doctrine: 'Pushing the Envelope with MLRS'" (August 1994) Lieutenant Colonel Jerry C. Hill raised some important MLRS employment issues. At the same time, he left the impression that our doctrine and tactics, techniques and procedures (TTP) are inadequate and our software doesn't work well—I disagree.

Striking Deep Doctrine and TTP. In his article, Lieutenant Colonel Hill discusses the use of an artillery raid, deep interdiction strike (DIS) and an artillery combat team (ACT) as described in detail in articles previously published in *Field Artillery.* He raises the issue that guidance for conducting these operations is not in our doctrine or TTP manuals. For example, he states, "There's no document that provides guidance on how to plan and conduct this [DIS] operation—unless you consider the April 1993 edition of *Field Artillery* a doctrinal publication."

In the process, he does an exceptional job of detailing considerations for these nonstandard MLRS employment techniques [see the figure on Page 41 of the April edition], which we have incorporated into the initial draft of *FM 6-60 TTP for MLRS* (November 1994). But we don't need to incorporate an "artillery" raid into our doctrine—*FM 6-20 Fire Support for the AirLand Battle.*

The raid always has been a type of spoiling attack addressed in both Army and maneuver doctrine—to include using indirect fire assets in both primary and supporting roles. Each division supplements doctrine with its own raid operating procedures for facilitating the "ad hoc" organization that meets the needs of its particular theater or mission. A cross-FLOT DIS is a raid with all of its inherent explicit and implicit missions, including an appropriate task force or team structure, forward and rearward passage-of-lines and security.

It is true that the raid has not been specifically addressed in *FM 6-20;* many view this as an ad hoc mission more appropriately addressed in unit SOPs [standing operating procedures]. General considerations for nonstandard employment methods for MLRS as well as force packaging and other issues now are part of our TTP in the newly revised FM 6-60. This should be enough without being prescriptive.

MLRS in Direct Support (DS). Regardless of what Change 1 FM 6-60 (September 1993) states, I firmly believe that MLRS can never support a true DS mission—the system was never designed for DS. I therefore disagree with the author that "An MLRS battalion is uniquely suited to perform the DS mission for the ACR [armored cavalry regiment]."

Change 1 to FM 6-60, Page 4-4 opens up the possibility for an MLRS unit to receive a DS mission. This is consistent with other portions of Change 1 that clarify the forward positioning of MLRS units, regardless of assigned echelon. Page 4-4 also lists reasons the system does *not* lend itself to DS missions—important points to consider if an MLRS unit wants to attempt to perform the DS mission for an ACR or any other unit.

A maneuver commander should expect his DS artillery battalion to provide him sustained, precise, quick-response, indirect fires. The munitions must be appropriate for the target (HE [high explosive], DPICM [dual-purpose improved conventional munitions] and FASCAM [family of scatterable mines]) or mission (illumination and smoke). An MLRS unit has few munitions appropriate for DS missions and cannot provide those it has with the precision or short response time required for a DS mission.

Precision and response times are critical considerations for DS effectiveness. The lack of precision inherent in rocket munitions makes the weapon an inappropriate choice for DS missions. There are variables—beyond those that affect cannon projectiles—that impact on the trajectory of a rocket. The rocket drop, rocket tip-off, low-level winds at the launch site and rocket motor burn-through are all inconsistent variables that contribute to lack of precision—not good for a DS mission.

In terms of response times, the future improved launcher mechanical system (ILMS) coupled with the improved fire control system (IFCS) will reduce response times considerably. Although we know times will improve, we don't know whether they'll meet the DS needs of brigade-level maneuver commanders.

The continuous volume of fire required for a DS mission is difficult, at best, for an MLRS battalion. MLRS was designed to put large volumes of munitions on large target areas in a short period of time. The DS mission normally requires smaller, but sustained, volumes of fire on targets indefinitely. The continuous volume of ammunition required for the DS mission would cause an MLRS battalion to quickly exceed its ammunition resupply capability. The fact that an MLRS battalion's ammunition trucks have been reduced from 54 to 36 only contributes further to the battalion's inability to resupply ammunition for a DS mission.

MLRS Software. In his article. Lieutenant Colonel Hill was concerned that software would never catch up to the MLRS battalion's needs unless the doctrine was fixed first. It used to be true that doctrine always drove materiel (and, therefore, software) developments, but today this is not always the case.

Technological advances have been incredibly rapid—especially those for processors and memory that allow the development of software tools. Regardless of technological advances, the software development process, unfortunately, is both difficult and cumbersome—often requiring NATO-level working group approval. This has, in many cases, forced our soldiers to discover innovative methods of applying software to tasks or missions for which it was not designed. These new methods can quickly grow from unit SOPs to standardized TTP. The Field Artillery School TTP writers need the field to help them document those procedures.

One example of the perception of the inadequacy of software is the SEAD [suppression of enemy air defenses] scenario discussed by the author. The author is not entirely correct when he states the software doesn't have the flexibility needed to execute SEAD "for Apaches in the deep attack mission...[when the] egress times changed quite often." The author said that because of the changing egress times, the battalion had to shoot the SEAD using the on-call [voice] method of control—"an operation fairly easy to do during Warfighter simulations but very difficult with an actual battalion."

The on-call method has been an extremely

Anticipated Reaction Time	Method
> 30 Minutes	Use the non-nuclear fire plan (NNFP) function and assign H-hour.
20-30 Minutes	Use the NNFP function, but don't assign H-hour. Once the actual H-hour is identified, enter it and process as you would any NNFP.
10-20 Minutes	Transmit each target as an at-my-command (AMC) mission to the launchers. The launcher must move to the firing point and lay on the target. Once the time-on-target (TOT) time is known, transmit an amended call-for-fire (CFF), deleting "AMC" from the "CONT:" field and entering a time in the "TOT:" field.
5-10 Minutes	Transmit each target as an AMC mission to the launchers. Then "back-off" the highest time of flight and coordinate trigger points with the aviation unit (through the appropriate fire support element, or FSE). When the aviators cross the trigger point, the FSE sends the fire message to the unit.
< 5 Minutes	Considering a potential time of flight of more than 1.5 minutes, only 3.5 minutes or less remains for the battalion fire direction center (FDC), battery FDC and the launcher crew to react with no keystroke errors. Be quick with changes, whatever the choice.

Based on anticipated reaction times to make changes, these are some options for processing MLRS fires. When the time allowed for processing and firing gets down to less than five minutes, it's tough for any weapon system to accomplish the mission.

useful tool while experimenting with sensor-to-shooter links for attacking deep targets with short dwell times. The problems with making last-minute changes to non-nuclear fire plans (NNFPs) are neither peculiar to Warfighter exercises nor MLRS software. The NNFP function for all TACFIRE [tactical fire direction system]-based systems does not lend itself to change.

Executing by voice is still unnecessary, however, unless all battalion, battery and platoon digital C^2 [command and control] computers are not functioning. If last minute changes are anticipated to the SEAD targets along the egress route (and they should be in this case), then the FDC [fire direction center] still has several options, based on anticipated reaction times to changes (see the figure). The key to making these methods work is rehearsals.

If the number of targets are excessive or the launchers available are limited, units can supplement either the NNFP methods shown in the figure (10-20 minutes and 5-10 minutes) with the multiple fire mission sequence capability. For instance, if a battery received eight targets to engage, it only has to commit four launchers (assuming no more than six rockets or one missile per target). The first target for each launcher is sent as a TOT mission (or AMC subsequently modified to TOT mission). The second target is sent as a when-ready (WR) mission. The launcher recognizes the missions in the order they're sent. As soon as the first mission is fired, the crew "safes" the rockets. The launcher loader module (LLM) then automatically will lay on the subsequent mission and prompt the crew to arm and fire.

In any case, units should never plan fires for more than two-thirds of their available launchers. This allows the unit to continue processing immediate requests for fire and redirect missions when launchers encounter system failures.

The FCS and FDS software meet most of our needs. But Lieutenant Colonel Hill identified a shortfall that both the Field Artillery School and units should address. Due mostly to continuous software upgrades, some of our technical manuals for software are incomplete and insufficient, at best. The field, the Field Artillery School—the entire artillery community—should submit changes to the manuals when we identify errors in our technical manuals or find they have insufficient information to perform a mission.

MLRS Commanders Conference. III Corps Artillery recently hosted MLRS Commanders Conferences, including MLRS battalion commanders, Field Artillery brigade commanders, the III Corps Artillery Commanding General and Field Artillery School instructors and combat developers. The first two conferences were extremely productive as an information exchange between the units and school. We fully expect this forum to provide a critical link between the Army's MLRS units (the majority of which are collocated with the school at Fort Sill) and the Field Artillery School.

If MLRS units have problems, questions or comments, they can call the MLRS Division at DSN 639-4711/4743/6688 or commercial (405) 442-4711/4743/6688. Units can write the division at Commandant, US Army Field Artillery School, ATTN: ATSF-GR, Fort Sill, Oklahoma 73503-5600.

MAJ Edward L. Hughes, FA
Chief, MLRS Instruction Branch,
Gunnery Department
FA School, Fort Sill, OK

Maneuver Shooters: Eyes for the Battlefield

Many units cannot successfully execute indirect fires during their campaigns at the National Training Center [Fort Irwin, California]. Units consistently discover that a fire support plan relying solely on combat observation/lasing teams (COLTs) or fire support teams (FISTs) will die with the teams. Unfortunately, once the fire support personnel are dead, normally no one left on the battlefield knows the fire support plan or how to make calls-for-fire.

Ensuring leaders plot all targets on their overlay is not the answer. Maneuver personnel must know and understand the scheme of fires, and equally important, trained maneuver personnel must be in position to serve as back-up observers if the primary observers cannot "pull the trigger."

Only FA as Shooters. There are several disadvantages in relying solely on artillerymen to "shoot the plan." The FIST and COLT operate in a vehicle presenting a unique signature—an obvious disadvantage. Opposing forces readily identify the FISTV as a high-payoff target.

Sadly, some FISTs are not adept at increasing their own chances for survival. FISTs are notorious for poor terrain negotiation. Unlike their maneuver brethren, FISTs are more likely to skyline themselves on ridge lines or hilltops. Many FISTs don't dismount personnel to clear an area before establishing an OP [observation

post]. Too often, FISTs follow behind or alongside the commander, acting as a wingman. Many of these company FSOs [fire support officers] will follow the commander into the direct fire fight, which normally results in the FIST's immediate death.

Finally, many fire support plans become "measle sheets" with little or no thought given to the movement or positioning of the FISTs needed to observe the targets. The limited number of FISTs available to the maneuver commander does not allow the FISTs to be everywhere on the battlefield at once observing the many targets and enemy actions.

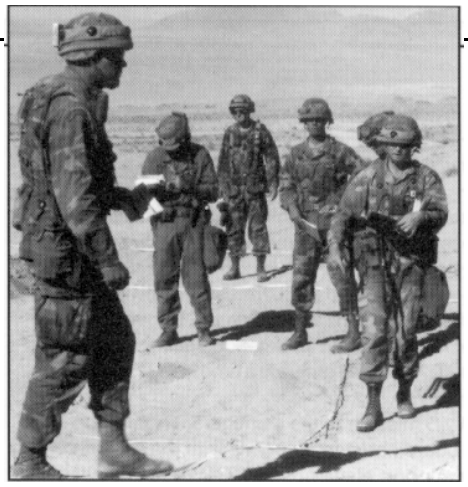
Sending COLTs deep into the brigade sector is not always the best solution for deep eyes. The COLT has several limitations to consider when planning for its positioning. The plan must include resupply of Class I, III and V. A security plan is important to increase the chances of the COLT's survival. An evacuation plan must be in place to retrieve the COLT, if required. Finally, potential long-distance communications problems may completely eliminate any advantage of a deep OP. A general rule to keep in mind is that positioning deep is not always best.

Other Observation Assets. Training and integrating non-artillery eyes into the fire support system can significantly increase the brigade's ability to execute the scheme of fires.

The OH-58D helicopter and its mast-mounted sight system (MMS) give the aerial fire support observer (AFSO) the capability for day and night target acquisition as well as the laser for range determination or target designation. Even without the lasing capability, the OH-58C can provide deep observation for the battlefield.

Task force scouts remain the ultimate pair of eyes. Given their normal taskings in the reconnaissance and surveillance plan, they can readily provide redundant sets of eyes without the limitations of COLTs. Another positive aspect of using these observers is their maintenance data system (MDS) requires them to be proficient in calls-for-fire.

Integrating electronic warfare (EW) assets also has been effective at the NTC. Information gained through EW collectors can be analyzed and used to direct human eyes to a possible target. Night Hawk or Night Stalker can provide intelligence in real time directly to the unit.



The 3d Brigade Commander and his FSO, 101st Airborne Division, discuss fire support during a combined arms rehearsal at the NTC.

The company commander, platoon leader or platoon sergeant can provide primary or redundant eyes for important targets in the task force sector. Maneuver shooters become even more critical during a deliberate attack as each member of the support force, both artillery and maneuver, must know the smoke and suppression targets as well as the timing for the execution of the targets.

The combat engineers can be of tremendous value to the unit to place calls-for-fire while overwatching obstacles. There are also situations when non-artillery personnel may be the *only* set of eyes—for example, military police calls-for-fire on enemy air assault positions or for the brigade support area.

Maneuver as Shooters. Although training maneuver personnel to be shooters is not graduate-level fire support, they still need training. Most maneuver leaders, especially at the company level, don't understand their responsibilities in the scheme of fires (if any); nor do many know the targets the commander deems most critical to success.

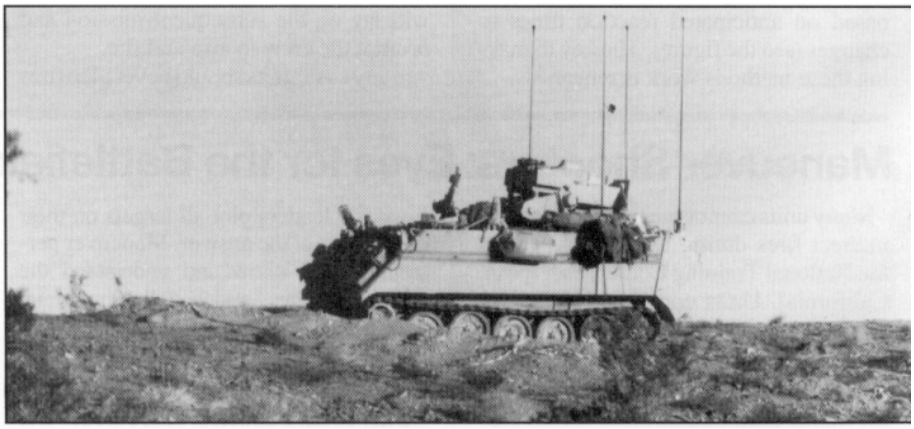
Most are taught early that their first reaction to an enemy action is to call-for-fire. This reaction often overloads the fire support system and adds confusion during battle rather than eliminating the threat to the company. Maneuver personnel also are notorious for trying to destroy one or two moving vehicles with artillery rather than waiting for the large massed formation, the target for which artillery is best suited.

If the mission actually makes it to the TACFIRE [tactical fire direction system] shelter, artillery personnel normally question the reliability of an untrained observer's target identification and location. The battalion FDC [fire direction center] probably will cancel the call-for-fire received from an untrained, unrehearsed and unplanned observer.

It's evident that many maneuver personnel don't understand the reaction time required for a Field Artillery battalion to mass fires. In turn, triggers are not identified when considering the rate of march of the enemy and the reaction time.

Many maneuver soldiers don't know the proper radio nets used to initiate a call-for-fire. Several additional problems a unit may face trying to integrate untrained maneuver shooters into the fire support plan include the shooter being unable to understand the fire support execution matrix [FSEM] and the maneuver shooter's inability to participate in a rehearsal.

Training Maneuver Shooters. The key to integrating maneuver shooters as primary or redundant observers into the



A FIST from the 1st Infantry Division is set up to overwatch targets in a task force engagement area during a deliberate defense at the NTC.

scheme of fires is home station training. The training must teach maneuver leaders the basics of calls-for-fire with the battalion FDC, how to read an FSEM and the importance of rehearsing the maneuver shooter. Training maneuver shooters can begin simply with instruction given on a blackboard or chart paper. An observed fire trainer—TSFO—at home station also will provide valuable training.

After the basics, nothing takes the place of actually adjusting live rounds from an OP. But many units don't have enough rounds for their own FIST training, much less maneuver observers. Units can improvise by having several personnel follow the mission and "make adjustments." Maneuver shooters should take advantage of every opportunity to train with the Field Artillery battalion.

All maneuver personnel acting as primary or redundant eyes must receive training on the FSEM. Given the many versions of FSEMS, the basic information on the matrix should include but is not limited to call signs, radio nets and frequencies, target numbers, grids, triggers, the high-payoff target list and attack criteria.

It is essential to include the fire support plan as part of the combined arms rehearsal. This may be the only time when maneuver shooters can rehearse the plan. A maneuver commander must be able to talk specifics about the targets he's responsible for executing, their triggers and who will be observing the fires, both primary and redundant. The observers, especially the maneuver shooters, must be able to articulate their responsibilities.

The wave of the future, a battle command vehicle (BCV) from Task Force 1-70 Armor, 94th Armored Brigade. The BCV gives the commander the ability to gain a "real-time" picture of the battlefield.

The key to an FM fire support rehearsal is flexibility. Normally, not all observers can get on the net for the rehearsal at the same time due to mission requirements. Among these are aviation pilots requiring crew rest and task force scouts already on the screen line.

The Field Artillery battalion must be able to rehearse the plan in bits and pieces. By using this method, all participants can rehearse their mission at some point before the battle rather than trying to find a time when all participants can get on the net for a rehearsal.

Methods units use to communicate the fire support plan that *don't* work include passing information through liaison officers (LNOs) or briefing the mission via early morning "dumps" from the tactical operations center (TOC). Passing information through second and third parties causes the information to become diluted, confused and incomplete. The early morning dumps are literally too much information in too little time just prior to execution.

Training maneuver shooters at home station takes time, energy and resources that units will find well spent when they need redundant shooters on the NTC battlefield. The bottom line is that the commander must accept responsibility for executing fires—and that means ensuring his unit can shoot the plan if the FIST or COLT dies.

CPT Robert P. Lott, Jr., FA
Fire Support Analyst
NTC, Fort Irwin, CA

FA Units in Vietnam—Book to Record Their Stories

The purpose of this letter is to ask readers for assistance. I am conducting research for a book I'm writing to pay tribute to US Army Field Artillerymen who served in Vietnam. More specifically, those who served in Field Artillery groups, battalions and separate batteries that fought in Vietnam.

Much has been written about our brothers in the infantry and deservedly so. But it is important for us to remember that Field Artillerymen fought, were wounded and died in Vietnam as well. As time marches on, it is easy to forget all those who shed their blood in Vietnam for our great country. As a proud member of the Field Artillery for 20 years, I'm concentrating my energies on recording the history of Field Artillery units in Vietnam.

My intention is to devote a chapter to each unit with each chapter containing as many significant historical details as possible along with at least one story describing acts of heroism or bravery under fire by the unit or individual members of the unit. I am trying to contact as many Field Artillery Vietnam veterans as possible and ask for their personal stories, copies of after-action reports, unit histories, copies of awards citations, unit crests, special patches, action photos, unit pictures, names of unit commanders and the dates they commanded, special or unusual techniques or applications used, special missions (Riverine Force Artillery, artillery raids, etc.) and other materials.

My first priority will be to use stories written and submitted by the Field Artillerymen who were there when the events happened. I feel it is essential that the history created by the Field Artillerymen be documented and preserved for future generations to read and learn from. Anyone contributing material used in the final publication will be given full credit in the book.

I thank any reader in advance for any help you can provide. My address is as follows: 4204 Berkeley Drive, Sheffield Village, Ohio 44054. Readers may call me at (216) 934-1750.

MSG(R) Daniel P. Gillotti, FA
Sheffield Village, OH

Major General (Select) Leslie M. Palm, Commanding
General, Marine Corps Air Ground Combat Center

Joint Fire Support—Training for the Future

Interview by Patrecia Slayden Hollis, Acting Editor

Editor's Note: *The Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms, California—900-plus square miles of rugged desert/mountainous terrain—operates in a manner similar to the Army's National Training Center (NTC) of about 1,000 square miles at Fort Irwin, also in California's Mojave Desert. Like the NTC, battalion or brigade-level task forces come to the MCAGCC for maneuver and live-fire training. Unlike the NTC, units at the MCAGCC generally don't fight force-on-force; they fight in offensive and defensive scenarios with pop-up targets and maneuver on the ground upon which they also live-fire. Separated by a distance of 40 miles, the two training centers are connected by a corridor for vehicle passage, which runs under Interstate Highway 40 between the two centers.*

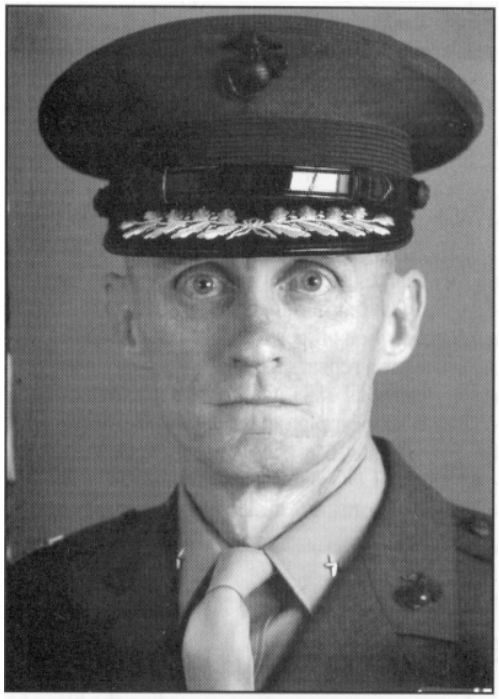
Q *Are there plans for more joint training exercises, such as the semi-annual Desert Fire Exercises (DESFIREXs) where Army multiple-launch rocket system (MLRS) battalions support Marine units?*

A Yes, in fact, we do a lot of joint training. A third MLRS unit, another battalion from III Corps Artillery at Fort Sill, will train here in DESFIREX in the spring. Our Marine units put their own training packages together—we, at MCAGCC, don't dictate they bring MLRS.

We do other joint training, including a lot with Naval aviation. We have an Executive Steering Committee that synchronizes Navy aviation to participate in CAXs [combined arms exercises], coordinating the carrier air wings' training schedules either to fly off the carriers in support of the CAX or take off from our expeditionary airfield at the MCAGCC. Air Force B-52s and B-1s also support our CAXs.

One of our charters is to facilitate joint training both here at the MCAGCC and at other service facilities. When the CAX units come here, we coordinate for the use of the range at the Naval Air Warfare Systems Center at China Lake [California], the weapons' test range at Naval Ail Station Fallon [Nevada] and the range at Nellis Air Force Base [Nevada] to simulate deep air strikes.

Q *As commander of the 10th Marines with the 2d Marine Division in Operation Desert Storm, the 2d Armored Division Tiger Brigade's A/92d FA (MLRS) battery was under your control.*



How did you employ your MLRS in Southwest Asia?

A Before hostilities started, we used MLRS on artillery raids. We sent cannon battalions up to the border with a Q-37 radar team and an MLRS platoon; they were the trap for the enemy artillery if it fired on our cannon battalions. Once the war started, we used MLRS strictly in the more traditional counter-fire role. Because of the size of our zone of action, the battery was employed by platoons spread out quite a distance.

When we initially went through the breach toward Kuwait City, we sent a radar through with the first battalion; but our MLRS platoons were close enough to support us from where they were. They were very effective in counterfire.

The MLRS battery didn't join us until after the air campaign had started, so we had less than a month to sort things out. By the end of the first day, we were talking digitally. (Today, the connectivity is even better.) Because the Army and Marine artillery had trained together at Fort Sill, both understood how each other worked. Equipment or tactical interoperability wasn't a problem.

Q *The Marine Corps recently signed an MOA with the Army for MLRS support for the Marine air ground task force (MAGTF). What do you see as the extent of Army MLRS support for Marine units? What are the advantages and disadvantages*

"The Marine Corps has a requirement for a general support rocket system, but because of fiscal realities, we currently rely on Army MLRS support."

of relying on Army MLRS assets to support Marine operations?

A Depending on the size of the deployment, the MLRS support can be from a battery to a battalion. If the Marine force is regimental-sized, it would have a battery. A MEF-sized [Marine expeditionary force, or division-sized] MAGTF would have a battalion of MLRS in support. Obviously, if we'll deploy with MLRS, we need to train with it as well. We'd use MLRS in the deep battle counter-fire role—as general support artillery.

The biggest advantage of using Army MLRS is that the Marine Corps doesn't have to acquire the system. The only disadvantage I see is if the MLRS doesn't fall on the TPFDL [time-phased force deployment list] early enough—sequenced to land in theater fast enough—to support the Marine unit. That's something we'll continually have to work with the Army to ensure the MLRS unit is identified and quickly phased into the theater to come under the operational control of the Marine unit.

During Desert Storm, even though MLRS was new to Marines and it was the system's first time in combat, there weren't any operational or logistical disadvantages to relying on the Army for MLRS support. The agreement was that the Army provided all the logistical support for the MLRS battery, so we really got fire support for nothing.

The MOA will ensure that MLRS support is there when we need it. Obviously, situations vary and the CINC [commander-in-chief] directs the allocation of forces. But as a basic premise, we must plan and train for MLRS support so we have an enhanced general support capability. The Marine Corps has a requirement for a general support rocket system, but because of fiscal realities, we currently rely on Army MLRS support.

Now for future rocket support, the developmental HIMARS [high-mobility artillery rocket system] is attractive because it's lightweight and mobile and has the MLRS's range. But we need to keep in perspective that while the launcher is lightweight and mobile, HIMARS could need a large logistics tail following it into theater.

When the 10th Marines and the Tiger Brigade's A/92 MLRS moved into Kuwait, that battery had 18 HEMTTs [heavy expanded-mobility tactical trucks] with trailers dedicated solely to ammunition. Now granted, that battery was logistically prepared for sustained, high-intensity combat in Operation Desert Storm, an unlikely scenario for HIMARS.

HIMARS is very attractive, but the Marine Corps is going to have to weigh the size of the tail HIMARS requires into the equation.

Q *In unit rotations to the MCAGCC, what's an enhanced CAX?*

A To explain what an enhanced CAX is, I first have to define the scope of our usual CAX. The CAX is centered around an infantry battalion task force supported by a composite aviation squadron and the necessary combat service support. Enhanced CAXs are really anything beyond that—whether it's more maneuver elements, more aviation or even different or more training objectives.

The concept of an enhanced CAX really got started when I MEF decided to combine its two CAXs into regimental-sized training, providing more training for the MAGTF command element.

The enhanced CAX also incorporates more joint training— greater use of Air Force assets and DoD [Department of Defense] agencies. We work with DIA [Defense Intelligence Agency] through the Marine Corps Intelligence Activity (MCIA) to get real-time intelligence.

In enhanced CAXs, we continue to evaluate the battalions' abilities to live-fire and maneuver. Like the normal CAX, the evaluation is not a grade, per se. But we have a tactical exercise and evaluation control group that tells them how they're doing, how they might improve their tactics—those sort of things. A formal after-action review goes to MCCDC [Marine Corps Combat Developments Center at Quantico, Virginia] to identify any trends that need to be addressed in doctrine or TTP [tactics, techniques or procedures].

Q *What fire support trends have you seen at the MCAGCC in recent times?*

A Greater joint efforts—units are using and coordinating joint fire support assets more in CAXs (Navy and Air Force aviation and MLRS).

Another trend is for forces to engage targets at greater distances on the battlefield. Technology has extended the battlefield. The "close" battle isn't as close as it used to be. Tanks can now kill at 4,000 meters. FISTs [fire support teams] must acquire and engage targets at greater distances; very seldom does a FIST engage a target at only 1,000 meters.

Units do a lot of work with UAVs [unmanned aerial vehicles], not only to gain intelligence, but also to acquire targets for indirect fire—a very effective technique. Using UAVs, units can even observe the effects on the targets.

Another trend is the pace of "combat." The only place Marine units can maneuver over so much space is at the MCAGCC. Synchronizing combat in time-distance is a big challenge. Coordinating and engaging targets is very different at mechanized speeds.

Q *I understand you're planning to increase the equipment allowance pool [EAP] at MCAGCC. What equipment are your adding and from where are you getting it?*

A This is an initiative to cut the cost of training at MCAGCC. Getting equipment here is the most expensive part of the CAX program. By increasing the EAP, we'll save about two million dollars each year.

Starting in the fall of 1995, we'll phase in 918 principal end items to the total equipment allowance pool. To give you

C/5-3 FA (MLRS), 17th FA Brigade, live fires during a raid in support of the 11th Marines' "Deep Strike" at MCAGCC.

perspective, we now have 216 principal end items in our pool. We'll phase in everything from radios to tanks during a three-year period.

The increased EAP will provide enough equipment for the normal CAX plus some more. For example, units coming for a CAX from Camp Lejeune [2d Marine Division in North Carolina] won't have to bring their principal end items; they'll be able to just fall in on their gear here.

The largest items we have right now are artillery pieces and trucks. The first major end items we'll receive in the first quarter of FY 96 will be 22 Abrams tanks coming out of the Army in Europe. They're being modified in Anniston [Alabama] right now.

We also will phase in 23 light armored vehicles and 58 armored amphibious assault vehicles. These are coming from our equipment stores at Barstow, California, and Albany, Georgia—we have those in stock. All the principal end items, with the exception of SINCGARS [single-channel ground and airborne radio system], which isn't completely fielded, have been identified.

Q *What is the LeatherNet initiative at MCAGCC?*

A LeatherNet is an ARPA [Advanced Research Projects Agency] project to create three-dimensional infantry soldiers in the computer to "fight" on a simulated battlefield. That battlefield is an accurate representation of MCAGCC—in some sections down to a grid fidelity of one-meter. This project will allow commanders to rehearse joint and combined arms exercises before training on the actual MCAGCC terrain. Initially we'll train commanders at the company level, but by the end of 1997, we'll train commanders up to the regimental level as well.

LeatherNet is the first simulation project in the joint arena to create infantrymen in such detail, which will allow us to validate doctrine, combat models and tactics and try out "equipment" before we develop it. The Army is considering taking our computerized high-fidelity foot soldiers and tweaking them to use as dismounted infantry in their simulations.

Q *What is your Emerald Light initiative and how does that relate to LeatherNet?*

A In Emerald Light we're instrumenting exercises at MCAGCC, much like the instrumentation system at the National Training Center. Our goal is to track units on the battlefield, transmitting their positions through a classified version of Internet, called the Defense Simulation Internet, or DSI. Once on DSI, our information becomes part of a standard simulation protocol that allows the Army, Navy—all our armed forces—to import Marines in live training at MCAGCC into their battlefield simulations. We hope to do a preliminary demonstration of our instrumentation system in late 1995.

Taken together, LeatherNet and Emerald Light will significantly enhance our participation in the synthetic theater of war (STOW) series of simulations, the next one in 1997. In STOW, MAGTFs will be able to play in a joint battle with live foot soldiers instrumented at the MCAGCC, virtual units in the LeatherNet center and constructive units (models, devices, etc.) from a number of sources. These MCAGCC capabilities will allow the Marine Corps to participate in the Advanced Distributed Simulation (ADS) paradigm of live, virtual and constructive training; the MCAGCC will be the first of two ADS centers for the Marine Corps.

As another benefit of Emerald Light, MCCDC is working with the NTC to link our instrumentation systems and share data for joint battle. Using microwave technology to transmit high-quality data and voice, we could link forces training at MCAGCC with forces training concurrently at the NTC. It would benefit us all if we could fight the regimental or brigade battle with one battalion live firing at the MCAGCC, one battalion maneuvering force-on-force at the NTC and one LeatherNet battalion "fighting" on a flank.

These initiatives are excellent and will enhance—but not replace—our live training. We still consider live fire/maneuver the "crown jewel" of our training. We will not degrade live to accommodate virtual or constructive training.

Q *The Marine Corps and Army are jointly developing the advanced tactical cannon system, the lightweight 155-mm howitzer to replace the M198 at the turn of the century. How important will the system's increased strategic deployability and tactical mobility be to the Marine Corps?*

A Critical—the Marine Corps needs a lightweight howitzer that gives us more strategic deployability and tactical flexibility than the M198. Part of that flexibility is its mobility on the battlefield—helicopter transportable.

The 198 is an old system. There's evidence of severe structural problems—we just need a new weapon system.

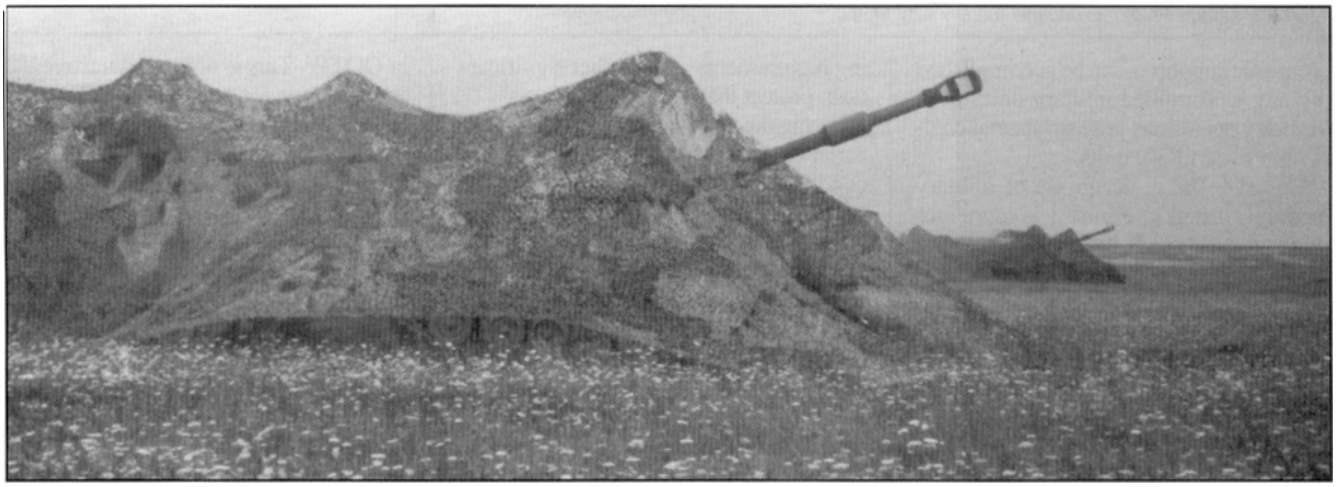
Q *What message would you like to send Army and Marine Field Artillerymen stationed worldwide?*

A Artillerymen need to continue to be proactive in assessing our ability to provide fire support on tomorrow's battlefield. Advanced technology has extended the battlefield significantly, and we need to ensure we have the equipment, doctrine and structure to support the joint commander.

Although that sounds basic, if you look at the Army Chief of Field Artillery's Vision 2020, supporting the joint commander with fires will be a challenge. The speed at which we prosecute war and the dynamics on the battlefield are going to change significantly in the future. [See the article "Field Artillery Vision 2020" by Brigadier General Leo J. Baxter, Assistant Commandant of the Field Artillery School, in the December 1994 edition.]

More than ever, joint commanders are thinking of fire support as an overall entity rather than individual components—Air Force air, Naval gunfire, Army and Marine aviation and artillery, etc. To ensure we can support those future commanders, we need today's fire supporters to have vision—to think ahead.

Major General (Select) Leslie M. Palm is Commanding General of the Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms, California. In the early 1980s, he served as Director of Manpower at MCAGCC. His previous assignment was as Assistant Deputy Chief of Staff for Manpower and Reserve Affairs (Manpower Plans and Policy), Headquarters, Marine Corps, Washington, DC. Major General (Select) Palm's other commands were the 2d Marine Division's 10th Marines out of Camp Lejeune, North Carolina, while the regiment was in Southwest Asia during Operations Desert Shield and Storm; the 4th Battalion (redesignated 5th Battalion), 11th Marines, part of the 7th Marine Amphibious Brigade at Twentynine Palms; the Artillery Demonstration Unit, The Basic School, Quantico, Virginia; and D Battery, 2d Battalion, 12th Marines, part of the 3d Marine Division in Okinawa, Japan.



Marne Thunder:
FA in OOTW and the Div Arty METL

by Colonel Keith W. Dayton and Lieutenant Colonel Richard P. Formica

...On order, the Div Arty transitions to war or operations other than war. The Div Arty employs all or part of its strength to provide conventional fires to support 3d Infantry Division combat operations in the NATO central region or, on short notice, deploys all or part of its force out of sector as a regional response force to conduct military operations across the spectrum of conflict.

3d Infantry Division (Mechanized) Artillery Mission Statement, 1994

Artillerymen need to counter the emerging consensus that operations other than war (OOTW) is a military area in which there's no role for Field Artillery (FA). Consider the precedents. In all recent OOTW deployments, FA units have either been left off the troop list or weren't used when present. In Somalia, a battery of artillery made it ashore but never saw action; its Q-36 Firefinder radar never was linked with an FA firing unit. In Macedonia, political considerations have prevented the presence of artillery among the 3d Infantry Division (Mechanized) peacekeepers, and there are none among soldiers deployed in Croatia. Long-standing peacekeeping operations, such as the Multinational Forces and Observers (MFO) in the Sinai, haven't featured artillery, and when OOTW is played at our combat training centers (CTCs), artillerymen are more often used as liaison personnel, infantrymen or communications providers than as cannoneers.

Does this mean artillery has no role in OOTW? Far from it. Whether the threat is primitive or more sophisticated, most OOTW environments have artillery present. One need look no further than the former Yugoslavia to realize that hostile artillery can be a major factor in OOTW. In the former Soviet republics of Moldova, Azerbaijan, Georgia and Tajikistan, artillery is a major threat.

As the *Training and Doctrine Command (TRADOC) Pam 525-5 Force XXI Operations* notes, we're entering a period when our opponents will not only be nation states, but also the "new warrior class" of non-national groups. These groups range from sub-national threats to meta-national threats—all of which have access to modern artillery systems.

When the political decision is made for American peacekeepers to defend themselves and fight back or participate in peace enforcement operations, we artillerymen need to be ready to fight and defeat the entire spectrum of threat forces.

Artillery Challenges in OOTW

As currently defined, the term "operations other than war" covers a spectrum of activities short of sustained ground combat (See Figure 1). Those on the left side of Figure 1—nation assistance, humanitarian assistance and disaster relief, and

Nation Assistance	Counterdrug Operations	Support for Insurgents
Humanitarian Assistance and Disaster Relief	Non-Combatant Evacuation Operations (NEO)	Show-of-Force
		Attacks and Raids
Domestic Support	Anti-Terrorism	
	Peacekeeping	
	Peace Enforcement	

Figure 1: Operations other than war (OOTW) cover the spectrum of activities short of sustained combat.

domestic support—can be accomplished by any well trained military unit; those military operations pose no special challenges for artillery units.

However the center group of military activities listed in Figure 1 is more ambiguous. Although the artillery has no special utility in counterdrug operations, anti-terrorism or non-combatant evacuation operations (NEO), there's a role for artillery in peacekeeping and peace enforcement. On the right side of the Figure 1, OOTW activities in support of insurgencies, shows-of-force and attacks and raids call for artillery involvement.

The point is that several activities in the OOTW spectrum call for FA capabilities. However, they do require we adapt our current tactics, techniques and procedures (TTP).

A useful way to portray how OOTW changes the focus and nature of FA operations is within the context of the seven doctrinal Field Artillery tasks (Figure 2). In a high-intensity environment, tasks such as "Coordinate Fire Support," "Acquire Targets" and "Deliver Fires" are clearly most important with the tasks of "Move," "Resupply" and "Survive" somewhat lower in priority. In an OOTW environment, the priorities shift. "Survive," "Communicate" and "Acquire Targets" achieve greater importance while "Deliver Fires" falls lower in the priority list.

OOTW is a profoundly different mission and can't be trained "on the fly." As a result, Marne Thunder—the 3d Infantry Division (Mechanized) Artillery in Germany—has incorporated OOTW-specific considerations into our Div Arty, battalion and battery mission-essential task lists (METLs). We must be prepared to deploy out of sector for missions ranging from peacekeeping to low-intensity combat.

OOTW METL

In the 3d Infantry Div Arty, our METL was based on the general defense plan (GDP) and oriented on the mission of defeating the Warsaw Pact with its superiority in cannon and rocket systems. While much of that METL remains valid and still forms the core of our training programs, it didn't adequately deal with OOTW. As a result, we revised the METL to correspond with our most likely missions in the future. (See Figure 3.)

Our new METL incorporates regional operations and deployment into our training requirements and another significant task: protect the force.

During the past year, our battalions and batteries developed OOTW METL tasks, conditions and standards easily linked to section-level training that are now part of our annual training program. The opportunity to practice OOTW at the local training areas—Grafenwoehr and the Combat Maneuver Training Center at Hohenfels—keeps us focused on what's important and leads to further refinement of our TTP as we gain experience. We haven't completely integrated OOTW tasks into all Div Arty training, but we're well on our way.

Back to the Future—OOTW TTP

What follows is a brief discussion of several of the new or revised procedures we've developed as we prepare Marne Div Arty units for regional deployments or OOTW. This is not an exhaustive list, and the basis for many of the TTP come from previous non-European conflicts, to include the Vietnam War. For ease of reference, our TTP are organized by the seven doctrinal FA tasks. The listing is not in priority but rather by the tasks that change most significantly in OOTW.

Survive. During the Cold War, the survivability of an FA unit depended much more on our ability to move rapidly than on establishing hardened positions. OOTW, however, changes the conditions for FA employment.

Mobility isn't nearly as critical to our ability to survive. Instead, for political reasons, artillery units may be more valuable for the deterrent effect of their presence than for their actual firepower. As a result, our firing units need to develop new methods (or re-look old ones) to enhance survivability.

Hardened Positions. In an OOTW environment, the firing unit doesn't try to hide

High-Intensity War	OOTW
1. Coordinate Fire Support	1. Acquire Targets
2. Deliver Fires	2. Survive
3. Acquire Targets	3. Communicate
4. Communicate	4. Maintain/Resupply
5. Move	5. Move
6. Survive	6. Coordinate Fire Support
7. Maintain/Resupply	7. Deliver Fires

Figure 2: In OOTW, the emphasis on the seven doctrinal Field Artillery tasks changes.

Then...	...And Now
• Transition to war.	• Transition to war/regional operations.
• Conduct operational moves.	• Deploy by road/rail to aerial port of embarkation/sea port of embarkation (APOE/SPOE).
• Provide fire support for offensive operations.	• Conduct tactical road marches.
• Provide fire support for defensive operations.	• Provide fire support for offensive operations.
• Sustain the division artillery.	• Provide fire support for defensive operations.
• Command and control.	• Provide fire support for regional operations.
• Conduct counterfire operations.	• Provide counterfire.
	• Provide fire support for deep operations.
	• Sustain combat/regional operations.
	• Command and control.
	• Protect the force.

Figure 3: In OOTW, the division artillery mission-essential task list (METL) changes.

and won't move frequently. Instead, it often wants to be seen. This is especially true in peacekeeping situations where visibility is a deterrent. As a result, firing units can expect to stay in one place for extended periods of time.

The hardened position area, or firebase, affords a more stable perimeter and enhanced protective cover. The more vulnerable elements of the firing unit can be consolidated within the firebase to take full advantage of its protection. Firebases incorporate tactical operation centers (TOCs), train elements, radars and the like. The FA firebase depends on maneuver forces to help protect it and engineer support to help prepare it for protection against direct and indirect fires.

Occupation by Battery. In OOTW, FA units may collocate platoons in the same position. In a high-intensity environment, survivability considerations dictate fighting by platoons—the more dispersed you are, the more survivable you are in the face of enemy artillery. The development of Paladin is a result of this imperative, allowing dispersion down to the individual gun.

In OOTW, however, the counterfire threat is low and the ground attack threat is high. Platoons or individual guns simply can't protect themselves in an OOTW environment where there's no forward line of own troops (FLOT) and no security. Batteries need to laager together to protect themselves. The separate platoon or individual gun is easy prey to the irregular forces that infest the OOTW environment.

Positioning the FAASV and Prime Mover. When massed volumes of fire are essential, we correctly position the FA ammunition support vehicle (FAASV) or the howitzer's prime mover directly to the rear of the howitzer to facilitate rapid and continuous ammunition resupply or rapid movement of the howitzer.

In OOTW, we're likely to expend far less ammunition. The ammunition vehicle with its armor and the prime mover, both with crew-served weapons, become far more valuable as firebase perimeter defense vehicles.

Increased Importance of Direct Fires. In OOTW, the importance of the FA's direct fire capabilities increases. In a high-intensity environment's linear battlefield, an artillery unit rarely sees an enemy armored vehicle—if it does, it's cause for grave concern because it means there was a breakthrough somewhere.

On a nonlinear OOTW battlefield, however, direct fire engagements become more likely. A well trained FA unit has a fighting chance in a direct fire engagement against lightly armed and usually independently deployed armored vehicles of an irregular force. And the deterrent power of cannons in direct fire in a peacekeeping environment is not to be underestimated.

Force Protection. Focusing on what likely will be required of an artillery unit to survive in OOTW brings a whole host of lost skills to mind. We need to rediscover the lost art of field craft.

A battery in the same location for weeks at a time in a politically sensitive environment needs to know the fundamentals of field sanitation, combat lifesaving and (believe it or not) environmental protection.

We must re-learn how to conduct small unit patrols and establish listening posts (LPs) and observation posts (OPs) for smaller, less distinguishable threats. We also need to re-familiarize our soldiers with employing booby traps and claymore mines, improve their crater analysis skills and teach them how to deal with land mines. In addition, units need to practice using noise/light discipline and challenge/password procedures and employing battery reaction forces.

Final Protective Fires (FPF). In the high-intensity environment, FA units plan and deliver FPFs for maneuver units. OOTW conditions demand we recover the lost art of providing FPFs to firing unit locations and firebases. Additionally, the location of firebases and firing units should allow FA units to provide reinforcing fires from one firebase to another.

Deliver Fires. Political considerations, diplomatic negotiations and the likely mandate to minimize civilian casualties and reduce collateral damage dictate a change in how we look at the task of delivering artillery fires.

In the high-intensity environment, we attack each high-payoff target rapidly with adequate fires to destroy or neutralize it. In line with the commander's criteria, we engage as many targets as we can, constrained primarily by ammunition availability and the controlled supply rate (CSR). Not so in OOTW.

Graduated FA Response. Firing at targets with the intent of destroying or neutralizing them may not be the intent for OOTW artillery operations. Instead, the artillery can issue warnings or demonstrate resolve by first using non-lethal munitions—smoke, illumination or low-impact training rounds (LITR). With these rounds, the target realizes it has been located and either stops firing or moves out of the area.

If and when lethal fires are acceptable within the rules of engagement (ROE), we can expect increased employment of precision munitions—Copperhead and Hellfire. For those situations that call for a full measure of our fires, the usual high-intensity munition of choice—the dualpurpose improved conventional munition (DPICM)—takes a back seat to the standard high-explosive (HE) round because of DPICM's high dud rate.

High-Intensity War	OOTW
Maximum Lethality/Responsiveness	Rules of Engagement (ROE)
Fight by Platoon	Fight by Battery
Survive by Hiding/Moving	Firebase Operations
Direct Support Battalions	Dedicated Batteries
Mass Fires	Graduated (or No) Response
Linear Battlefield	6400-Mil Orientation
Conduct Road Marches: Start Point (SP), Release Point (RP) and Checkpoints (CPs)	Convoy Operations: CPs/Roadblocks/Ambushes
Permissive Fire Support Coordinating Measures (FSCM)	Restrictive FSCM
Strike Deep	Few Deep Targets
Traditional FA Missions	Non-Traditional FA Missions

Figure 4: A comparison of some traditional Field Artillery tactics, techniques and procedures (TTP) to those new or revised TTP for OOTW.

...Or No FA Response. In contrast to the high-intensity battlefield, it's likely the OOTW force commander won't have the latitude to respond to targets with indirect fire. ROE may prohibit shooting back. In this situation, cannon units merely record and report instances of hostile fire.

6400-Mil Orientation. It's no surprise that nonlinear battle space requires artillery men to perfect shooting rapidly in any direction. The use of multiple aiming points (not just the collimator) and distant aiming points is vital. Gun sections need to practice shooting out-of-traverse missions, and self-propelled artillery should become comfortable with shooting while the gun tube is laid over the rear of the howitzer.

Acquire Targets. The sophisticated systems and procedures we have to locate and destroy targets on the high-intensity battlefield are still quite valuable in OOTW. In fact, radars probably will be among the first systems deployed to an OOTW to accurately locate hostile mortars and artillery. Even if not linked to FA shooters, radars and counterfire targeting cells can identify targets for appropriate action by attack helicopters or ground maneuver forces.

Coordinate Fire Support. OOTW promises to stretch the FA's ability to support the maneuver commander in ways for which we're inadequately prepared. It also will cause us to change our emphasis on fire support coordinating measures (FSCM) as the linear battlefield will be far less common than a nonlinear free-for-all.

Direct Support (DS) Relationship. The area of responsibility for a maneuver commander in OOTW is likely to be far larger than on the linear battlefield. Imagine a maneuver brigade combat team operating in a large sector with its task forces widely dispersed. The maneuver commander most likely would choose to spread out his artillery as well. The firepower provided by FA assets enhances the commander's ability to protect his force and enables him to transition rapidly to combat operations, if required.

But dispersion over great distances plays havoc with our usual DS relationship. Separate maneuver task forces may be operating more than 100 kilometers from each other in difficult terrain. There's no way the FA can cover the entire zone of operations. The DS battalion commander has a tremendous challenge to coordinate fires for the entire brigade, and in OOTW, the standard DS relationship often will be simply too hard.

Dedicated Battery Alternative. One answer may be dedicated batteries. A firing battery is the smallest firing unit capable of providing fire support to a dispersed task force in OOTW.

When deployed independently, however, a firing battery must be augmented with the operational and logistical elements normally found at the Div Arty or FA battalion level. These include a Q-36 radar, meteorological section, survey section and maintenance, fuel, ammunition, medical and food service support.

Similarly, firing batteries must be trained and ready to employ these additional assets. For example, we've practiced linking the Q-36 radar digitally with the battery computer system (BCS) in the fire direction center (FDC).

The firing battery commander must develop the command and control capability to employ, protect and care for these non-organic assets. The lieutenants, warrant officers and NCOs assigned to these dedicated batteries must be prepared to deploy independent of their parent unit and must fully consider the unique aspects of operating in OOTW's more decentralized environment.

FSCM. Although the guiding principles of FSCM don't change in OOTW, there's a difference in emphasis. In high-intensity scenarios, we focus on FSCM that are permissive to facilitate massing all available forms of firepower. In OOTW, the emphasis shifts to restrictive FSCM.

No-fire-areas (NFAs) will be established throughout an OOTW area of operations. We must design NFAs around population centers and protected civilian areas, such as hospitals, churches and landmarks. The force's targeting element must include civil-military and staff judge advocate representation to help identify the NFAs.

Restricted-fire-areas (RFAs) will be employed as a function of local ROE. Restrictions on particular weapon systems or munitions effects also may be imposed. Moreover, units need to be trained to expect changes in what is permissible. Today's rules will likely be restricted further tomorrow.

Clearance of Fires. On the linear battlefield, we work hard to engage targets rapidly. In OOTW, however, we must be able to work under command and control conditions that restrain us.

Target identification is likely to be more difficult, and we won't always be able to identify enemy forces or distinguish them from non-belligerent local civilians. Some fires in and around populated areas will require clearance by local civilian officials, if allowed at all.

The degradation of responsiveness is obvious. OOTW will demand that artillerymen and maneuver commanders understand the requirements to prevent unwarranted civilian casualties and to be absolutely certain that fires are cleared by many agencies before they're delivered.

Move. In most high-intensity scenarios, movement means road marching long distances along developed roads to get to the fight. Start points (SPs), march order discipline and release points (RPs) are crucial as whole corps compete for limited road space in movements-to-contact and offensive operations. OOTW brings different parameters for the task of movement.

Convoy Protection. Artillerymen moving in OOTW won't have the luxury of traveling along well secured main supply routes (MSRs). Instead, hostile ambushes of FA (and other) convoys is an effective, low-cost and highly likely means for a less sophisticated foe to inflict casualties on our units. We must be vigilant for likely ambush sites and trained on actions upon ambush.

We also must be able to respond with indirect fires anywhere along convoy routes, not only to support maneuver or logistical movements, but also to protect ourselves. Because OOTW environments are often infested with land mines, leaders must know how to reconnoiter the routes and soldiers how to identify mines and avoid or disarm them.

Roadblocks and Checkpoints. Movement in OOTW presents a challenge for which we never train in high-intensity scenarios. Experience in Somalia and the former Yugoslavia shows that belligerents commonly use roadblocks and checkpoints throughout areas of operations. We must train our platoons and batteries on how to approach and negotiate roadblocks and checkpoints, particularly because they're manned by irregular forces whose language and motivations are different from our own.

Maintain and Resupply. If these are tough tasks for an artillery unit on the linear battlefield, they're even tougher in OOTW. Historically, OOTWs have been in areas with poorly developed or severely damaged infrastructures. Usually, large numbers of refugees and displaced civilians clogg the area. Couple this with long unsecured lines of communications

interdicted by roadblocks and checkpoints and the challenges are evident.

Communicate. There isn't much difference between communications TTP for a high-intensity battlefield and those for OOTW. However, the challenge is the distances are far greater. When an artillery battalion is spread over several hundred square kilometers in support of a maneuver brigade involved in peacekeeping operations, the usual FM challenges are magnified; communications retransmission is a skill we need to train well.

Mobile subscriber equipment (MSE) coverage alleviates the distance problems somewhat, but protecting widely dispersed signal nodes becomes a maneuver commander's nightmare. To communicate effectively, we may need to learn how to digitally integrate other advanced communications systems, such as the international marine satellite (INMARSAT) and cellular telephones.

Non-Traditional FA Contributions to OOTW

To this point, we've addressed changes to TTP we're developing in the 3d Infantry Div Arty to employ FA in OOTW. There may be times, however, when political and diplomatic considerations preclude deploying FA weapon systems or prohibit their use if deployed. In some OOTW, FA simply isn't required. For those situations, FA battalions are uniquely organized to contribute in more non-traditional FA ways.

Command and Control (C^2). With operations centers at the battalion, battery and platoon levels, FA battalions offer excellent C^2 facilities for any mission. The battalion has a robust voice and digital communications network that enhances its C^2 capabilities, making it a critical communications asset for the deploying force.

Observation Posts. By this we don't mean the standard OPs/LPs. In OOTW, an OP is often under a United Nations umbrella along a border or demilitarized zone (DMZ). Manning OPs is not something new for FA units. The fire support team vehicle (FISTV) is uniquely suited for this role. While the FISTV's limitations make it slow and cumbersome on a highly mobile, linear battlefield, it has characteristics that contribute to its effectiveness in OOTW: day and night optics, excellent FM voice and digital communications and light armor protection.

Convoy Operations. The ammunition platoon of a cannon battalion has 27 heavy expanded-mobility tactical trucks (HEMTTs) and is trained to conduct long-range convoy operations. For those convoys that require more protection, the cannon battalion also has 24 armored FAASVs, each with considerable cargo space and a mounted .50-caliber machinegun.

Local Security. Infantry and armor battalions are better suited than cannon battalions to provide local security. However, we can't overlook the capability offered by an artillery battalion; the M109 howitzer in a direct fire mode and the FAASV with its .50-caliber machinegun are extremely effective against most lightly armed security threats.

Sustainment Operations. In disaster relief operations and for other humanitarian assistance missions, FA battalions are organized, as most battalions are, to provide basic logistical services. FA battalions can establish base camps and tent cities, provide food service, offer limited medical care and provide a full range of maintenance, recovery and fueling operations. In US Army Europe (USAREUR), FA battalions practice sustainment operations not only during field training operations, but also when tasked to provide life support for major command post exercises (CPXs) at local simulation centers.

Liaison and Civil-Military Affairs. While just about any unit can provide liaison officers (LNOs) and conduct civil-military operations, the fire support structure of the DS battalion may be ideally suited for this role. Fire support soldiers are accustomed to operating with a different headquarters than the FA battalion. They train extensively to coordinate operations and provide liaison. They're equipped with adequate communications and are conditioned to operate independently. The fire support elements (FSEs) and teams are ideal candidates to work with local civilian officials, Department of Defense (DoD) activities and other federal agencies.

Conclusion

So what's the bottom line? Like the rest of the Army, the FA must expand its scope and develop new techniques to train for and conduct regional OOTW. The 3d Infantry Div Arty will continue to refine its new METL tasks.

Today's Field Artilleryman is like Janus of Roman mythology—one face looking to the future and the other looking back to the past. The future is represented by astonishing strides forward in technology and sophisticated weapon systems, such as Crusader and the Army tactical missile system (ATACMS) Block II. It's the FA of the present and beyond, reaching out in a lethal and high-intensity battlefield to digitization and Force XXI. It's the traditional artilleryman's world of massed and responsive fire support, fighting deep and dominating battle space.

However, fighting and winning in OOTW is as much a mission for today's Field Artilleryman as is preparing for the digitized battle space of Force XXI. The past provides lessons learned and TTP that worked in a lower intensity environment. In Marneland, we follow the guidance of TRADOC Pam 525-5: "...examine alternatives and explore new (and old) ideas that will ensure success in OOTW."

Colonel Keith W. Dayton commands the 3d Infantry Division (Mechanized) Artillery in Germany. His other commands were the 4th Battalion, 29th Field Artillery, 8th Infantry Division (Mechanized), Baumholder, Germany, and Headquarters and Headquarters Battery and C Battery, both in the 1st Battalion, 84th Field Artillery, 9th Infantry Division at Fort Lewis, Washington. Also during his 24 years of service, Colonel Dayton served as Executive Officer to the Deputy Chief of Staff for Operations and Plans at the Pentagon, was a National Security Fellow and graduated from the University of Southern California with a master's degree in International Relations.

Lieutenant Colonel Richard P. Formica until recently was the Deputy Fire Support Coordinator for the 3d Infantry Division (Mechanized), having already served as the Division Artillery S3. Currently, he commands 1st Battalion, 3d Field Artillery, part of the 2d Armored Division at Fort Hood, Texas. He also commanded Headquarters and Headquarters Battery, 2d Armored Division Artillery, and B Battery, 2d Battalion, 33d Field Artillery, 1st Infantry Division (Forward), both in Germany. He holds a Master of Military Art and Science from the Command and General Staff College, Fort Leavenworth, Germany.

Hells Fires Deep: The DOC—An Integrated Approach

by Colonel Thomas E. Culling, Lieutenant Colonel Daniel A. Nolan III and Captain Mark W. Jones

His headset crackled with the report from G2 targeting: "One 2S3 battalion and one BM21 battalion verified in EA [engagement area] Grizzley." The grids were passed to the aviation officer for relay to the attack battalion and the Field Artillery intelligence officer (FAIO). The battle captain looked to Eagle 6 [aviation brigade commander], who gave permission to continue to REDCON 1 [readiness condition 1].

Fifteen minutes later, the battle captain glanced at his watch and announced, "The time is now 2338, F-5 minutes. Fire support?"

"Shot, SEAD [suppression of enemy air defense] program AA0032!"
"Aviation?"

"Apache 6 [attack helicopter battalion commander] reports launch with 12 aircraft."
"A^2C^2 [Army airspace command and control]?"

"AC [air corridor] Trout is open. ADA [air defense artillery] is at rotary wing hold!"
"EWO [electronic warfare officer]?"

"EW assets on station. Jamming early warning radars, fire support and ADA communications nets!"
"G3 Ops?"

"TF [task force] 3-66 alerted that friendly aircraft will be crossing the FLOT [forward line of own troops] in their sector in five minutes!"

The battle captain looked at the synchronization matrix. "Next event is F-1, rounds complete on SEAD. Time is now 2339."

Deep operations isolate the enemy and set the conditions for success in close operations. Prosecuted against enemy forces not yet in contact, deep operations establish those conditions by stripping away the enemy's ability to concentrate combat power and mass his artillery. Deep maneuver and firepower synchronized in time and space to strip combat power from the enemy require a team effort by all members of the division staff. For this reason, the 2d Armored Division at Fort Hood, Texas, created the deep operations cell (DOC).

Separate from the fire support element (FSE) and located in the division main command post (DMAIN), the DOC plans, coordinates and executes division deep operations. It is not an action agency—it *coordinates* the actions of the G3, G2, division artillery and aviation brigade to synchronize deep maneuver and firepower.

DOC Organization and Responsibilities

The DOC is staffed with two sets of personnel. The first is a full-time set of primarily Field Artillery (FA) and aviation personnel, as shown in Figure 1. The second set of personnel is assembled in the DOC only during the execution phase of deep operations and is called the execution cell. This cell includes the division artillery and aviation brigade commanders and the G2, G3 and A^2C^2 representative.

The full-time personnel come from the general support (GS) battalion (provisional) in our division artillery and from the headquarters and headquarters company of the aviation brigade. (In the 2d Armored Division, the GS battalion is provisional, pending the assignment of an additional multiple-launch rocket system, or MLRS, battery.) The officer-in-charge (OIC) of the DOC is the GS battalion commander, and the battle captain is the battalion S3. The DOC's liaison officer to corps is the assistant S3.

Although the division tactical command post (TAC) is responsible, doctrinally, for current operations, deep operations are planned and executed from the DMAIN. The requirement for near real-time intelligence and a separate facility to maintain focus makes the DMAIN the logical location for the cell. DOC personnel operate in an M934 five-ton, expandable van

Deep Cell OIC	Lieutenant Colonel (FA)
Battle Captains	2 x Captain (FA and AV)
NCOs in Charge	2 x Sergeant First Class (13Fs)
Radio/Telephone Operators (RTOs)	2 x Specialist (13F and AV)
Corps Liaison Officer (LNO)	Captain (FA)
Corps Aviation LNO	Captain (AV)

Figure 1: Division DOC Full-Time Personnel

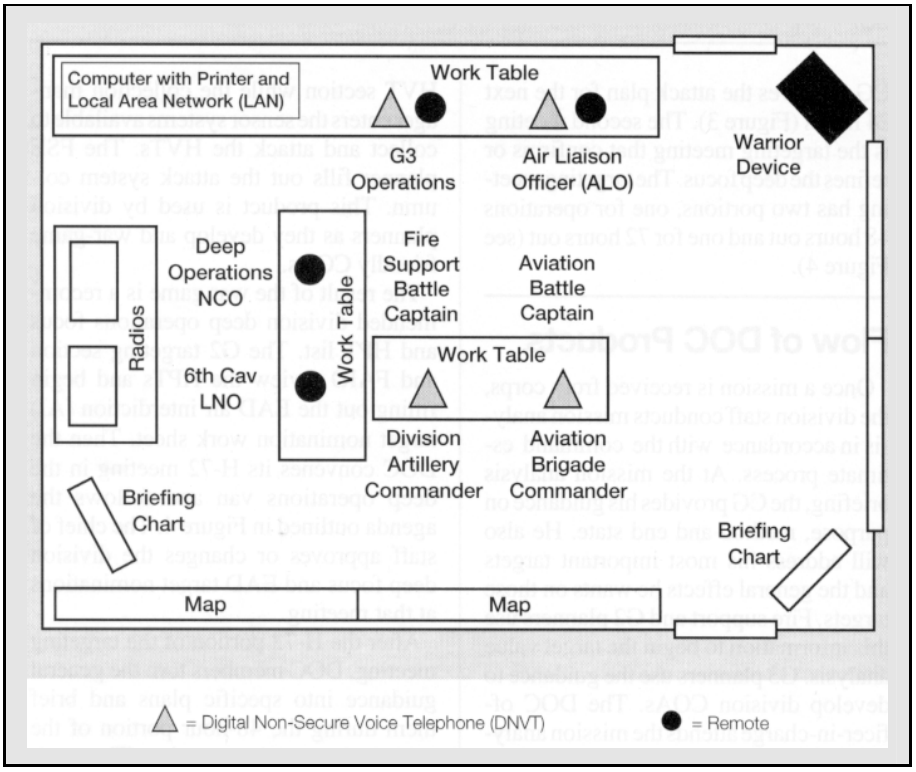


Figure 2: Division DOC Layout in an M934 Van

equipped and laid out as shown in Figure 2. (The DOC's "Warrior Device" shown in Figure 2 is an interface with the G2's all-source collection element, or ACE, to provide real-time intelligence.)

Combat Components

Deep operations are normally economy-of-force efforts and have three components: deep maneuver, deep fires and command, control and communications countermeasures (C^3CM).

Deep maneuver is conducted primarily by attack helicopter squadrons and is directed against the most critical high-payoff targets (HPTs). Because deep maneuver requires the synchronization of Army aviation, fire support and C^3CM, it's the most complex form of deep operations and requires detailed planning and command involvement during execution.

In the *deep fires* component, the division employs deep fires from GS and GS reinforcing (GSR) artillery as well as echelons above division (EAD) assets to destroy, disrupt, delay or limit specific targets.

The *C^3CM* component supports deep operations by disrupting the enemy's troop control process, increasing his decision times and reducing his ability to concentrate his forces. To do this, the division employs EW. The goal of EW is to identify high-value command and control nets and disrupt the enemy's electronic and communications activities at critical times during his decision cycle. The division's C^3CM process (operations security, deception, jamming and destruction) is an integrated, balanced employment of lethal and non-lethal attacks directed to disrupt enemy target acquisition, intelligence gathering and C^3 systems while protecting friendly battle command systems from similar efforts.

Deep Focus

Although both the division commanding general (CG) and the G3 planners address deep operations when developing course-of-action (COA) statements or providing the commander's guidance, the DOC is responsible for developing and war-gaming deep operations COAs. Deep operations must be consistent with the next higher commander's intent and scheme of maneuver. The primary way the DOC directs the efforts of collection, fires, C^3CM and deep maneuver planning is by articulating the division deep focus and synchronizing the division deep effort with the corps' deep effort.

The division deep focus is a prioritized, time-sensitive, phased HPT list that's a product of the command estimate and targeting processes. It's the base from which all other DOC functions operate. The deep focus is developed by the DOC and approved by the chief of staff or CG and sets the priority of effort for all members of the staff involved in deep operations.

The following is an example of how the DOC develops the division deep focus. Deep operations employ maneuver, fires and C^3CM to deny the enemy specific systems judged to be critical to enemy operations. When fighting a Soviet-style opponent, one such system would be his fire support. Typically, the commander's guidance specifies the elimination of this asset as key to success. Historically, we've engaged in an artillery duel with a numerically superior opponent to eliminate his artillery. Deep operations provide the opportunity to deny the enemy his artillery while preserving ours.

The process begins with the commander's guidance. For our example, that guidance will state the requirement to destroy enemy fire support systems early in the operation. As a result of the war game, the division planners choose deep maneuver as opposed to deep fires as the asset to destroy the enemy's artillery.

The DOC assesses this COA and determines that the destruction of enemy air defenses provides attack aviation the freedom of maneuver necessary to accomplish the mission. In conjunction with the G2, the DOC analyzes the enemy's order of battle and determines what his most effective air defense systems are by type, unit and location on the battlefield. Using deep fires to destroy his air defense assets before conducting the maneuver is essential to success. The G2 targeting section concentrates on locating the air defense assets, and the FSE concentrates on an aggressive complementary SEAD program.

The decision then raises the question of force protection. To protect our artillery from the enemy's counterfire, we must destroy his target acquisition (TA) assets immediately. A Soviet-equipped organization has sound and flash assets, but it relies heavily on radar TA assets. We must employ EAD C^3CM to search out these scarce resources so we can destroy them or jam their nets. This brief analysis results in a deep focus that implies the elimination of Ark-1 and Small Yawn radars, SA-15s, SA-8s and then artillery assets.

Although the commander's guidance didn't address enemy TA and air defense artillery, the deep focus translates his goals into specific actions. All deep operations

assets are employed to deny the enemy commander access to critical systems at specific times.

Three Phases of Deep Operations

In planning and coordinating deep operations, the DOC simultaneously concentrates on three time phases: final coordination for operations to occur within 24 hours, development and war-gaming of COAs for those to occur in 48 hours and providing general guidance for operations in 72 hours. The time frames of 24, 48 and 72 hours are aligned with the air tasking order (ATO) cycle and synchronize deep operations with EAD assets. Once deep focus is established, the components of deep operations are allocated as appropriate for the targets.

For clarity of purpose and synchronization, deep maneuver planning must have answers to several questions. What's the purpose of the mission? What's the success criteria and desired end state? How does the operation support the current battle plan? How will this operation affect the future close fight? What's the abort/no-go criteria? How important is it to collect immediate battle damage assessment (BDA)?

In addition to any mission-specific abort/no-go criteria (i.e., number of aircraft lost, light availability), the 2d Armored Division established three universal criteria. The following three questions must be answered "Yes" for the mission to continue. Does the mission support the commander's overall plan and intent? Is SEAD available (lethal or non-lethal)? Does the intelligence picture clearly indicate the target will be in the engagement area at time-on-target (TOT)? If the answer is "No" to any of these questions, the deep maneuver is canceled, shifted to a new engagement area, put on hold until the criteria is met or executed, if the CG or chief of staff decide the risk to be acceptable.

The DOC plans division deep operations based on the deep focus and recommends execution to the G3, chief of staff or the CG. The cell meets twice daily in the DMAIN. Early and continuous planning is critical as many targets must be nominated to higher headquarters 72 hours before they can be attacked.

The first of these meetings is the execution briefing in which the chief of staff or CG approves the attack plan for the next 24 hours (Figure 3). The second meeting is the targeting meeting that confirms or refines the deep focus. The targeting meeting has two portions, one for operations 48 hours out and one for 72 hours out (see Figure 4).

Flow of DOC Products

Once a mission is received from corps, the division staff conducts mission analysis in accordance with the command estimate process. At the mission analysis briefing, the CG provides his guidance on purpose, method and end state. He also will address his most important targets and the general effects he wants on those targets. Fire support and G2 planners use this information to begin the target value analysis. G3 planners use the guidance to develop division COAs. The DOC officer-in-charge attends the mission analysis briefing knowing the corps deep focus and begins developing deep COAs that support the CG's guidance and corps deep operations and are compatible with the overall division COAs.

G2 planners then continue the intelligence preparation of the battlefield (IPB) to determine the enemy's most likely COA. Using target sheets and in coordination with the FSE planners, the G2 targeting officer develops the high-value target (HVT) list. On the sensor/attack matrix, the targeting officer fills out the HVT section while the collection manager enters the sensor systems available to collect and attack the HVTs. The FSE planner fills out the attack system column. This product is used by division planners as they develop and war-game friendly COAs.

The result of the war game is a recommended division deep operations focus and HPT list. The G2 targeting section and FAIO review the HPTs and begin filling out the EAD air interdiction (AI) target nomination work sheet. Then the DOC convenes its H-72 meeting in the deep operations van and follows the agenda outlined in Figure 4. The chief of staff approves or changes the division deep focus and EAD target nominations at that meeting.

After the H-72 portion of the targeting meeting, DOC members turn the general guidance into specific plans and brief them during the 48-hour portion of the next day's targeting meeting. The products presented at that time and the agencies responsible for them are as follows: the proposed deep maneuver *synchronization matrix* shown in Figure 5 on Page 18 (DOC), recommended updates to the *attack guidance matrix* (DOC), intelligence collection plan (G2) and deep *targeting work sheet* (DOC).

Once these products are approved by the chief of staff, subordinate commanders can complete their attack plans. All products along with the detailed aviation and

Who	What	Briefs From
ALO	Air Tasking Order (ATO) Lay Down	Sketch
LNO	Corps Deep Focus (24 Hours)	Sketch
G3 Operations	Friendly Set at F-Hour (Forward Line of Own Troops, or FLOT-Hour)	Sketch
G2 All-Source Collection Element (ACE)	Enemy Set at F-Hour	Overlay
Chief of Staff	Restate Division Commander's Intent	Chart
G3 Plans and Exercises (PLEX)	Decision Support Template (DST)	Sketch
Collection Manager	Update Priority Intelligence Requirements (PIRs) Collection Plan/Assets	Chart
Electronic Warfare Operations (EWO)	EW Plan/Assets	Chart
Deep Operations Cell/Battlefield Operating Systems (DOC/BOS)	Synchronization Matrix	Chart
All	Rehearsal	Matrix

Figure 3: Agenda for the DOC Execution Meeting—24 Hours Out

Who	What	Briefs From
	48 Hours Out	
LNO	Corps Deep Focus	Sketch
ALO	ATO Laydown	Sketch
G3 PLEX	Friendly Set	Sketch
ACE	Enemy Set	Overlay
Field Artillery Intelligence Officer (FAIO)	Target Refinements	Target Nomination Work Sheet
Chief of Staff	Division Deep Focus	
CM	Collection Assets	Chart
EWO	EW Assets	Chart
DOC	Proposed Attack Plan	Attack Guidance Matrix (AGM)/Synchronization Matrix
Chief of Staff	Approve Attack Plan	
BOS (+)	Proposed Time Line	Synchronization Matrix
	72 Hours Out	
LNO	Corps Focus	Sketch
G3 PLEX	Friendly Set	Sketch
ACE	Enemy Set	Overlay
Collection Manager	Collection Assets	Chart
EWO	EW Assets	Chart
DOC	Attack Assets	Chart
DOC	Recommend Division Deep Focus	
Chief of Staff	Approve Division Deep Focus	
FAIO	Target Nominations	Target Nomination Work Sheet

Figure 4: Agenda for the DOC Targeting Meetings—48 Hours and 72 Hours Out

fire support plans are presented for final review and approval at the next day's execution meeting.

Executing Deep Ops

The G2 targeting section coordinates with the ACE to determine the locations of the HPTs. In the absence of visual or electronic surveillance, the DOC uses situational templates and situational rates of advance to track HPTs. When a HPT crosses a decision point (DP), G2 and G3 current operations officers alert the DOC, G3, chief of staff or the CG (as appropriate). The FSE and other agencies are alerted as required to attack the targets.

Immediately after the execution meeting, the DOC conducts FM radio and mobile subscriber equipment (MSE) rehearsals for deep maneuvers planned for the next 24 hours. Staff representatives and subordinate units participate in the rehearsals. Rehearsals are absolutely essential to execute these complex operations—without them, soldiers will die.

Executing deep maneuver requires a well drilled team with a common vision of the battlefield. The common vision allows DOC members to make intuitive leaps based upon incomplete information. It requires a detailed understanding of how the opponent employs his system so everyone can share a clear picture of the battlefield. The execution of deep maneuver also requires instant access to key decision makers.

Synchronization Matrix

Six hours before crossing the FLOT, the F-hour sequence begins. F-hour is based upon the time the attack battalion will cross the FLOT to achieve the time on target. This sequence is laid out in the synchronization matrix (Figure 5 on Page 18) and details what each player is responsible for and when.

At F-3 hours, the chief of staff gathers the members of the execution cell in the DOC van. Not all must be physically present in the cell. Multiple communications allow the DOC to mass information, not people. The battle captain for the maneuver maintains contact with those members not physically present.

DOC personnel monitor the division command and operations nets and the division artillery and aviation brigade command nets. The DOC also uses MSE and tactical local area networks (LAN) to pass orders and instructions. Communication between the battle captain and other staff members is by short-range commercial radios or face-to-face. The execution cell receives final updates, evaluates abort/no-go criteria and makes sure communications checks are made with subordinate units. The DOC then conducts any final coordination and monitors the employment of their units/agencies using the communications links in the deep operations van.

The DOC OIC is responsible for establishing the decision windows for the operation. The decision windows refer to the specific decisions required during a deep maneuver and the time in which the decision must be made. For example, in the 2d Armored Division, we attempt to conduct deep maneuvers during darkness to take advantage of the capabilities of our AH64 Apache helicopters. Every maneuver must be launched so the aircraft can execute the attack and recross the FLOT before morning nautical twilight (BMNT). We call this the "light wall," and it's one of the factors that "closes" a decision window. As the operation progresses, the battle captain ensures the required information is presented to the decision maker.

The synchronization of all components that must occur within minutes of each other requires all members of the execution cell to have a common vision of the battle as it unfolds. For example, the agility of attack aviation is tremendous but not unlimited. Execution cell members must clearly understand the strengths and limits of this asset and the pace at which deep maneuver unfolds.

Intelligence must be minutes, not hours old. The speed of maneuver of attack aviation requires detailed planning, and last moment changes in engagement areas, routes, etc. can de-synchronize the entire maneuver. The execution cell must be flexible in planning and firm in execution.

Finally, the key to success in deep operations

is commitment. These operations require commitment of resources and the commitment of the leadership. If the commander's intent is to attack the enemy throughout the depth of the battlefield simultaneously, then he must be willing to commit the resources and the force of his will to that end.

What you take away from your enemy today, he can't employ tomorrow. Effective deep operations translates to soldiers staying alive in the close fight.

Event: EA GRIZZLY — As of: 280935 May 94

F-Hour	F-6	F-3	F-35	F-20	F-5	F-1	F	F+10	F+12	F+42	F+47	F+52	F+1
Time	1743	2043	2308	2323	2338	2342	2343	2353	2355	0025	0030	0035	0042
Enemy Action	Defend									Move Out of Ea			
NAI / DP			NAI1 / DP1										
Friendly Action	AA												
Aviation	FARRP	REDCON 4	REDCON 2	REDCON 1	Launch		Cross FLOT	Battle Positions	TOT	Egress		Cross FLOT	Arrive FARRP
Fire Support	Plan SEAD	Verify Geom		Activate RFA;ACA	Fire AA0032	EOM AA0032	Activate NFA@BPs				Fire AA0032	EOM AA0032	
EW					Jam								
ADA					Rotor Hold			Weapons Tight		Rotor Hold			Weapons Tight
A^2C^2					Open TROUT								Close TROUT
C^2					Report to TAC		Report to TAC			Report to TAC		Report to TAC	

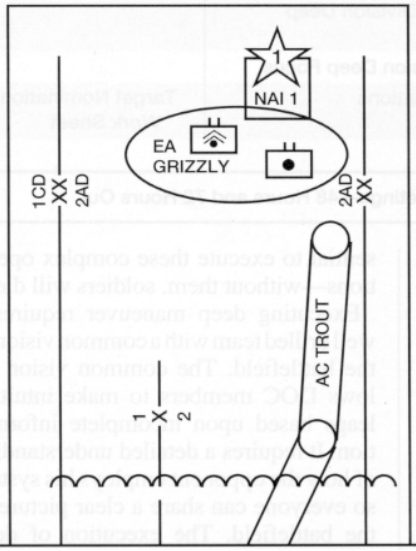
Focus: DAG, 10th GMRD

Success: 2 x Arty Bn

ABORT/NO-GO Criteria:
- < 1 Bn Located
- Loss of 3 Aircraft

Decision Point:
- DP1: Verified 2 Bn in EA
- DP2: Light Wall is 0450

Concept Sketch



Collection Assets

	Requested	Approved	Available
LRS	1800-2300	1800-2300	
UAV	1800-2300	1800-2300	
IEW	1800-2300	1800-2300	
Guardrail	1900-0300	1900-0300	
National	1900-0300	1900-0300	

EW Assets

	Requested	Approved	Available
Cmps Call	2000-0200	2000-0200	2000-0200
F4G	2000-0200	N/A	N/A
EF-111	2000-0200	2000-0200	2000-0200

Fire Support Assets

	Requested	Approved	Available
Cannon			
Rkt/Msl	36	36	32
Atk Helo	15	15	12

Legend:

EA = Engagement Area
F-Hour = Forward Line of Own Troops (FLOT)-Hour
NAI = Named Area of Interest
DP = Decision Point
AA = Assembly Area
FARRP = Forward Area Rearm/Refuel Point
SEAD = Suppression of Enemy Air Defenses
EW = Electronic Warfare
ADA = Air Defense Artillery
A^2C^2 = Army Airspace Command and Control
C^2 = Command and Control
REDCON = Readiness Condition
RFA;ACA = Restricted Fire Area; Airspace Coordination Area
NFA@BPs = No Fire Area at each Battle Position
TAC = Tactical Command Post
TOT = Time-on-Target
EOM = End of Mission
DAG = Division Artillery Group
GMRD = Guards Motorized Rifle Division
Bn = Battalion
1CD = 1st Cavalry Division
2AD = 2d Armored Division
AC = Air Corridor
LRS = Long-Range Surveillance
UAV = Unmanned Aerial Vehicle
IEW = Intelligence and Electronic Warfare
Cmps Call = Compass Call
Rkt/Msl = Rocket/Missile
Atk Helo = Attack Helicopter

Figure 5: 2d Armored Division Deep Maneuver Synchronization Matrix

First reports were beginning to come in. Apache 6 reported the destruction of a battalion of 2S3s and two batteries of BM21s. He suffered no loses on ingress and one aircraft in the EA. The crew was recovered. That attack battalion was "Winchester" on ammunition, and Apache 6 reported exiting battle positions and beginning egress.

The battle captain turned to the fire support operations officer, who, without prompting, reported shot on the egress SEAD. A^2C^2 verified ADA weapons' status as G3 operations relayed the cross-FLOT time to the affected task force. The many rehearsals ensured all players took action without direction.

After Apache 6 reported arrival at the FARRP without additional losses, the battle captain announced, "The time is now 0042, F-Hour for EA Gazelle is F-2 22 minutes.

"Fire Support?..."

Colonel Thomas E. Culling until recently commanded the 2d Armored Division Artillery, beginning with its activation at Fort Hood, Texas, in December 1992. He commanded the 5th Infantry Division (Mechanized) Artillery beginning in June 1992 until it was reflagged the 2d Armored Division Artillery. He also commanded the 2d Battalion, 5th Field Artillery, 42d Field Artillery Brigade in Germany and served as Deputy G3 for Operations in VII Corps, Germany. Colonel Culling is currently Secretary to the Chief of Staff of the NATO Land Central Command in Germany.

Lieutenant Colonel Daniel A. Nolan III served as Executive Officer of the 2d Armored Division Artillery. Currently, he commands the 9th Battalion, 1st Field Artillery and is the Deep Operations Officer in the 2d Armored Division. In previous assignments, he served as B Battery Commander, Brigade Fire Support Officer and S3, all in the 1st Battalion, 82d Field Artillery, 1st Cavalry Division at Fort Hood. Lieutenant Colonel Nolan also served as S3 of the 6th Battalion, 1st Field Artillery in the 1st Armored Division, Germany.

Captain Mark W. Jones until recently was the Assistant Fire Support Coordinator for the 2d Armored Division at Fort Hood. He currently commands A Battery, 1st Battalion, 3d Field Artillery, also in the 2d Armored Division. In other assignments, Captain Jones served as a Company Fire Support Officer in the 6th Battalion, 29th Field Artillery and Division Artillery Fire Direction Officer, both in the 8th Infantry Division (Mechanized) in Germany.

Joint Laser Interoperability

"Sierra-four-Whiskey-two-five, this is Viper 11 flight checking in—two Fox-16s and four LGBs [laser guided bombs] each. We have 10 minutes play time," said the F-16 pilot over the radio.

"Roger, Viper 11. Authenticate Charlie Yankee?" responded the combat observation lasing team (COLT).

"Viper 11 authenticates Victor. Authenticate Bravo Zulu?"

"Whiskey 25 authenticates Hotel."

"Roger, Viper 11 is ready for target brief."

"Copy that, Viper 11. It's gotten quite dark, and our laser designator is inop. Have an IR [infrared] pointer. Understand you can see the spot with LANTIRN [low-altitude navigation and targeting infrared for night]."

"Negative, Whiskey 25. We have to use coordinates. We've got GPS [global positioning system]. Give me UTMs [universal transverse mercator] or Lat/Longs."

"Unable, Viper 11. Target has moved since your ABCCC [airborne command, control and communications] in brief. Don't have FORMS [forward observers ranging and marking system]. We'll have to estimate with NVGs [night-vision goggles]."

"How close are friendlies, Whiskey 25?

"Unknown, Viper 11. Not in contact with forward element. Do you have NVGs?"

"Negative."

"Can you use LANTIRN?"

"We'll try. Field of view is small. It will take time. Any clue to ID friendlies?"

"Friendlies have GLINT [gated laser intensifier tape]. Will that help?"

"Negative, Whiskey 25."

Given the scenario painted by this air-ground radio conversation, what are the chances the F-16s will be able to identify the target and provide the friendly forces close air support (CAS) at night responsively enough? What are the risks of fratricide? The time to find out that one system won't work with another is *not* five minutes before time-on-target (TOT). Knowing which laser systems are interoperable is the responsibility of all joint warfighters—anyone who has to provide or coordinate fires.

An article printed in three publications discusses joint laser compatibility in detail, including "Joint Laser Interoperability" by Major Philip M. Ruhlman, US Air Force, which appeared in "The Air Land Sea Bulletin 94-2," September 1994, published by the Air Land Sea Application (ALSA) Center at Langley Air Force Base, Virginia; and *USAF Weapons Review,* Summer 94 (Issue 2, Volume 42), published by the USAF Weapons School, 57th Wing, Nellis AFB, Nevada. The third publication is *Aimpoint* (Summer 94), a classified magazine by the Naval Strike Warfare Center, Fallon NAS, Nevada.

The article presents the compatibilities of joint laser equipment divided into six classes. These are laser guided weapons, including laser guided bombs, missiles and projectiles; coded laser target designators on helicopters and fixed-wing aircraft; coded laser acquisition/spot trackers on helicopters and fixed-wing aircraft; IR pointers on air and ground systems used with NVGs; NVGs on ground systems, helicopters and fixed-wing aircraft; and other night-vision systems, including forward-looking infrared (FLIR) systems such as LANTIRN.

The bottom line: all coded laser target designators work with all coded laser acquisition/spot trackers and all coded laser guided weapons. Likewise, IR pointers and night-vision devices are only compatible with each other. IR pointers can't designate for coded laster acquisition/spot trackers, and night-vision devices can't see targets designated by coded laser target designators. FLIR systems are compatible with neither.

So how do all players understand the capabilities of laser systems before the bullets are flying? They start by reading the referenced article and then read *Joint Publication 3-09.1 Joint Laser Designation Procedures (J-LASER)*. This publication is the authority for all services on procedures for conducting joint laser operations—the only single-source reference for all joint laser operations. Another manual being staffed that facilitates interoperability is *Joint Publication 3-09.3 Joint Tactics, Techniques and Procedures for Close Air Support (J-CAS)*. This manual includes important information on laser and night operations associated with CAS.

If readers have questions about or input for joint laser systems' interoperability or procedures, call ALSA at DSN 574-5934 or commercial (804) 764-5934 or write: ALSA Center, 114 Andrews Street, Suite 101, Langley AFB, Virginia 23665-2785.

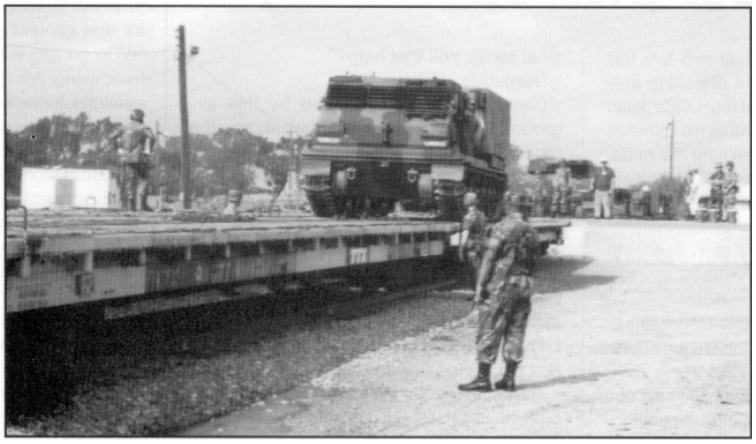
Army MLRS Support for Marines

by Major Edward L. Hughes

During the last several years, the Marine Corps has considered options for obtaining the multiple-launch rocket system (MLRS) to augment its organic indirect fire capability. Much of the discussion was a result of the experiences of the 2d Marine Division in Operation Desert Storm and recent exercises at the Marine Corps Air Ground Combat Center (MCAGCC) at Twenty-nine Palms, California. The Marine options ranged from buying its own MLRS to using Army MLRS assets.

Little more than a year ago, the Commandant of the Marine Corps requested the Army augment Marine general support (GS) artillery with MLRS, and the Chief of Staff of the Army concurred. Subsequently, the Field Artillery School at Fort Sill, Oklahoma, established a working group to explore issues inherent in providing the Marines MLRS support.

The working group conducted research and wrote a "white paper" addressing the impact on MLRS tactics, techniques and procedures (TTP); training; and logistics. The thrust of the report is there are no significant hurdles for Army MLRS to support the Marine Corps. This article is a summary of that report.



5-3 FA (MLRS), part of III Corps Artillery, rail loads equipment for movement to the MCAGCC at Twentynine Palms, California.

Tactics, Techniques and Procedures

Although there are no major changes to MLRS TTP required to integrate an Army MLRS unit into a Marine air ground task force (MAGTF), there are concerns.

Deployment. The method of deployment or entry will depend largely upon the mission, enemy, terrain, time and troops available (METT-T) in the specific contingency operation. The entry method is also a function of the size of the force, the availability of secure airfields and port facilities and whether an amphibious landing is to an uncontested or benign beach or port.

Size of Force. The appropriate force alignment is an MLRS battery supporting a Marine expeditionary brigade (MEB) and an MLRS battalion supporting a Marine expeditionary force (MEF). This is commensurate with Army force structure and Field Artillery (FA) doctrine.

The exact composition of the deploying unit will be a function of METT-T. Packages smaller than a battalion should include liaison and staff elements to interface with a controlling headquarters on operational and logistical matters. An MLRS contingency deployment package must be supplemented with an additional logistical package due to the lack of Army support available and the likelihood the unit will be entering an immature theater.

Entry into Theater. The MLRS equipment can come into the theater by air, land or sea, depending on the MAGTF commander's priorities. In those cases where the command authority directs MLRS equipment be on a ship as part of a maritime prepositioning force (MPF), the MAGTF commander must consider the limitations of moving MLRS ashore by landing craft as the equipment isn't "through-surf" capable.

The landing craft, air cushion (LCAC) is the preferred means of ship-to-shore transit for MLRS. The LCAC allows the launchers to disembark on dry land, affording maximum protection to MLRS electronic components.

The landing craft, utility (LCU) and landing craft, mechanized (LCM-8) will likely expose the MLRS system to partial immersion, potentially damaging components with salt water. However, these craft can be used for all ancillary vehicles, both wheeled and tracked.

Command and Support Relationships. Military authorities have several options when establishing the command relationship for Army MLRS support of Marine operations. *Joint Publication 0-2 United Action Armed Services* and *3-0 Joint Operations* discuss these options in detail. The command relationship will be a function of METT-T and require modifications to include MAGTF logistical support. Two of the most likely joint command relationship options are tactical control (TACON) or operational control (OPCON).

When the MLRS is TACON to a Marine unit, the Marine commander controls its movements and maneuvers and directs MLRS application of force to accomplish missions or tasks. Under TACON, the Marine commander doesn't have the authority to alter the organizational structure of the MLRS unit.

When the MLRS is OPCON to the Marines, the Marine commander can organize and employ Army MLRS units to accomplish missions. Commanders may assign tasks, designate objectives and direct all aspects of military operations and joint training to accomplish the mission. In this case, OPCON gives Marine commanders the authority to task and employ subelements of MLRS batteries and battalions. OPCON does not include authoritative

Major General John Libutti, 1st Marine Division Commander, straps in and then drives and fires the M270 launcher during DESFIREX 1-95.

direction for logistics or matters of administration, discipline, internal organization or unit training unless specifically delegated by the commander holding combatant command (COCOM) authority. OPCON won't give the Marine commander the authority to reorganize personnel or equipment internal to the MLRS unit.

In battle, the MLRS unit should be under the command and control of the force FA headquarters. In the case of a MEB, this would be a Marine artillery battalion. In the case of a MAGTF of larger size, this would be the Marine artillery regimental command operations center (COC).

Tactical Missions. Although the Commandant of the Marine Corps requested Army MLRS augment Marine GS fires, the MAGTF commander ultimately will determine MLRS' tactical mission. GS and general support reinforcing (GSR) are the preferred tactical missions.

Marine divisions have no dedicated GS artillery. They rely predominantly on Marine air power and cannon units DS to maneuver regiments in reserve to provide GS firepower. The MLRS unit is well-suited for the GS mission because of its weapon's range, lethal shock effect and large submunition dispersion patterns.

GSR may be an appropriate mission if the MAGTF already has a GS artillery unit available. The MLRS unit could readily respond to the GS artillery headquarters.

The direct support (DS) mission, while not prohibited, is normally inappropriate for an MLRS unit. The weapon system lacks the diversity of ammunition found in a DS cannon unit. MLRS rocket munitions are inherently less precise largely because rocket drop, tip-off and rocket motor burn-through are not consistent variables. This yields a standard "danger close" range of 2,000 meters. In addition, the continuous volume of ammunition required for the DS mission would cause an MLRS battalion to quickly exceed its ammunition resupply capabilities. If an MLRS battalion reinforces a Marine DS unit, it would face these same challenges.

Communications. Army and Marine radios (AM and FM) are compatible. MLRS units supporting Marine units not equipped with single-channel ground and airborne radio systems (SINCGARS) can operate in a non-frequency hopping mode. But there are some minor communications challenges when the VRC-12 series radios operate with SINCGARS; these challenges are addressed in both *FMFM 6-18-1 Marine Corps Fire Support System (MCFSS) Techniques and Procedures* (5 October 1994) and Change 2 to *FM 6-60 Tactics. Techniques and Procedures for MLRS Operations* (initial draft published in November 1994).

The number of radio systems in the MLRS battery and battalion meet the expected needs with one exception. Deployments to MCAGCC indicate MLRS units need dual retransmission (RETRANS) station capabilities to communicate with operations and logistical agencies at extended ranges.

There are few compatibility issues with the joint artillery computer systems. The MCFSS and MLRS fire direction system (FDS) and fire direction data manager (FDDM) all communicate using tactical fire direction system (TACFIRE) protocols. Although MCFSS software (Version 9) can operate with a 16,000-baud digital data transmission rate, FDS (Version 9) only operates at a 1200-baud analog data (frequency shift keying—FSK) transmission rate. This is overcome by making appropriate entries in the MCFSS subscriber tables and by the controlling MCFSS maintaining a separate channel for the MLRS battalion FDS.

Version 10 software allows full compatibility of MCFSS and FDS and FDDM with rocket and missile munitions. Version 10 FDS and FDDM software has been fielded. All the MEFs will complete fielding of Version 10 MCFSS software by this June. Version 10 software allows FDDM to operate at a 16,000-baud transmission rate, thus eliminating the need for a separate channel. In the interim, MCFSS Version 9 software and FDS and FDDM Version 10 are not compatible and, thus, will present some challenges to Marines controlling and managing MLRS fires.

Target Acquisition. The planning range of MLRS exceeds that of the Marines' M198 howitzer. The Marine Corps has both unmanned aerial vehicles (UAVs) and organic Q-36 Firefinder radar sections to gather intelligence and acquire targets. However, supplementing the Marine force FA headquarters with multiple Army Q-37 radar sections would significantly add to the target acquisition capabilities of the MAGTF.

Liaison. The exercises at MCAGCC and lessons learned in Southwest Asia both indicate a need for robust and multiple liaison sections in the MLRS battalion table of organization and equipment (TOE). This is especially true in situations where the tactical mission for the MLRS unit changes frequently.

The need to modify the TOE is a separate force structure issue the Field Artillery School is addressing. If the MLRS unit's tactical mission remains GS and it is under the control of the force FA headquarters, the MLRS battalion's current liaison section is adequate. Additionally, during joint operations, liaison is reciprocal. This requires the controlling Marine headquarters to provide a liaison to the MLRS unit headquarters.

Army-Marine MLRS Training

Individual training (both initial resident and sustainment at the unit) may require limited modifications. Marine artillery

officers will need training in the capabilities, limitations, employment considerations, TTP and target attack matrices for MLRS. Army officers must be familiar with Marine terminology and organization. Both call for minor modifications to the instruction in the Field Artillery Officer Basic and Advanced Courses (FAOBC and FAOAC).

All soldiers and Marines will need training in vehicle and aircraft identification to facilitate target identification and reduce the potential for fratricide. Soldiers will need some amphibious training—perhaps limited to familiarization with equipment loading, Navy ships, amphibious landing craft and general procedures.

However, amphibious training requirements could become significant if MLRS needs to support Marines during their initial amphibious assault waves. *Army Regulation 350-41 Army Forces Training* describes a four-phased training program for amphibious operations. Additionally, there are courses available at the Joint Warfare Training Division of the Expeditionary Warfare Training Group-Atlantic (EWTGLANT) in Norfolk, Virginia. In a crisis, this division prepares training teams to deploy to the unit to conduct training.

Joint Command Post Exercises (CPXs). One of the areas of concern for training revolves around the MLRS battalion headquarters, the Marine artillery headquarters and the MAGTF (division and/or higher) fire support coordination centers (FSCCs). Training objectives for these commanders and staff officers and NCOs could be achieved during Army Battle Command Training Program (BCTP) exercises and MAGTF Staff Training Program (MSTP) exercises. Modifying planned exercises to include MLRS-supported Marine operations has a small price tag, but it has great potential for training officers and senior NCOs. These CPXs are important training vehicles.

Joint Training Exercises. Both desert fire exercises (DESFIREXs) and combined arms exercises (CAXs) with the Marines at MCAGCC are excellent training events. They have allowed both the 1st Marine Division and elements of III Corps Artillery to achieve joint training objectives. Additionally, training at MCAGCC has, for the first time, provided MLRS battalions a tactically realistic environment for scenario-driven live-fire exercises.

A launcher from 5-3 FA fires in an early morning prep for a Marine assault at MCAGCC.

MLRS Logistical Considerations

There are some fundamental differences between the services' approaches to logistics. The MEF has a force service support group (FSSG) of eight battalions task-organized by missions. The MEF normally conducts operations within 50 miles of its support base, which is generally established around a major seaport or air-head. Its FSSG is resourced to support all classes of supplies and deploys with enough supplies for 60 days. The group supports the ground combat element (GCE) via a smaller mobile combat service support element (CSSE)—DS to the GCE.

The Army, on the other hand, provides dedicated support to its maneuver units by means of its division support command (DISCOM) forward support battalions (FSBs). Corps support battalions provide area support to divisional and corps MLRS units. Corps MLRS battalions are supplemented with attached maintenance support teams (MSTs) for intermediate DS and GS (third echelon) vehicle, fire control and communications maintenance.

The Marine Corps can provide MLRS units supply Classes I Subsistence; II Clothing and Organizational Equipment; III Petroleum, Oil and Lubricants; IV Construction Materials; VI Personal Demand Items; VII Major End Items; and VIII Medical Supplies without significant impact to its support structure. Some other classes of supplies create challenges.

Class V Ammunition. The MLRS battalion has an organic ammunition resupply capability. There are 12 ammunition resupply trucks and trailers organic to each of its three firing batteries. Based on data derived last June for the MLRS family of munitions (MFOM) force development test and evaluation (FDTE), the MLRS battalion can expect to expend as many as 99 rockets per launcher or 2,673 rockets per battalion per day. The threat environment for this data was the Army Training and Doctrine Command's standard Southwest Asia scenario; the targets were close battle targets that included heavy, medium and light Field Artillery cannon and missile units; heavy, medium and light air defense artillery; personnel assembly areas; armored units; and command, control and communications elements.

The ability of the FSSG to transport Class V for its MEF is already stretched. The additional burden of pushing MLRS ammunition forward from the FSSG to the unit is not supportable with organic Marine assets.

In most cases, Marine responsibilities for MLRS ammunition support should be limited to requisitioning MLRS Class V and positioning it at the FSSG. When special munitions—such as the Army tactical missile system (ATACMS)—are critical, the Marines could push small quantities of MLRS ammunition forward with organic assets. To provide the maximum ammunition initially, MLRS units should be combat loaded when placed on the ship for transport.

If the MLRS battalion is no more than 80 kilometers from the FSSG, the MLRS battalion could meet its expected expenditure rate of 2,673 rockets by resupplying with its organic trucks. The battalion's

ammunition resupply trucks each would have to make two resupply runs a day to the FSSG.

As the distance from the MLRS battalion to the FSSG grows to 100 kilometers and beyond, the resupply rate will be reduced correspondingly. This will ultimately result in a logistically driven reduction in the rate at which an MLRS battalion can engage targets.

However, it's likely an MLRS battalion in support of Marine operations will require a daily ammunition expenditure rate lower than 2,673 rockets; the targets sets encountered on those operations should be "softer" and require fewer munitions for effects. Expenditure rates should be continuously examined and refined during joint BCTP and MSTP exercises.

Class IX Repair Parts. There are many systems and components of systems common to the Marines and MLRS. The same engine powers both the Marine amphibious assault vehicle (AAV) and the MLRS M270 launcher. The Army's heavy expanded-mobility tactical truck (HEMTT) and the Marine logistics vehicle system (LVS) are both manufactured by Oshkosh and have many common parts.

But there is a significant difference in the quantity of repair parts carried by Marine and Army units. The MEB carries enough repair parts to sustain itself 30 days whereas the MEF carries enough for 60 days. Army units normally carry 15 days of supplies. Stockage of additional quantities of parts from unit prescribed load lists (PLLs) and DS-authorized stockage lists (ASLs) is limited by the MLRS unit's organic hauling capacity. Although PLL and ASL parts could be prepositioned on ships, line replaceable units (LRUs) often require modification and are thus subject to obsolescence.

A better approach would be to develop 30-day battery and 60-day battalion packages of PLL and ASL parts. These packages would primarily include items not common to the Marine Corps. Preparing four packages (two battalion and two battery sets) would allow different units to deploy immediately in support of different theaters. Further, these stocks could be validated, rotated, modified or supplemented by using them during rotations to MCAGCC.

Prepositioning these packages in military vans (MILVANs) at a single location, such as the Red River Army Depot in Alabama, would facilitate the Army Missile Command's (MICOM's) modifying stocks as LRUs change. Regardless of the location of these stocks, they should be managed and controlled at the installation level and purchased with joint funds.

The Marines can requisition and deliver MLRS parts to the FSSG and CSSE. Beyond 30 to 60 days' supply of PLL and ASL parts, the Army Force (ARFOR) headquarters can facilitate resupply within theater (if deployed by that time). Additionally, the Red River Army Depot, MICOM or the unit's home station can resupply via airlift.

Although cumbersome, Marine logistical channels can resupply PLL and ASL stockages. The supply system is a Department of Defense (DOD) system. The challenge is the computer incompatibility of the Army unit-level logistics system (ULLS) and the Marine asset tracking for logistics and supply system (ATLASS). Army MLRS units have to enter PLL and ASL replenishment part requisition statuses manually into the ULLS, based on manual feedback from the supporting FSSG. Similarly, Army MLRS units have to submit requisitions manually on Marine forms to the supporting FSSG so it can enter the requisition into ATLASS. The MLRS unit logistics liaison officer at the FSSG will facilitate this process.

Maintenance. The Army has four categories of maintenance: organizational, DS, GS and depot.

Organizational maintenance consists of both operator and unit maintenance activities (Marine 1st and 2d echelons). MLRS units have extremely robust sections in each battery for organizational maintenance. Operators and mechanics perform maintenance activities on all equipment—this won't change.

DS maintenance is performed by MSTs attached to the MLRS battalion. These teams include carrier, launcher, heavy and light wheeled-vehicle mechanics and administrative clerks. GS maintenance supports the theater by repairing components and modules. The corps support command (COSCOM) provides both DS and GS maintenance for corps MLRS battalions. When an MLRS battery or battalion deploys in support of Marine operations, the MSTs from the supporting COSCOM must accompany them. Depot maintenance is normally accomplished out of theater.

Marines must be prepared to assist with the MLRS organizational and DS maintenance overflow, as necessary. Marine logistical elements must be able to provide facilities for MLRS MSTs as required—hardstands, controlled environment containers, etc.

The MLRS unit will need extensive GS maintenance support for both the fire control system (FCS) and other components. The vehicle and communications GS maintenance needs of the MLRS unit should fall on the Marine's 4th echelon at the FSSG or CSSE. The Marines should be responsible for evacuating the FCS and other MLRS-specific LRUs requiring GS-or depot-level maintenance. These LRUs could be evacuated by air directly to the Red River Army Depot. Marines are responsible for retrograde of depot-level repairables to the appropriate depot-level agency.

Conclusion

There are many considerations when establishing a joint operations relationship with a sister service. Neither this article nor the white paper addresses all of them.

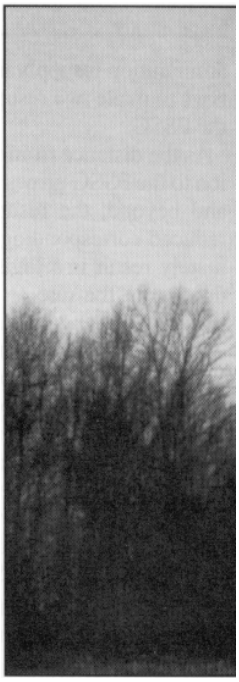
Recently, the Army and Marine Corps signed a memorandum of agreement (MOA) establishing the general parameters for MLRS support of Marine operations. Although *MLRS* support for the Marines is new, Army support for Marines is not. The two services have supported each other in conflicts throughout America's history.

When all is said and done, the soldiers and Marines on the ground will have a mission to accomplish—and they will, together.

Major Edward L. Hughes chaired the Multiple-Launch Rocket System (MLRS) Working Group at Fort Sill, Oklahoma, that studied MLRS support for the Marine Corps and wrote the MLRS White Paper. He's Chief of the MLRS Instruction Branch of the Gunnery Department of the Field Artillery School. During Operation Desert Storm, he commanded A Battery, 92d Field Artillery (MLRS), part of the 2d Armored Division; the battery was under the operational control of the 10th Marines, 2d Marine Division, during its push to Kuwait City. Among other assignments, Major Hughes commanded A Battery, 1st Battalion, 3d Field Artillery for two years; the battery is also part of the 2d Armored Division, at Fort Hood, Texas. He holds a Master of Arts in Computer Resources Management and Human Resources Development from Webster University in Missouri.

RAIDS—Fire Coordination for Aviation in the Deep Battle

by Major Thomas A. Kolditz and Colonel Neil E. Nelson



Editor's Note: *"Kingfish" was the code name for the 101st Airborne Division Artillery during World War II. The white "bomb" painted on the side of the helmet also signified the 101st Div Arty.*

Attack aviation gives land force commanders the ability to quickly mass combat power deep into contested battle space. Fast and mobile, helicopters can close with and defeat enemy forces more rapidly than any other maneuver force. Flexible and lethal, attack helicopters equal or exceed other fire support systems in their destructive capability.

Traditional Fire Support Coordination

Attack helicopters operate across expansive terrain. Deep attacks often place the enemy lead elements in a zone *behind* friendly aviation. To place fires on the full depth of the enemy's formation, commanders need permissive fire support coordinating measures (FSCM) suited to the deep battle. Coordination must occur in four dimensions: three-dimensional battle space (which includes altitude) plus time.

The deep fight poses special problems in fire support coordination. Permissive FSCM, such as the coordinated fire line (CFL) and the fire support coordination line (FSCL), are best suited to a close battle because permissive rules extend to the depth of the establishing headquarters' sector or zone.

Forces operating deeper in zone, beyond the permissive measures, must be protected by exception, usually with a restrictive measure such as a no-fire area (NFA). If the forces operating deep in zone are highly mobile, the NFAs must either be large (which is undesirable) or frequently shifted (which is difficult to coordinate and manage). Unfortunately, the net result is often the dis-establishment of the CFL and the clearance of fires with the aviation brigade headquarters—a safe but time-consuming process.

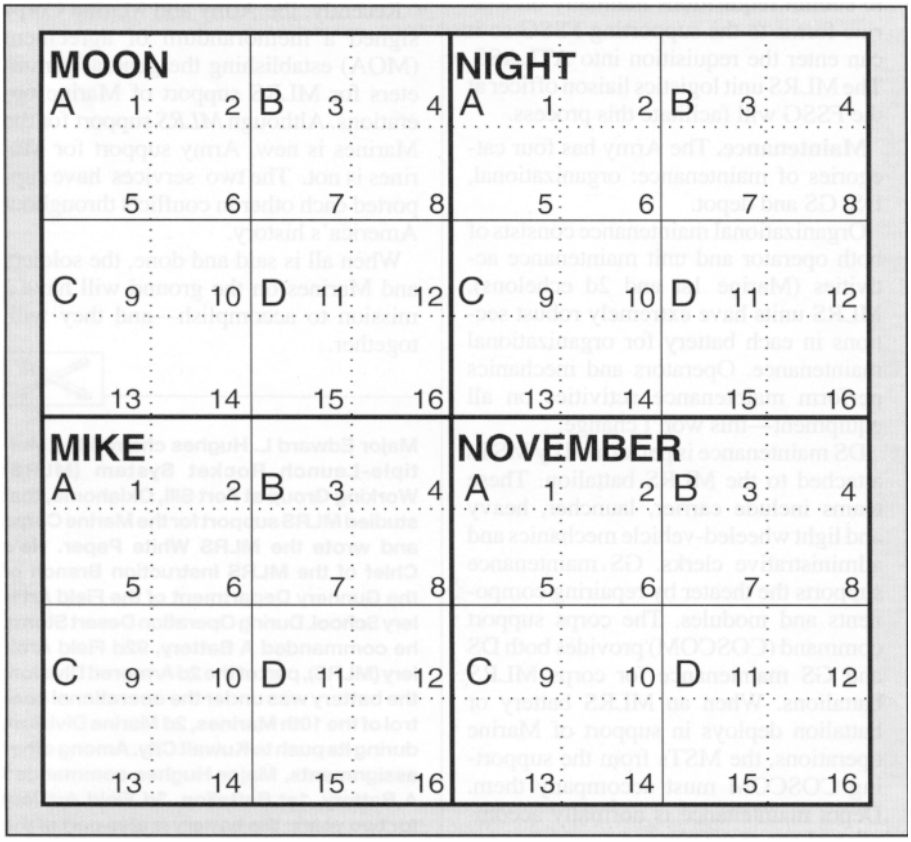


Figure 1: RAIDS Grid Matrix Subdivisions. Each 10-by-10 kilometer square (ie: "Moon") is subdivided into four 5-by-5 kilometer boxes (labeled A through D) with each further subdivided into four 2.5-by-2.5 kilometer boxes (labeled 1 through 16). The matrix is overlaid on that portion of a map applicable to the division's battle space.

RAIDS for Deconfliction of Aviation and Fires

There's a simple, efficient method to deconflict aviation and indirect fires when an aviation brigade or air cavalry squadron is maneuvering deep. The rapid aviation indirect fire deconfliction system

B/1-320 FA

(RAIDS) is a technique whereby surface-to-surface fires are permitted in zone without clearance *except* in those specific portions of the zone where helicopters are at work. The occupied areas are defined in the context of a grid system, the basis of which is the short-range air defense (SHORAD) grid system matrix used by the air defense community in its manual SHORAD control system: MSCS (pronounced "miscus").

The SHORAD grid matrix is a standardized matrix consisting of 400 10-kilometer squares with a name assigned to each square. The matrix is overlaid on operational maps using instructions and a reference point provided in the air defense paragraph or annex of the division operations order (OPORD), and only that portion of the matrix applicable to the division's battle space is used.

The RAIDS technique subdivides each 10-by-10-kilometer box (as shown in Figure I—"Moon," "Night," etc.) into 5-kilometer square boxes (labeled A through D); each of the four 5-by-5-kilometer boxes is subdivided into four 2.5-by-2.5-kilometer boxes (labeled 1 through 16). Thus, a name and a letter defines a 5-kilometer box, such as "Moon D." A name and a number defines a 2.5-kilometer box, such as "Moon 16."

To coordinate fires in his zone, the aviation brigade commander declares RAIDS in effect (giving an effective date-time-group, or DTG) and specifies MSCS boxes that contain friendly aircraft by labeling the boxes as "Blue." The information is passed over both command and fire coordination nets as a net call: "All stations this net, RAIDS in effect in the aviation brigade zone; effective 232300S, Mike Alpha and Bravo and Moon 14 are Blue. Acknowledge, over." The remainder of the aviation zone is then posted "Green," which permits surface-to-surface fires without further coordination in those areas. Areas declared Blue require clearance through the aviation brigade.

When the aviation commander declares RAIDS in effect, he has changed the fundamental nature of his boundary from restrictive to permissive. On a traditional maneuver battlefield, the commander typically places permissive measures forward in zone and carefully restricts fires in the main battle area and the rear. The aviation commander's rear is frequently 70 or 80 kilometers away at an intermediate staging base (ISB) or forward operating base (FOB). His main battle area may change rapidly throughout the night.

In addition, fire discipline necessarily focuses his efforts on only the most critical high-payoff targets (HPTs), causing the zone to the rear of his attack positions to become target rich for other fire support and maneuver systems. His focus, then, is on facilitating fires in zone, and the RAIDS technique causes that to occur more rapidly and with less potential for confusion than other methods.

Something Old/Something New

Artillery men have long used counterfire grid systems and anti-fratricide matrices as quick references for the clearance of counterfire. The beauty of RAIDS is that the analog reference—the MSCS grid system—is already shared with the rest of the land component through established air defense channels. In the division main command post (DMAIN), RAIDS information is useful, not only to fire supporters, but to the air defense and Army airspace command and control (A^2C^2) cells. Maneuver commanders have redundant access to the system through assigned air defenders and fire supporters.

RAIDS is a technique with a future. It's a manual fire support coordination system that uses the universal transverse mercator (UTM) grid system as its primary reference. It may, therefore, be expressed digitally and used in existing or emerging automated command and control systems.

Currently, it's used for surface-to-surface fires, but it appears to have potential for the coordination of all fires, as well as serving the A^2C^2 function, much like an informal airspace coordination area (ACA) (see Figure 2, on Page 26). It may be useful to think of RAIDS as a system of ACAs that extend to the ground, providing a standardized, lightning-fast, mutually understood implementation plan.

Facilitating Joint Ops

Given that RAIDS has a future, that future is clearly joint. Land forces subdivide the MSCS to a scale appropriate for them. Air forces can use consecutively labeled MSCS zones in precisely the same manner as the 15-minute latitude by 15-minute longitude CENTAF (Central Command 9th Air Force) kill boxes assigned to Air Force command and control

agencies during Operation Desert Storm.

Because RAIDS includes altitude as a dimension, it has potential for clearance of fires above the ground (ie., surface-to-surface missile flight). The airborne warning and control system (AWACS) can manage all the information and both receive and transmit over tactical data linkages to Air Defense Artillery command and control centers. The concept of an FSCL pales in comparison.

Most importantly, RAIDS works now. During a recent division Warfighter exercise in the Battle Command Training Program (BCTP), both the aviation brigade and the division cavalry used RAIDS to facilitate fire support coordination in support of deep attacks, screens, guard missions and other aviation activities—both day and night. They cleared fires expeditiously in zone and had no ground or aviation fratricide.

The result was the successful destruction of opposing force (OPFOR) HPTs throughout the depth of the division zone and the eventual defeat of the OPFOR. Similar results were achieved during three previous exercises in preparation for the Warfighter exercise.

Although RAIDS is a non-doctrinal technique, its simplicity enables the 101st Airborne Division (Air Assault) at Fort Campbell, Kentucky, to coordinate fires successfully with adjacent and supporting units. During the Warfighter, a reinforcing artillery brigade and a ground maneuver brigade under the operational control of the division quickly understood and adopted the technique during pre-battle liaison. Both organizations took advantage of rapid deconfliction and placed heavy fires in the aviation zone during the course of battle.

Enthusiastic supporters of RAIDS have proposed that RAIDS take effect at all times inside aviation boundaries, as designated by standing operating procedure (SOP). Such a policy is premature. In every instance, the commander must make a decision about how to coordinate fires in zone, based on mission, enemy, terrain, troops and time available (METT-T). In some cases, current doctrinal measures may work better than RAIDS. It is the commander's call.

RAIDS is a useful tool. It facilitates a commander's requirement for permissive fire support coordination in a specific situation—namely, Army aviation fighting deep. Highly lethal and mobile situations may call for other unique FSCMs or coordination techniques. Whatever the need, the result must always be the same: rapid deconfliction of maneuver and fires and the relentless attack on the enemy—regardless of where he might be.

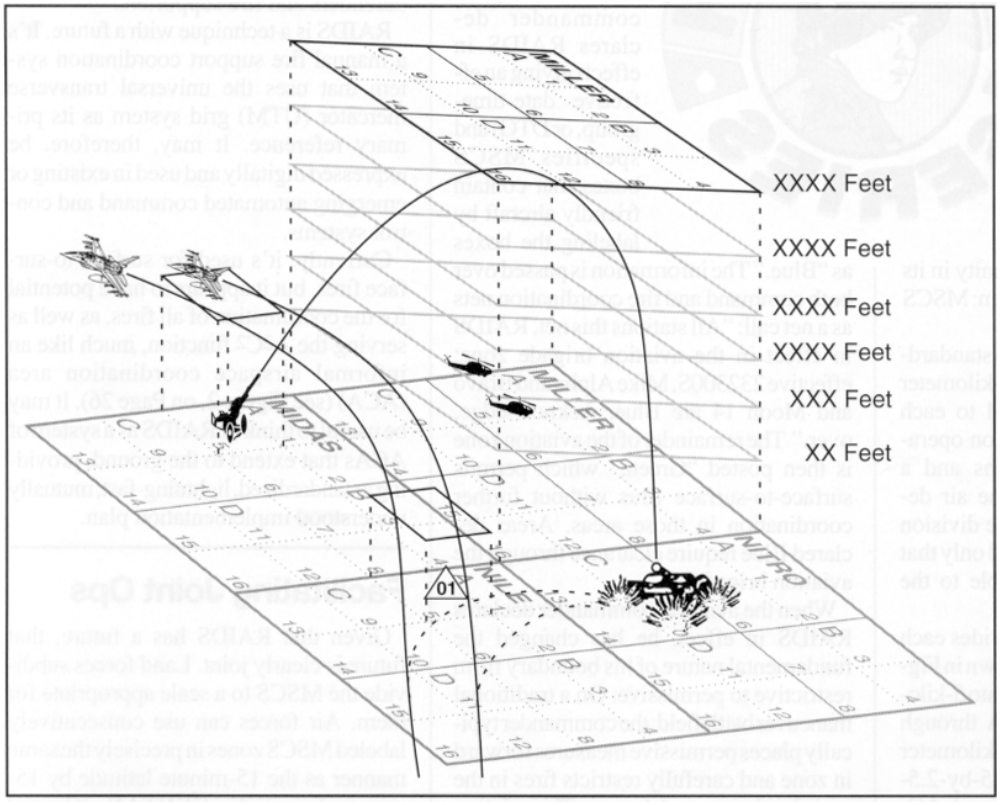


Figure 2: RAIDS is used for surface-to-surface fires but can serve as a tool for an informal ACA—a system of ACAs that extend to the ground for standardized, fast implementation.

Major Thomas A. Kolditz until recently was the Deputy Fire Support Coordinator for the 101st Airborne Division (Air Assault) at Fort Campbell, Kentucky. Currently, he's the Executive Officer for the 3d Battalion, 320th Field Artillery, also part of the 101st Division. Previous assignments include serving as Fire Support Officer for Task Force 3-12 Infantry in the 2d Brigade and Commander of A Battery in the 4th Battalion, 29th Infantry, both in the 8th Infantry Division (Mechanized) in Germany. Major Kolditz is a graduate of the Command and General Staff College and the School of Advanced Military Studies, both at Fort Leavenworth, Kansas, and holds a master's degree and Ph.D. from the University of Missouri.

Colonel Neil E. Nelson has commanded the 101st Airborne Division (Air Assault) Artillery since June 1993. His previous assignments include Commander of Fort Monroe, Virginia; Chief of Staff of III Corps Artillery, Fort Sill, Oklahoma; and Commander of 1st Battalion, 78th Field Artillery, Field Artillery Training Center, also on Fort Sill. He commanded batteries in the XXIV Corps in Vietnam, 3d Infantry Division (Mechanized) in Germany and 82d Airborne Division at Fort Bragg, North Carolina. Colonel Nelson is a graduate of the Army War College at Carlisle Barracks, Pennsylvania, and holds a Master of Arts in History from Lincoln University in Missouri.

A Primer on the BCE

by Lieutenant Colonel Donald G. Oxford

The September Senior Fire Support Conference at Fort Sill, Oklahoma, provided a forum for discussing several topics affecting the application of joint fires. Among these were briefings on the "Joint Force Air Component Commander (JFACC)," "Joint Fire Support Doctrine Update" and "Fire Support Coordination Line (FSCL) Challenges." An organization mentioned in these presentations and others as key to successful joint air-ground operations was the battlefield coordination element (BCE).

If your reaction to this statement is, "What's the BCE?" you're not alone. This small organization is charged with tremendous responsibility yet is frequently unknown or misunderstood by both Army and joint service planners and decision makers. This article provides a brief history of the BCE and the organization, functions and current issues affecting Army BCEs.

BCE History

The Army and Air Force developed the BCE concept in the 1980s. A joint study of the echelonment of threat forces emphasized the need to interdict enemy reinforcing and follow-on forces before they could support the enemy's close battle. The friendly objective for this effort was to interdict enemy follow-on forces determined critical to his success and to control the rate of appearance of follow-on forces at the forward line of own troops (FLOT).

The primary deep weapon systems at this time were Air Force nuclear and conventional munitions delivery aircraft. Army Pershing and Lance missiles and special operations. Doctrine writers and commanders saw the need for effective and continuous coordination between the Army and Air Force to ensure the complementary application of both air and ground combat power against follow-on forces.

According to the 1984 *Army Training and Doctrine Command (TRADOC) Pam 525-45 (USREDCOM Pam 525-8, TACP 50-29), General Operating Procedures for Joint Attack of the Second Echelon (JSAK)*, the air component commander (ACC) and land component commander (LCC) coordinate with each other on a continuing basis. As stated in the Pam, "The LCC discusses his proposed scheme of maneuver, priorities for tactical air support to his subordinate land units, his desired effects on the enemy's combat forces, land forces' capability to meet ACC requests for land support, planned surface-to-surface missile operations, mining operations and the FSCL location with the ACC. The ACC and LCC consult on the air apportionment recommendation and discuss the availability of battlefield air interdiction (BAI) for planning purposes. [The term BAI is no longer accepted Air Force terminology; the term is now air interdiction, or AI.] The ACC advises the LCC on the capabilities of theater air assets, discusses air delivered mining operations, theater airlift and the status of strategic air assets which support theater tactical operations" (Page 2-3)

The agencies identified to represent LCC and ACC interests in their absence were the BCE and tactical air command center (TACC), respectively. (The Air Force TACC is now designated the air operations center, or AOC and, during joint operations, is referred to as the joint AOC or JAOC.) The mission assigned to these agencies was to exchange detailed operational and intelligence information to accomplish joint coordination for J-SAK operations.

The wording in TRADOC Pam 525-45 assumed the LCC would be an Army commander and the JFACC an Air Force commander. However, certain situations may place Army forces under command or control of another US or Allied commander, and the JFACC may be designated from the Navy or Marine Corps. Emerging BCE doctrine and procedures recognize these possibilities.

The complementary and ever-improving capabilities of both the Army and Air Force to see and attack deep with deadly accuracy and efficient ordnance has emphasized the importance of the BCE-AOC relationship. The mission of the BCE is essentially unchanged, but necessity increased the original 28-person organizational structure to 32 on the table of organization and equipment (TOE) dated 1 October 1990. The BCE includes a headquarters element lead by a colonel; an operations section lead by a lieutenant colonel; fusion and air defense/Army airspace command and control (A^2C^2) management sections lead by majors, a plans section lead by a lieutenant colonel and intelligence and airlift sections, both lead by majors.

Today's BCE continues to represent the battlefield functional area interests of the Army forces (ARFOR) commander to the JFACC in joint air-ground operations. The definition of the BCE in *Joint Pub 1-02 Department of Defense Dictionary of Military and Associated Terms* recognizes that the ARFOR BCE may establish a liaison with the AOC of any service component designated as the JFACC by the joint force commander (JFC). It states, "[The BCE is] an Army liaison provided by the Army component commander to the AOC and/or to the component designated by the joint force commander to plan, coordinate and deconflict air operations. The [BCE] processes Army requests for tactical air support, monitors and interprets the land battle situation for the AOC, and provides the necessary interface for exchange of current intelligence and operational data."

In a multi-corps environment, the ARFOR may be a field Army commander (e.g., Third, Seventh or Eighth Army).

Subordinate corps provide the BCE enough liaison to support operations and the information requirements of the corps commander. In a single corps in which the corps commander is also the ARFOR commander, a BCE is assigned to the corps headquarters during deliberate or crisis action planning and collocated with the JAOC. During some contingency operations, a BCE may be tailored to support the requirements of a corps(-) or smaller sized headquarters.

The AOC is normally the JFACC's command post. The AOC is the ACC's centralized facility to plan, direct and control combat air resources. Figure 1 shows the organization of an AOC with the Air Force as the JFACC (ACC) and its interface with the BCE. If appropriate, a Marine liaison officer (LNO), Naval air liaison element, and Navy surface operations liaison element also will join the AOC structure.

The BCE can be tailored to support the requirements of a contingency force headquarters collocated with the ACC AOC (or maritime component commander, MCC, counterpart) to monitor and analyze the land battle for the AOC, exchange intelligence and operational data, and coordinate and support requirements. The BCE processes ARFOR requests for combat air and coordinates and integrates ARFOR requirements for airspace control measures (ACM), fire support coordinating measures (FSCM) and tactical airlift. The BCE can link automated data processing (ADP) from a standard theater Army command and control system (STACCS) terminal, if available, to both the Air Force AOC's CTAPS—standing for the contingency theater air control system (TACS) automated processing system—terminal and the ARFOR STACCS terminal or corps STACCS terminal.

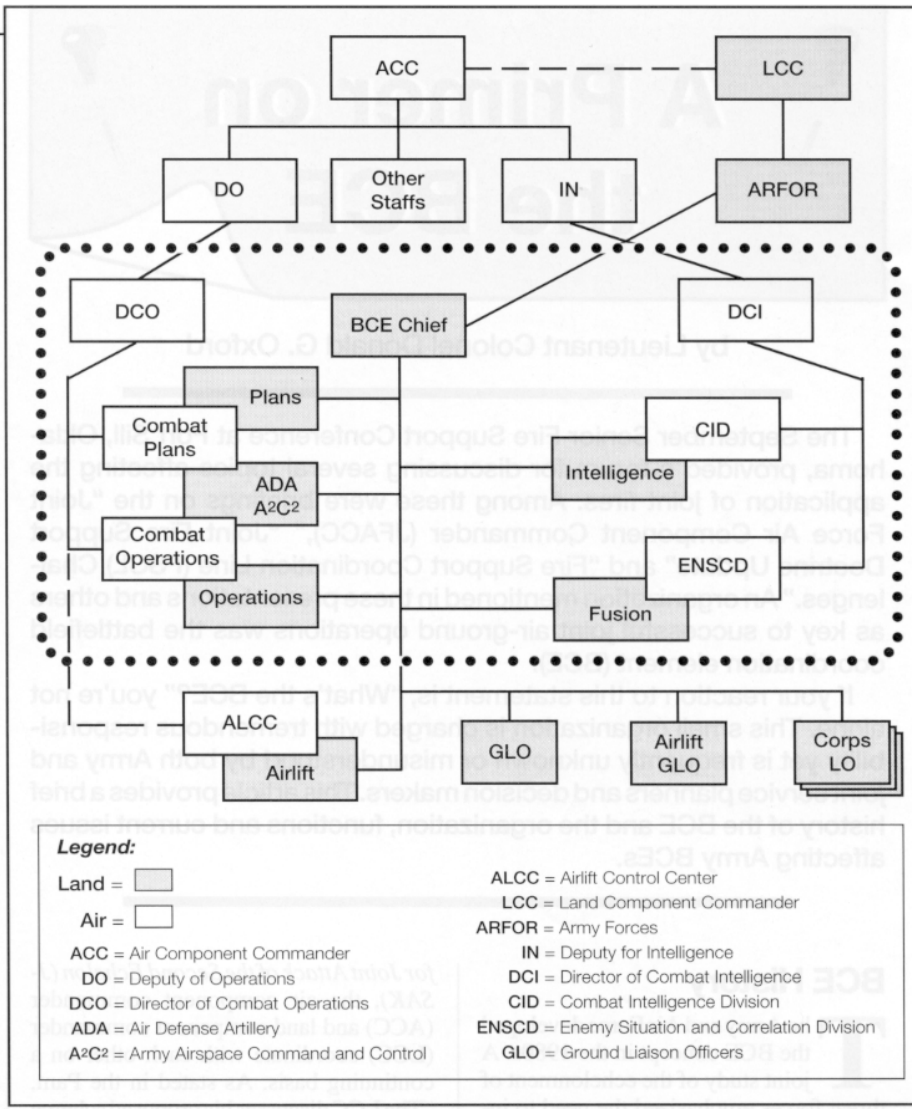


Figure 1: The Army's Battlefield Coordination Element (BCE) and Air Force's Air Operations Center (AOC) Interface. The AOC is normally the ACC's command post.

BCE Operations

The six sections under the BCE headquarters element have important functions to plan, coordinate and execute air and ground operations.

Operations Section. It monitors the execution of the current air tasking order (ATO) and coordinates changes to ARFOR targets and priorities that occur during the battle. It's collocated with the AOC combat operations division. It stays updated on land operations and provides the ARFOR updates on AI missions and targets. It monitors the air situation and sorties of interest to the ARFOR and ensures that current ATO AI sorties supporting ARFOR operations are not canceled or diverted without consultation with the ARFOR or his designated representative.

Intelligence Section. This section coordinates with the ARFOR G2 sections to obtain Army intelligence reports and collection requirements. It provides the AOC's combat intelligence division (CID) information on the enemy ground order of battle and assists in target development.

Fusion Section. It analyzes current Army intelligence and the friendly situation to help refine and validate targets for execution in the ATO. It's collocated with the AOC enemy situation and correlation division (ENSCD).

Plans Section. Collocated with the AOC combat plans division, this section coordinates land force requirements for combat air support in developing the ATO. It provides the ARFOR scheme of maneuver and priorities for combat air support.

ADA/A^{2}C^2. This section coordinates Army air defense and airspace matters with the AOC combat plans and combat operations divisions, Army sections at control and reporting centers (CRCs), the ARFOR A^{2}C^2 and the ARFOR ADA headquarters.

Airlift Section. It coordinates ARFOR airlift support with the airlift control center (ALCC) and the AOC. The airlift section may not collocate with the AOC or

BCE; it may operate with the ALCC elsewhere.

Liaison. Forces Command provides ground liaison officers (GLO) located at the various tactical air force wings and squadrons. The GLOs monitor pilot debriefings and mission reports and pass information to the BCE, which in turn passes it to the ARFOR G2.

More information on the BCE functions can be found in the appendices of *FM 100-15 Corps Operations* and *FM 6-20-30 Tactics, Techniques and Procedures for Fire Support for Corps and Division Operations.*

BCE Challenges

Activities in the BCE are joint by virtue of the joint coordination—the primary function of the BCE. "Joint" is the word characterizing the nature of current and future military operations. No single service can or should conduct any joint operation without the support of or coordination with other services. This fact emphasizes the importance of the BCE function and explains its recent increased visibility. The BCE is critical to the effective application of fires in support of the ARFOR commander. However, it faces several challenges in coordinating joint fires to support the ARFOR.

- The BCE must interface with any service, yet doctrine focuses on only the Army-Air Force interface. The BCE must work with the Air Force AOC in its TACS, the Marine tactical air command center (TACC) in its Marine air command and control system (MACCS), or afloat with a Navy JFACC tactical air control center (TACC—acronym the same as the Marine's).
- The Army needs a fire support element (FSE) at echelons above corps (EAC) to perform some of the functions now expected of the BCE. Consider the Air Force-Army TACS architecture shown in Figure 2. Note that an FSE exists up to the corps level but not at EAC. The latter is the level at which the fire support focus is on deep attack to isolate and support subordinate corps operations and major battles. In the absence of an EACFSE, the BCE is the focal point for Army deep attack coordination. However, the BCE is not organized to perform the fire support planning, coordination and execution functions of an FSE.

According to FM 6-20-30, a corps main command post FSE is authorized 19 Field Artillery personnel and a division main command post (DMAIN) 13 Field Artillery personnel. An EAC ARFOR commander may have a small fire support section within his operations staff, which is not an FSE. The corps commander has the corps artillery commander as his fire support coordinator (FSCOORD), but the ARFOR commander has no FSCOORD, so the fire support visibility falls on the BCE chief. He may not have a fire support background.

The BCE TOE authorizes only one Field Artillery officer and four enlisted personnel: a major (assistant operations officer) in the operations section and one sergeant first class (SFC) military occupational specialty (MOS) 13F Fire Support Specialist each in the operations (targeting NCO), fusion (targeting NCO), plans (fire support sergeant) and intelligence (fire support sergeant) sections. The BCE's highly visible, 24-hour fire support coordination function requires these artillery soldiers perform many of the same tasks of the more robust corps main FSE.

- The BCE needs communications and ADP equipment. The BCE may be widely separated from the ARFOR or corps main command post where ARFOR deep operations planning, coordination and execution decisions are made. The BCE normally isn't directly involved in the ARFOR decision-making process. This means the BCE may provide long-distance input but doesn't participate directly in mission analysis, course-of-action (COA) development, war gaming, command estimate and ARFOR targeting processes, operations order development or the command decision briefing. All the discussion that results in the ARFOR scheme of maneuver and concept for fires is secondhand information to the BCE, coming through the ARFOR commander and staff and corps liaison officers. Continuous and efficient communication between the BCE and ARFOR is critical to BCE functions.

The BCE TOE authorizations fall short in communications and ADP support. The TOE authorizes personnel with individual weapons and protective masks, but it provides no communications and ADP equipment to the BCE. This must be provided by the ARFOR headquarters "out of hide." In the absence of appropriate support, BCE functions must be manually processed and voice communication is inadequately slow.

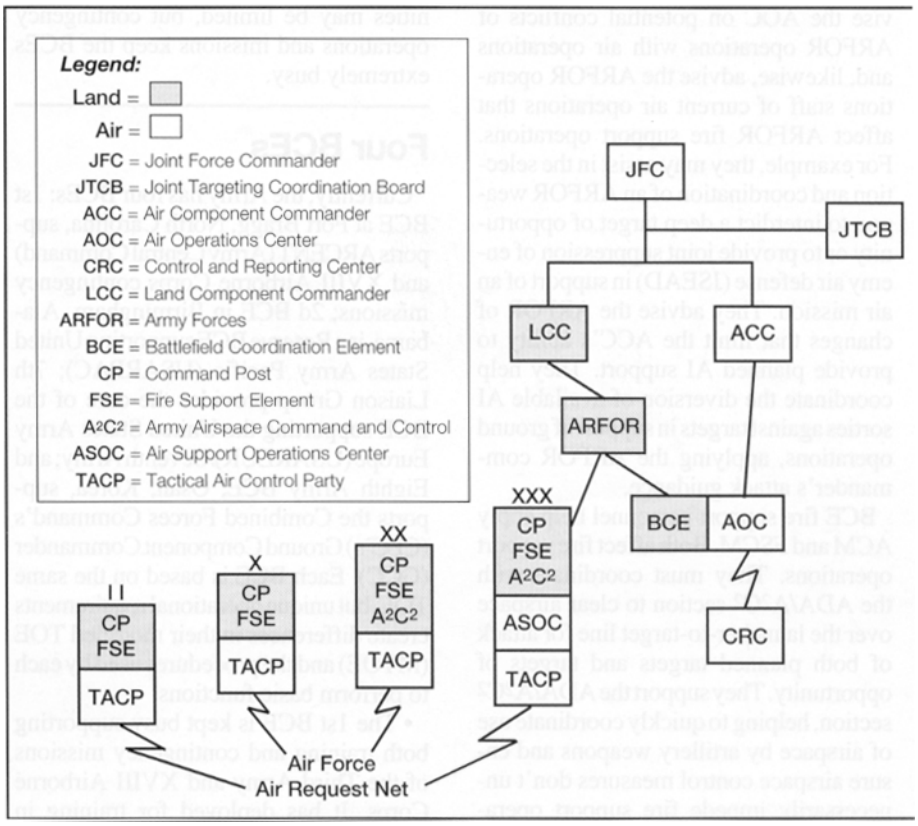


Figure 2: The Theater Air Control System (TACS)

BCE interface functions require its personnel to request and receive information internally from their AOC counterparts and externally from their supported headquarters. Communications planners must provide the BCE interoperable support. The potential for the BCE to collocate with a Navy or Marine Corps JFACC emphasizes its need for joint service communications and ADP interoperability. BCE coordination functions require the ability to communicate extensive text, graphic and tabular data.

• BCE fire support personnel should be augmented to perform their multiple functions 24 hours per day. In deep operations, BCE fire supporters must articulate the position and concerns of the ARFOR commander to integrate ARFOR requirements into the ACC interdiction effort. They advise the AOC on ARFOR fire support systems' capabilities and limitations and the ARFOR commander's concept for employing fire support. They help integrate ARFOR target nominations into the ATO developed by the AOC. They also pass information on ACC interdiction targets planned within the ARFOR area of operations to the ARFOR plans staff.

To support current operations, they advise the AOC on potential conflicts of ARFOR operations with air operations and, likewise, advise the ARFOR operations staff of current air operations that affect ARFOR fire support operations. For example, they may assist in the selection and coordination of an ARFOR weapon to interdict a deep target of opportunity or to provide joint suppression of enemy air defense (JSEAD) in support of an air mission. They advise the ARFOR of changes that limit the ACC's ability to provide planned AI support. They help coordinate the diversion of available AI sorties against targets in support of ground operations, applying the ARFOR commander's attack guidance.

BCE fire support personnel help apply ACM and FSCM. Both affect fire support operations. They must coordinate with the ADA/A^2C^2 section to clear airspace over the launcher-to-target line for attack of both planned targets and targets of opportunity. They support the ADA/A^2C^2 section, helping to quickly coordinate use of airspace by artillery weapons and ensure airspace control measures don't unnecessarily impede fire support operations. They keep the AOC informed of pending changes to FSCMs, such as the FSCL, restricted fire areas (RFAs) and no-fire areas (NFAs) designed to facilitate fires and protect forces.

These fire support functions challenge the ability of the BCE to adequately manage personnel and perform continuously during 24-hour operations. Even with cross-training, 24-hour operations severely strain the BCE.

Fire support is only one of seven BCE functions; the other six are intelligence, operations, plans, air defense, airspace management and airlift. The BCE must be augmented to perform these functions adequately. Augmentation comes from the ARFOR and corps staffs as deemed necessary by the ARFOR commander. Liaison personnel help validate information regarding parent organizations and reduce the burden on the BCE to respond to the many requests for information or support.

Augmentation may not be possible in some situations, such as those in which space is limited: a BCE in support of a Navy JFACC afloat or rapid deployment in support of a smaller force in a contingency mission. In these cases, the BCE must be tailored to perform its mission.

Existing BCEs support real-world missions on a daily basis. Training opportunities may be limited, but contingency operations and missions keep the BCEs extremely busy.

Four BCEs

Currently, the Army has four BCEs: 1st BCE at Fort Bragg, North Carolina, supports ARCENT (Army Central Command) and XVIII Airborne Corps contingency missions; 2d BCE in Birmingham, Alabama, is a Reserve BCE supporting United States Army Pacific (USARPAC); 7th Liaison Group provides the core of the BCE supporting the United States Army Europe (USAREUR)/Seventh Army; and Eighth Army BCE, Osan, Korea, supports the Combined Forces Command's (CFC's) Ground Component Commander (GCC). Each BCE is based on the same TOE, but unique operational requirements create differences in their modified TOE (MTOE) and the procedures used by each to perform basic functions.

• The 1st BCE is kept busy supporting both training and contingency missions of the Third Army and XVIII Airborne Corps. It has deployed for training in working with a Navy JFACC afloat. It participates regularly in Air Force Blue Flag exercises at Hurlburt Field, Florida. Recently, the 1st BCE supported the XVIII Airborne Corps' deployment to Haiti.

• The 2d BCE provides sections to participate in major exercises in the Pacific Command (PACOM), including Korea and Japan. The 2d BCE is composed of dedicated and capable Army Reserve personnel. Their greatest challenge is training as a unit.

• Seventh Army in USAREUR supports the US Air Force in Europe (USAFE) with the 7th Liaison Group. Though not a BCE, this organization performs functions similar to a BCE. USAREUR and the 7th Liaison Group are studying the feasibility of forming a BCE using their personnel and augmentation from other USAREUR commands, such as V Corps. This concept was assessed during Exercise Atlantic Resolve last November.

• The Eighth Army provides the US portion to South Korea's GCC within CFC. The Eighth Army's BCE works on a daily basis with the 7th Air Force Combined AOC in the hardened TACC (HTACC) on Osan Air Base. This BCE performs its mission daily as part of a forward-deployed deterrent force structure.

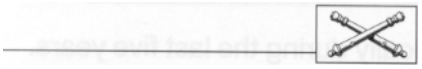
Conclusion

These BCEs are critical to facilitate air ground operations. The increased emphasis on "jointness" in air and ground operations has greatly increased the visibility of these BCEs and their personnel.

In May 1994, the TRADOC Commander designated the Field Artillery School as the TRADOC proponent for the BCE with the Army Commandant of the Air Force's Air Ground Operations School having oversight of the proponency transfer. In response to the requests of the BCEs and in coordination with other TRADOC schools and agencies, the Field Artillery School initiated an update to BCE doctrine. TRADOC approved the proposed development of a new field manual *FM 100-13 Battlefield Coordination Element.*

The initial work group conference in October developed a plan for completing the manual, which will provide the doctrine for manning and equipping the BCE to perform its mission. Concurrent with the development of FM 100-13, recommendations from the conference for TOE changes are being forwarded for TRADOC schools to review.

The importance and workload of the BCE make it a challenging duty assignment. A tour of duty with any of the BCEs provides extremely valuable joint experience and knowledge beneficial to future assignments in command and staff positions at any echelon.



Lieutenant Colonel Donald G. Oxford is Chief of the War Fighter Division in the Fire Support and Combined Arms Operations Department at the Field Artillery School, Fort Sill, Oklahoma. His previous assignment was joint duty as a Plans Officer at Headquarters, Combined Field Army (ROK/US), Uijongbu, Korea. He's a graduate of the Joint and Combined Staff Officer School, Norfolk, Virginia, and Command and General Staff College and School of Advanced Military Studies, both at Fort Leavenworth, Kansas. He works extensively on developing fire support and targeting doctrine for echelons division and above, including participating in related joint doctrine work groups. Persons with interest in these areas may contact him at DSN 639-6207 or commercial (405) 442-6207 or write him: Commandant, US Army Field Artillery School, ATTN: ATSF-TW, Fort Sill, Oklahoma 73503-5600.

Combined Operations and the Korean Culture

A tour of duty in the 2d Infantry Division, Korea, provides a wide range of rewards and challenges that don't occur in continental US (CONUS) assignments. One challenge is to continually maintain a combat ready force that can assemble virtually at a moment's notice. Second Infantry Division units stay ready to fight an enemy four to 40 kilometers away.

The Warriors of the 2d Infantry Division must maintain their personnel and readiness capabilities as a combined force with the Republic of Korea Army (ROKA). The key to making combined forces work is understanding the people who are your allies.

A Truly Combined Theater

The 2d Infantry Division is the backbone of the VI (ROK) Corps and works with the corps daily to deter the potential attack of North Korean People's Army (NKPA) forces. It's unique to work as a subordinate division to a ROKA Corps; it's also unique and challenging to have a ROK armored brigade as the 2d Infantry Division's third brigade. Working daily together, the 2d Infantry Division and ROKA have succeeded in maintaining a very capable force much feared by the NKPA.

Korean soldiers are involved in our training. Every US unit in the division has a number of Korean augmentees to the US Army (KATUSAs). They have served as round-out personnel, alleviating shortages in the 2d Infantry Division since the Korean War. The KATUSAs are a great combat multiplier. They're familiar with the local customs, people and certainly the Hangul (Korean) language. Can you imagine trying to call-for-fire to a ROKA soldier who only speaks Hangul?

The KATUSAs' only drawback is, at the beginning of their tour, their conversational English is unrefined. Therefore, each unit must take care and the time to teach its KATUSAs English.

The brigades and division headquarters all have ROKA liaison officers (LNOs) and soldiers. This is primarily for the 2d Infantry Division to have rapid contact with the VI (ROK) Corps and its higher headquarters, the Third (ROK) Army (TROKA). These LNOs also keep their ROKA chain of command informed about 2d Infantry Division activities.

The Korean Culture

My experiences in Korea gave me great appreciation for the struggles of the Korean people during the past 500 years. Being a conquered people for many of those years has made Koreans very wary and slow to act. This is not bad, just their way. US soldiers who serve in Korea must understand this.

The Korean culture is more deeply rooted in custom than ours is, and it shows in their everyday activities. ROKA soldiers are very respectful of rank, position and status. They also expect success to come as the result of long, hard work—something Americans with the "fast track" or something-for-nothing mentality could learn from.

Working with the ROK Army requires patience and diligence. ROK soldiers are curious about how the US operates and want to study our doctrine as much as possible. They send students to the officer advanced courses at our various branch schools and the Command and General Staff College at Fort Leavenworth, Kansas, to learn our doctrine.

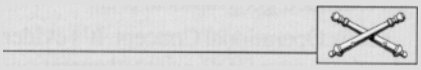
The ROKA doctrine is basic, and the complexities of our doctrine, specifically the three-dimensional battlefield, is very different for them. I've taught many ROKA officers about the fire support techniques the 2d Infantry Division will employ in case of conflict as well as US fire support doctrine. Patience with the language gap and tolerance of the ROKA learning curve was the key to success.

Sharing our techniques and doctrine with the ROK Army allows us to work better as a combined force, but our ROK allies will not take our word as gospel. The Koreans are very creative people and will seek to learn all they can from us and apply parts of our techniques and doctrine to improve theirs. As a result, their capabilities have advanced significantly, especially in terms of fire support in the past few years.

The ROK Army is embracing counterfire. Until early 1994, the ROK Army believed that artillery fires should only support the close fight. They now see the value of using artillery for counterfire in deep operations, thanks to the leadership of the 2d Infantry Division. This is a result of close planning and training with ROK Army units and due to the latest developments in solving the unique counterfire challenge in Korea. For the first time, the theater has a truly combined solution to the NKPA artillery, maximizing the US-ROKA capabilities to defeat the NKPA artillery threat.

The readiness of the 2d Infantry Division is critical to stability on the Korean peninsula. The evolution of ROKA doctrine, equipment and training during the past several years has greatly enhanced the capabilities of the combined forces in Korea.

The efforts of the VI (ROK) Corps and TROKA represent a significant combat power deterring conflict today. The success of our combined forces give international diplomats leverage to work to resolve longstanding disputes and help pave the way for Korean reunification.



CPT David T. Vacchi, FA
Until recently, FAIO, HQ 2d ID, Korea
Now, Counterfire Officer, 75th FA Bde
III Corps Artillery, Fort Sill, OK

The German FA Today and Tomorrow

by Brigadier General Christian Hellwig, Chief of Artillery, Bundeswehr

The political situation in Germany and Europe has changed dramatically during the last five years. The collapse of Soviet communism and the Soviet empire has resulted in the need for Germany to review its security policy and adjust the mission, size, organization and disposition of the Bundeswehr.

This adjustment is an ongoing political and military process, and one need not be a prophet to predict it will continue for quite a while. In this time of reorientation and transition, it's vital the Field Artillery (FA) determine its objectives for the future—its principles for force design and required capabilities—*before* the next decisions on German force structure.

Political Framework

Political guidelines given by the German Secretary of Defense and planning directives issued by the Chief of the Defense Staff and the Chief of Staff of the Army form the framework for all considerations on future FA doctrine, concepts and structure. The parameters include:

• New Political Reality. Germany's new geopolitical or geostrategic position is no longer divided into two "frontline states"—the focal point of the military confrontation between NATO and the Warsaw Pact. Germany is in the middle of Europe and now has borders in common with nine countries, all allied or friendly.

• No Threat—Risks Only. A clearly identified and specific threat no longer exists. But the Federal Republic of Germany must be prepared to deal with potential risks to its security spanning the range of military operations.

• Extended Mission Spectrum. For about 35 years, the German Army focused on accomplishing its NATO General Defense Plan (GDP) mission in central Europe. It now must be prepared to perform a much wider variety of missions in an extended geographical area.

• New Operational Concept. It's evident that the former GDP-oriented operational concept doesn't meet present and future requirements. The changes in tasks, time, space and forces must be reflected in a revised concept.

• Changes in Force Categories. In line with the new NATO criteria, the German Army will consist of reaction forces, main defense forces and a base organization. The German Army no longer has separate field and territorial armies.

• Increased Multinationality. Multinational structures are a characteristic of both our reaction and the main defense forces. At the corps level, they're the rule; at lower echelons down to the brigade level, the capability to operate in a multinational environment is very important. Below that level, multinational interoperability is required or desired, depending on the unit and its mission.

• Reduced Manpower. After the drawdown of the Bundeswehr to 370,000 military personnel, another reduction to 340,000 has been announced. This new reduction will be implemented simultaneously with a shortening of the duration of national basic service from 12 to 10 months, effective 1 January 1996.

• Tight Budget. The funds available for research, development and procurement of new equipment have dropped significantly below the target of 30 percent of the defense budget. Consequently, programs have focused on modernizing our reaction force—as a first priority.

FA Capabilities and Design Principles

A key consideration for the future of the artillery is the impact of modern technology. State-of-the-art technology will allow the future FA to engage moving and stationary, hard and soft targets at great depths as well as in close combat with a degree of precision, speed and reliability that reaches beyond the scope of fire support as we know it today. Fundamentally, the contribution of artillery fires to the combined arms battle will increase significantly.

The goal of a modernized FA is to provide the force commander the capability to fight with artillery fires—*mutatis mutandis*—similar to the way he fights the battle with maneuver elements. To this end, the FA must be able to engage targets deep as well as immediately in front of friendly troops. Using organic assets, it must acquire targets and provide substantial information for real-time situation awareness.

The artillery must be able to take out tactical and operational targets flexibly, responsively and reliably to accomplish a wide variety of missions in accordance with the commander's intent. Those future capabilities are outlined in Figure 1.

The FA must pursue carefully devised design principles to achieve the capabilities it needs for the future force.

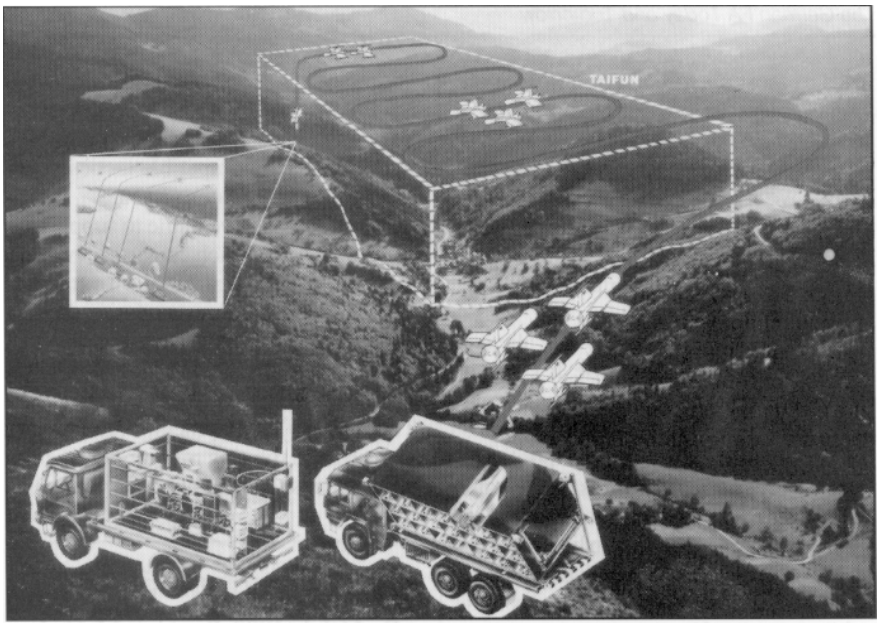
• *The "FA System" must be modernized and employed as integrated components.* These components are reconnaissance and target acquisition (TA), command and fire control, weapon platforms and effects on target. The system is complex and interdependent, each component requiring equal attention to be effective. For example, sophisticated weapon platforms are of little value if we can't locate targets for them quickly and accurately.

At the same time, we're trying to simplify the system for maximum effectiveness. This includes efforts to reduce the number of soldiers and interfaces required in the system—thus, reducing its vulnerability. Unmanned aerial vehicles (UAVs)

FA Systems must be able to—

- Locate targets throughout the tactical operational area of responsibility under all conditions and visibility.
- Minimize the time between target identification and effects on target.
- Increase the accuracy, rate of fire and effectiveness of munitions against targets of any hardness, eliminating the need for a large number of delivery means to mass fires.
- Accomplish a broader scope of tasks, thereby improving the flexibility of all artillery assets.
- Package and employ tube and rocket artillery and their various types of ammunition at the tactical level to achieve maximum effectiveness with minimum resources.
- Destroy operational-level high-value targets across the spectrum from "hard movers" to "soft sitters," engaging them from long distances with a high hit and kill probability.

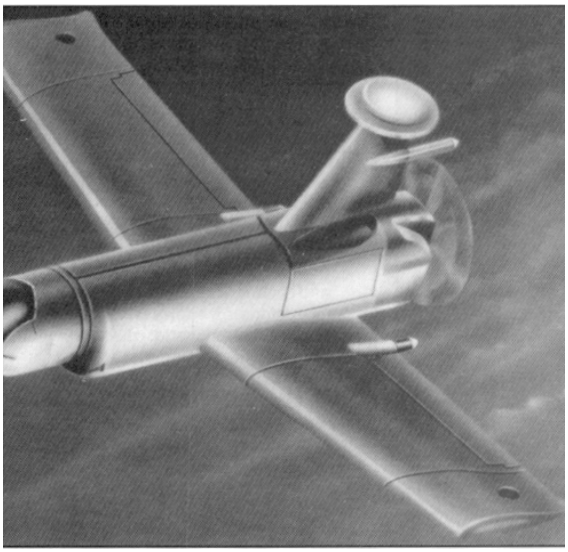
Figure 1: The future FA system must be tactically and operationally flexible, responsive and reliable to support the commander in a wide variety of missions.



The developmental Taifun, an autonomous attack drone, will be able to loiter, identify targets and kill them in deep operations.

and fiber-optic guidance technologies—such as the fiber-optic guidance missile (FOG-M)—appear very promising.

• *We must develop and employ enough systems to do the job—but stay within our limited budget.* Our budget won't allow us to develop and field all the types of equipment or to procure the quantities we consider necessary. Yet it takes a lot of systems to locate targets throughout the area of responsibility (active or passive, stationary or moving, under camouflage or in the open, in all weather and day or night conditions and in real-time) and then engage them rapidly and accurately enough with munitions effective enough to neutralize or destroy them. Because multiplicity is required, the guiding developmental and procurement principle must be "some of a lot" instead of "a lot of some."



The KZO is a UAV for surveillance, TA and battle damage assessment—part of the total FA system modernization.

• *The FA must make the most of its capabilities to provide fires in the five-to 30-kilometer range.* We need to continue to ensure we can provide fire support for troops in close combat; however, as a trend, the increased range, lethality and high first-hit probability of modern weaponry suggest a diminishing demand for artillery in close combat.

The FA is increasing its ability to fight with fires against all types of targets beyond visual range. The emphasis is shifting from tactical fires to fires within a range of five to 30 kilometers. In this sector of the battlefield, FA fires could hit areas for approach marches or reorganizing attack formations, assembly areas, reserve positions of lower tactical echelons, the bulk of FA and Air Defense firing positions, tactical command posts and forward logistical facilities.

Early in an engagement, artillery fires from five to 30 kilometer ranges can prevent an attacking enemy from realizing his intentions. His forces will be destroyed or at least weakened considerably before the force-on-force battle unfolds. Thus the artillery can "pre-decide" the outcome of a battle and minimize friendly casualties.

This shift in emphasis does *not* mean the FA will decrease its quality of close fires for combat troops. On the contrary, those troops will receive better support as they'll be able to count on fires of not only their organic direct support (DS) battalion, but also all artillery units within the extended range, making the most of the delivery means and munitions available.

• *The FA also must be effective at operational depths of the battlefield—the deep battle.* Rockets with extended range, improved accuracy and increased effects on target as well as UAVs (attack drones) with various warheads will give the FA increased deep battle capabilities.

Fast-paced, highly mobile operations on the nonlinear battlefield—sectors with long open flanks and large areas unprotected by friendly troops—are characteristics

of most post-GDP scenarios. Such scenarios call for long-range surveillance and TA assets as well as long-range weapon systems. The following are some capabilities we must develop to provide the most effective operational-level fires: rapid reaction fires, adequate protection for the force, multinational interoperability and versatility of support.

The ability to react rapidly has always been a decisive factor in battle. It's key to fighting outnumbered and winning. Time must and can be saved in every component of the artillery system. Options to increase the speed of our fires range from using computerized command and fire control systems, autonomy in linkages between sensors and weapon platforms and other automated and mechanical processes to increase speed.

Adequately protecting our soldiers is mandatory and is achievable through a combination of measures. For example, widely dispersing FA platforms with short dwell times in firing positions help protect the FA force. In addition, our soldiers are more survivable employing highly mobile platforms that fire munitions with non-ballistic trajectories that have reduced, fuzzy or even misleading acoustic, optic and electronic signatures.

In view of multinational force structures and the need to provide mutual fire support across boundaries, interoperability among artillery systems is indispensable. Key to interoperability are compatible command control, communications and intelligence (C^3I) systems; standardized weapons' characteristics; interchangeable munitions; and compatible tactics, techniques and procedures (TTP).

The FA must be versatile to support the German Army, which consists of mechanized, wheeled and airmobile formations. In addition to its primary mission of German or NATO defense, it must be prepared for a variety of other missions and tasks carried out by specially tailored task forces. The artillery's equipment, organization, doctrine and training must ensure we can render and sustain support for all operations.

Army Structure 5

On 16 July 1990, President M. Gorbatschow and Chancellor H. Kohl agreed to limit the peacetime strength of the German Army to 370,000 military personnel. The reductions had to be completed by the end of 1994. This accord paved the way for an agreement signed in Moscow on 12 September 1990 that removed the last hurdles for the reunification of Germany.

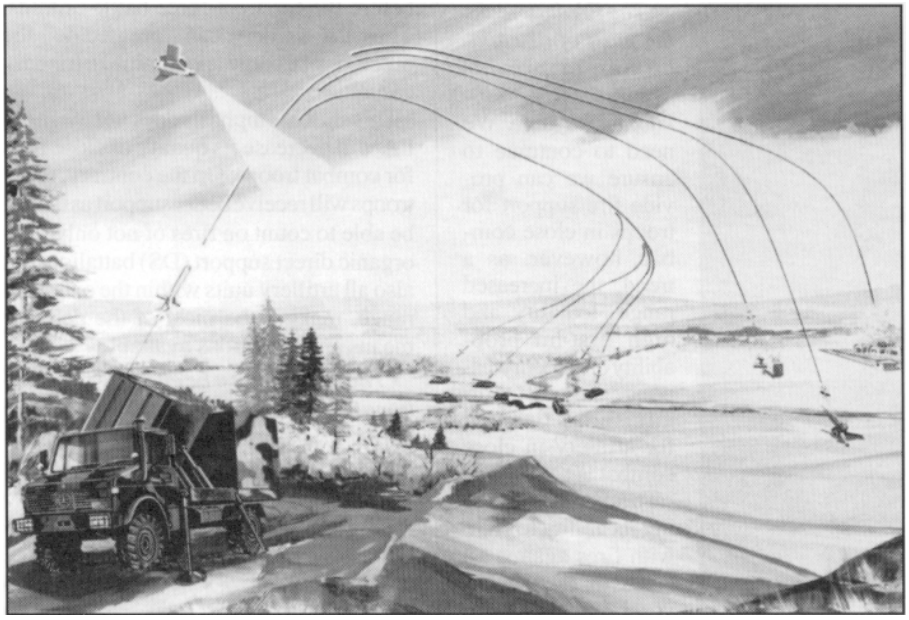
Military planners faced a tremendous challenge in redesigning the German Army in a relatively short time. They had to take into account the political and strategic changes required to amalgamate the West German Bundeswehr (495,000) and the East German Volksarmee (170,000); they had to balance force positioning to cover the unified Germany; and they had to redress the deficiencies of the army. With all that in mind, they had to design and transition to a force structure of no more than 370,000 soldiers within four years—a 56 percent reduction of the total of the West and East German armies. Military planners also had to facilitate the withdrawal of allied forces from West Germany and of Soviet forces from East Germany as well as accommodate the changes in NATO's military policies and organization.

The German Army completely reorganized. Its new structure, called Army Structure 5, is a national command organization established as outlined in Figure 2. The German Army began the reorganization in 1991 and, with few exceptions, completed it by the end of 1994.

FA in Army Structure 5. Based on Army Staff guidelines, the FA down-sized from approximately 41,000 to 21,000 personnel. The new German FA has no nuclear elements, no organic artillery at the corps level, organic artillery at the division and brigade levels, integrated TA and firing capabilities, standardized 155-mm caliber weapons, tube artillery in 3 x 8 battalion formations, one battery of CL 289 (reconnaissance UAV) per division and no more than 37 ready battalions (down from 76 battalions). The German Army Structure 5 FA is shown in Figure 3.

Planning had to be based on the fielding of new equipment as laid down in the then current procurement plan. In the interim, the FA had to be creative until the equipment fielding and force structure aligned.

After careful consideration, the German FA eliminated all the former East German



With a UAV identifying targets, FOG-Ms can be launched from an extended distance, reducing the danger to soldiers.

- Integrated the field and territorial army commands.
- Eliminated the nuclear deterrence mission and elements.
- Activated a corps with two divisions and six brigades in West German Army formations in the former German Democratic Republic after disbanding the East German Volksarmee.
- Reduced the number of divisions from 12 (West German) and six (East German) to a total of eight divisions.
- Redesigned all corps to make them multinational.

Figure 2: The German Army Structure 5 implemented by the end of 1994 included combining the West and East German Armies into one force and reducing it by 56 percent.

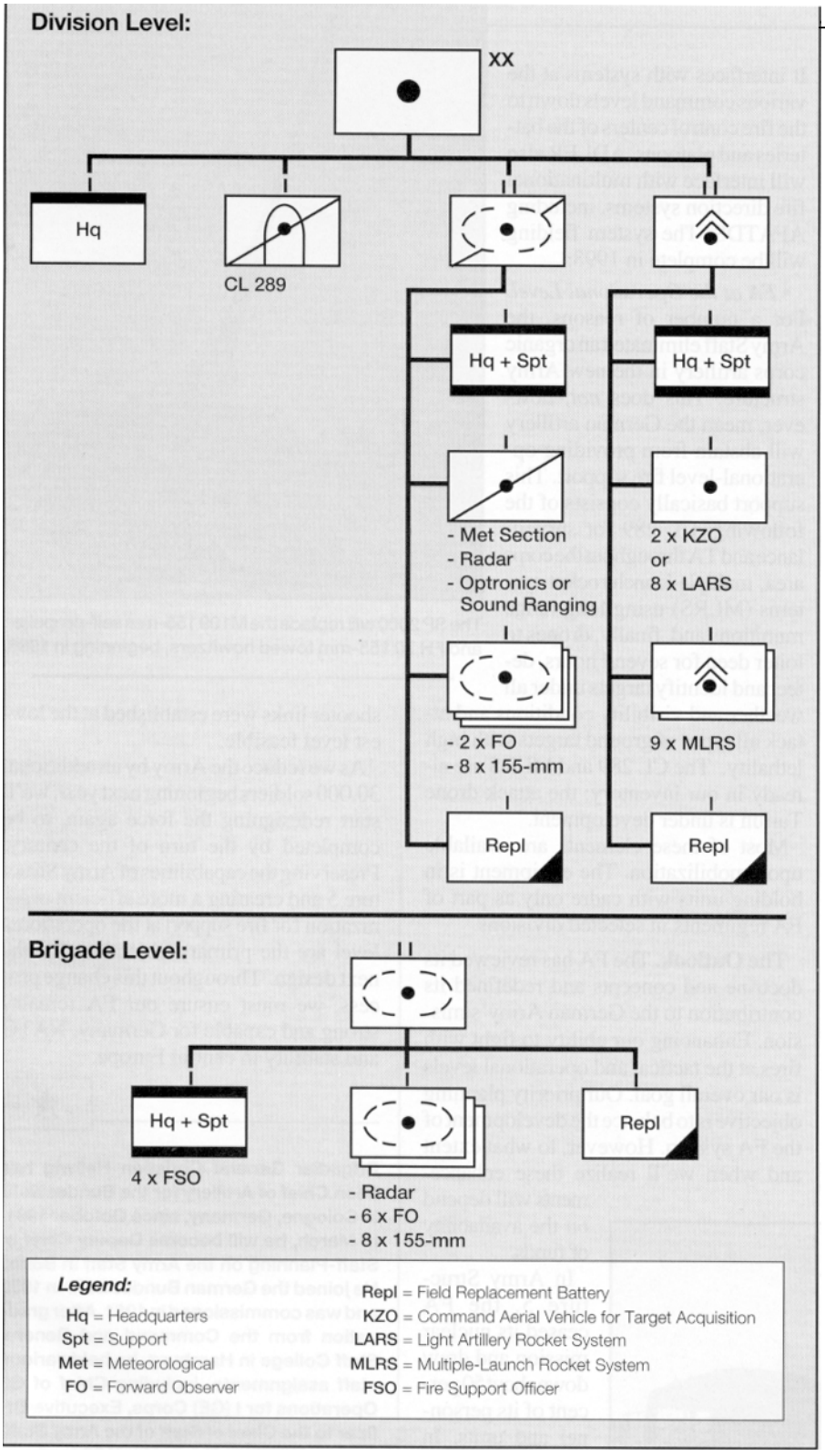


Figure 3: Field Artillery in the German Army Structure 5

Volksarmee major artillery equipment. Quantity limitations imposed by the Conventional Forces Europe (CFE) Treaty, western safety standards and logistical considerations drove this decision. An additional advantage was that artillery units throughout Germany now have standardized equipment.

Three corps artilleries and six division artilleries with their units as well as a substantial number of brigade artillery battalions were disbanded in West Germany. Two division artilleries and 10 battalions were formed in East Germany, which already have achieved training standards. The reorganization basically was implemented in 1992 and 1993 with 1994 devoted to adjusting the structure, as necessary, and training soldiers in their new units.

In 1995, the command organization of the artillery will be altered. The Directorate of Field Artillery in the Army Office—the equivalent to the US Army's Training and Doctrine Command (TRADOC)—will cease to exist and transfer the majority of its responsibility for FA policies to the School of Artillery in Idar-Oberstein. (Some of the FA responsibilities will move into the newly formed Directorate of Combat Support in the Army Office.) In essence, the artillery centers at Fort Sill, Oklahoma, and Idar-Oberstein will have similar responsibilities, once this transfer is complete.

• *FA at the Tactical Level.* As a result of making all corps multinational, the divisions are the highest national echelon in the German Army. Each consists of divisional troops and combat brigades. The number of brigades assigned per division is based on the division's mission, which also dictates the peacetime readiness of each brigade (cadre only vice fully manned brigades), and on NATO requirements.

Each of the eight German divisions has an FA regiment of basically identical structure (Figure 3): a headquarters battery, one drone battery (CL 289), one TA/tube artillery battalion and one rocket artillery battalion.

The newly designed TA/tube artillery battalion facilitates fast firing from sensor-to-shooter. It's TA battery has a meteorological section, counterbattery radars and sound ranging or optronic systems. The battalion's three howitzer batteries are either M109 155-mm self-propelled or FH 70 155-mm towed, both to be replaced by the SP 2000, which starts fielding 1998.

The field replacement battery in each of the TA/tube and rocket battalions has cadre only. These replacement batteries would be mobilized, as necessary, to train and provide replacement personnel for the line batteries.

In the division's rocket artillery battalion (Figure 3), the linkage of sensors and shooters as closely as possible will be realized once the UAV for TA, the

Kleinfluggeraet fuer Ziel-Ortung (KZO), is fielded. Until the KZO becomes available, the battalion will have a third firing battery equipped with the light artillery rocket system (LARS).

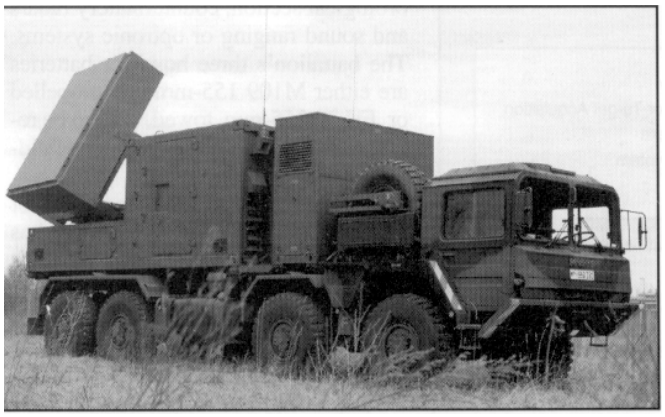
At the brigade level, all 19 of the armored or armored infantry brigades in the German Army have an organic FA battalion equipped with 24 M109A3G howitzers upgraded with the autonomous laying and positioning system AURORA (*Autonome Richtungs-und Orientierung sausstattung Rohrartillerie*).

In the Mountain Brigade and the French/German Brigade, the artillery battalion has 24 towed FH 70 155-mm howitzers.

Because of limited air transportation assets and our airmobile brigades' mission, their organic fire support element will be built upon fiber-optic guidance technology, such as the FOG-M. A battery of eight launchers will provide these brigades—and thus the German Army—long-range, precise, remotely controlled fires with limited collateral damage yet effective against all types of targets.

The German FA is exploiting a technology that will add a new dimensions to its capabilities. But until these developmental FOG-M systems become available, we'll continue to rely on our air-transportable FH 105-mm howitzers and LARS in our airmobile brigades.

The ADLER (*Artillerie-Daten-Lage-Einsatz-Rechnerver bund*) command, control, information and fire direction system—the equivalent to the US Army's advanced FA tactical data system (AFATDS)—is currently fielding in the German artillery. This digital system conducts fire planning, controls fires, performs targeting functions, issues fire missions and reports the status of artillery systems. It interfaces with systems at the various command levels down to the fire control centers of the batteries and platoons. ADLER also will interface with multinational fire direction systems, including AFATDS. The system fielding will be complete in 1998.



Cobra—the German counterbattery radar for the turn of the century and beyond.

• *FA at the Operational Level.* For a number of reasons, the Army Staff eliminated an organic corps artillery in the new Army structure. This does *not*, however, mean the German artillery will abstain from providing operational-level fire support. This support basically consists of the following: CL 289 for surveillance and TA throughout the corps area, multiple-launch rocket systems (MLRS) using long-range munitions and, finally, drones to loiter deep for several hours, detect and identify targets under all weather and visibility conditions and attack all types of ground targets with high lethality. The CL 289 and MLRS are already in our inventory; the attack drone Taifun is under development.

Most of these elements are available upon mobilization. The equipment is in holding units with cadre only as part of FA regiments in selected divisions.

The Outlook. The FA has reviewed its doctrine and concepts and redefined its contribution to the German Army's mission. Enhancing our ability to fight with fires at the tactical and operational levels is our overall goal. Our priority planning objective is to balance the development of the FA system. However, to what extent and when we'll realize these enhancements will depend on the availability of funds.

In Army Structure 5, the FA ceased its nuclear mission and drew down about 50 percent of its personnel and units. In the remaining structure, the TA capability as well as the firepower per battalion were increased significantly and a variety of sensor-to-shooter links were established at the lowest level feasible.

As we reduce the Army by an additional 30,000 soldiers beginning next year, we'll start redesigning the force again, to be completed by the turn of the century. Preserving the capabilities of Army Structure 5 and creating a more efficient organization for fire support at the operational level are the primary objectives for the next design. Throughout this change process, we must ensure our FA remains strong and capable for Germany, NATO and stability in central Europe.

The SP 2000 will replace the M109 155-mm self-propelled and FH 70 155-mm towed howitzers, beginning in 1998.

Brigadier General Christian Hellwig has been Chief of Artillery for the Bundeswehr in Cologne, Germany, since October 1991. In March, he will become Deputy Chief of Staff-Planning on the Army Staff in Bonn. He joined the German Bundeswehr in 1959 and was commissioned in 1961. After graduation from the Command and General Staff College in Hamburg, he held various staff assignments, including Chief of G3 Operations for I (GE) Corps, Executive Officer to the Chief of Staff of the Army Staff, Deputy Assistant Chief of Staff G3 for Combat Support in NATO's Northern Army Group (NORTHAG) and Director of Army Doctrine and Concepts on the Army Staff. Brigadier General Hellwig commanded the 125th Field Artillery Battalion in Bayreuth and the 6th Armored Brigade in Hofgeismar. He's a graduate of the US Army War College at Carlisle Barracks, Pennsylvania.

French Artillery School Trains French and Allies for Liaison Duties

The Senior Artillery Officers Qualification Course is conducted every other year at the French Artillery School at Draguignan, a small city in the sunny south of France. The purpose of the course is to train senior artillery officers—up to half of whom are from allied armies—in employing artillery for French and inter-allied contingencies. The ever-increasing number of multinational interventions has created a requirement for artillery liaison teams with working knowledge of foreign armies to function as part of allied staffs.

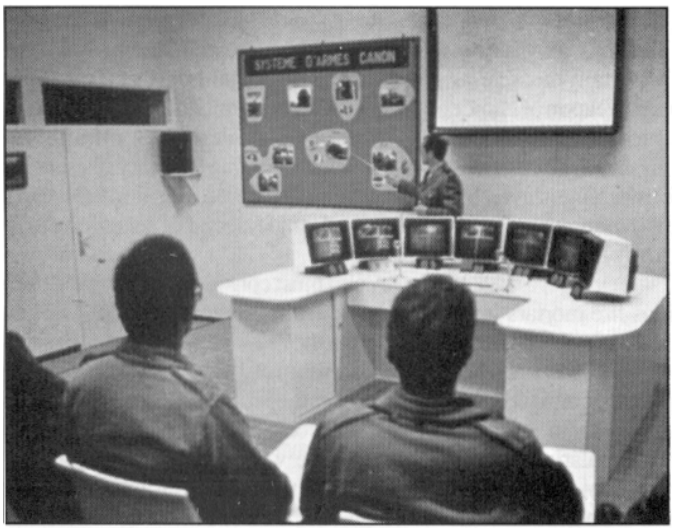
Evolution of the Course. Before the allied course began in 1992, French artillery officers (majors and above) attended a course that enhanced their skills and knowledge in artillery as well as in regimental command post (CP) operations and personnel management. Aimed at French combined arms and territorial army officers who had commanded a battery, this course was a refresher for students before they were assigned at the regimental level.

The purpose of the upgraded version of the course is to provide 18 officers (also majors and above, including five or six allied officers), who are serving or subject to serve in an allied force headquarters, the qualifications to employ artillery. Allied students have come from American, Belgian, British and German armies.

Because the course is oriented on field artillery, two-thirds of the students come from that branch with one-third from air defense. Although the revised course presents instruction on the capabilities and tactics, techniques and procedures (TTP) of the French artillery, it also covers instruction facilitating interoperability. Liaison officers with the Paris *Cours Superieur d'Etat-Major* (Command and General Staff College) present the military decision-making process used by their country's staff system, and the liaison officers at the French Artillery School present instruction on their artillery and major formations.

The Course. The two-week course covers three phases: General Knowledge, The Decision-Making Process and Interoperability. The first phase, General Knowledge, updates the officers' knowledge of French artillery. All weapons systems used by the French Artillery (field artillery, acquisition, air defense and nuclear) are highlighted. With the importance of artillery in deep battle, students are briefed on employing air forces and attack helicopters and on coordinating airspace.

Because artillery is so dependent on logistics the course covers the logistical organization of our corps and *Force d'Action Rapide* (Quick-Reaction Force). The emphasis is on logistics for maneuver units and artillery regiments.



The two-week Senior Artillery Officers Qualification Course covers general knowledge of French artillery systems, among other subjects.

In the Decision-Making Process phase, the course focuses on tactical decision-making for employing field and air defense artilleries. It teaches students how to integrate them into an operation during the "estimate of the situation" phase. Students also learn how to prepare the artillery orders stemming from the commander's tactical decisions.

Interoperability, the third phase, teaches students about allied armies and systems' interoperability. Course members learn the artillery liaison responsibilities normally expected of them at major allied army units. American, British and German liaison officers at the French Artillery School teach students the organization and tactics of their major combined arms units (brigade and division), the capabilities of their artilleries and their orders preparation processes.

Instruction on interoperability documents—NATO Land Forces' fire planning and procedures—conclude these presentations. Some classroom sessions and exercises are conducted in English.

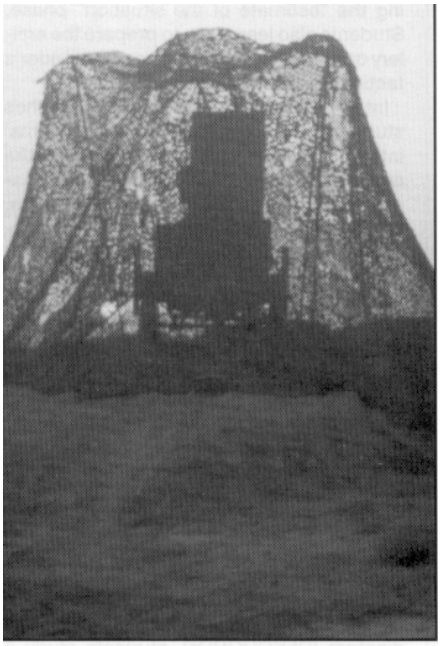
The Final Exercise. The course ends with a two-day practical exercise covering the three phases. Day One is based on a French Army scenario where students prepare a divisional artillery operations order. Acting as division deputy fire support coordinators (DFSCOORDs), students study a corps operations order and help prepare the divisional tactical plan. Each DFSCOORD advises his commander on the most suitable employment of artillery and then writes the field artillery and air defense portions of the operations order fire support annex.

In Day Two, students serve as artillery liaison officers in an inter-allied scenario. Two or three students, including at least one non-French student, make up each liaison detachment. The teams consider their respective artillery problems and, when summoned to the allied unit CP, converse in English with the unit's DFSCOORD played by one of the liaison officers at the French Artillery School. After they receive the corps operations order, students plan the divisional artillery support.

In a subsequent part of the exercise, students act as liaison officers for allied brigades. After a "war-time incident," the liaison officers recommend artillery support. Finally, the students plan the artillery for relief of a withdrawing allied division with a rearward passage-of-lines.

Final Words. The Senior Artillery Officer Qualification Course creates a pool of officers capable of employing artillery for a French or inter-allied contingency. It gives students the qualifications to fill artillery liaison positions and prepares them for complex multinational military actions for which interoperability is a condition for success.

Lieutenant Colonel Claude Mathey is an Instructor in the Tactics Division of the French Artillery School in Draguignan, France. Among other assignments, he attended the Allied Targeting Course at the US Army Field Artillery School, Fort Sill, Oklahoma in 1993.



Put Out The Fire:
Countering Mortars in Operations Other Than War

by Captain Keith R. Yoder and Chief Warrant Officer Four Luke M. Thompson

"Counterfire, counterfire, counterfire!" blares out across the tactical operations center (TOC) as the light tactical fire direction system (LTACFIRE) printer begins to hum. In an instant, the nerve center of the Field Artillery battalion is a blur of well-rehearsed actions.

"Target grid—Whiskey Echo zero-two-three-four, zero-one-zero-five," barks the fire direction NCO as the fire direction officer (FDO) springs to his situation map.

"Impact predict—Whiskey Echo zero-three-eight-one, zero-two-niner-two."

"Range two-point-three, "calls the FDO. "Looks like a mortar."

"Same spot as last night," adds the S2 from his post.

"Mission is down to all three batteries, Sir. I sent it 'Do not load' with the standard fire order," says the fire direction NCO.

"All clear for the batteries and mortars. It's not one of ours," states the Assistant S3 from his position at the operations map.

"Twenty-one seconds," growls the FDO. "Come on FSE [fire support element], let's get 'em this time."

A tense silence settles over the TOC as the clock ticks. Time seems to drag on forever as they wait for the clearance to fire from the brigade FSE. "Forty-five seconds...Come on, let's go, let's go."

"They'll get it. We just rehearsed this two hours ago," the S3 says confidently.

"Foxtrot six-four, this is Golf four-eight. Target Alpha Echo seven-zero-one-zero is cleared to fire," sings out over the fire support coordination net.

"Cancel, 'Do not load,'" yells the FDO—"Cancel 'Do not load.'"

Fire support has been aptly described as a system of systems. No where is that system more stringently tested than when trying to protect the force from mortar fire in operations other than war (OOTW). All systems within the system must work smoothly and be synchronized with the combined arms effort to succeed in this environment.

Clearly, fire supporters must continue to prepare to fight on the mid- to high-intensity battlefield. However, they also must be able to solve problems intrinsic to counterfire in OOTW. Lessons learned by units at the Joint Readiness Training Center (JRTC) at Fort Polk, Louisiana, can be the basis for this education.

To defeat guerrilla mortars, a unit must locate and destroy the mortar logistics bases and (or) find and capture or destroy the mortar, executing a battle drill that allows for the rapid attack of the weapons platform within two minutes of acquisition. But first, the unit must understand what it's up against.

The Threat

The indirect fire threat in OOTW includes all types of weapons and formations. Mortars are especially notable as they are the fire support weapon of choice for unconventional forces. There are thousands of mortars in insurgent groups worldwide. In the former Yugoslavia, for example, at least 9,000 mortars were part of the Yugoslavian Army before the country broke up.

In OOTW, guerrillas fire mortars from prepared positions and mount them in the beds of pickup trucks. They use them independently or in support of combined arms operations. They even use them simply to rain terror on civilian populations.

The Field Artillery S2 looks principally at fire support systems as he goes through the intelligence preparation of the battle-field (IPB) process. During the threat integration step, he templates likely mortar firing positions and cache sites. A cache normally will support two or more firing positions, each within a relatively short distance. For mortars, they usually are within one kilometer because the crew must carry its ammunition to the firing point. By finding and capturing or destroying these caches, a unit can put the mortars out of action.

Equally important is finding the logistics bases and transportation routes the enemy uses to resupply the caches. A brigade may destroy or capture the original caches, but if the guerrillas can continue to resupply, it's easy for them to establish new ones. The larger logistics bases often have command posts (CPs) with radios near them, thus having an electronic signature. Finding these CPs often provides clues to where the mortar logistics bases are located.

Ultimately, units must find and destroy or capture the weapons to defeat the mortar threat. Sometimes a maneuver force may get the weapons with the logistics bases; however, when they don't, the unit must attack the mortars when they fire.

Firefinder Radar

The Q-36 Firefinder radar is the most important target acquisition asset a brigade has for countermortar operations. It's crucial that units use it effectively.

A critical consideration for the Q-36 is site selection. The primary factors for determining where to position the radar(s) are mask angle, sector of search and radar security.

A unit must consider mask angle closely when selecting a radar position. The goal is to get the mask angle as low as possible (a maximum of 15 to 20 mils); this greatly improves the probability of acquiring hostile weapons. Even though mortars are high-angle weapons, they can fire with very low maximum ordinates at short ranges. If the radar mask angle is too high or if the radar is too far from the weapon, the trajectory likely will fall below the radar's beam.

When selecting a search sector, a unit should refer to the S2's IPB products. It should orient the radar(s) to cover the templated firing positions based on predictions made in war-gaming. The artillery S2 works closely with the maneuver S2 to select sectors of search.

The targeting team (S2, S3 and fire support coordinator, or FSCOORD) synchronizes the radar's search sectors with maneuver operations. If an infantry company is moving-to-contact against a suspected large supply point, it's reasonable to assume that the company may come under mortar attack. Therefore, the brigade orients the radar to provide protection for the operation.

The place to synchronize counterfire is in the brigade targeting meeting when the intelligence, operations and fire support personnel decide how and where to focus assets. It simply doesn't work to hand counterfire to the artillery and tell the artillery to fight it as a separate battle.

Radar security is crucial in the OOTW environment. The enemy is everywhere, and the radar is a threat to his survival. A unit should consider siting the radar inside the perimeter of another unit. Positioning the radar with a firing battery. TOC or logistics support area for security reasons is a good idea if the radar can accomplish its mission from one of these locations. Most units at the JRTC attach at least one squad of infantry per radar section to provide additional protection.

Other Targeting Assets

Although the Firefinder radar is the most effective collection asset a brigade has for counterfire, it's by no means the only asset. Intelligence officers should use every asset available to develop targets (see Figure 1).

As the targeting team decides how to detect and attack targets, it must consider target selection standards (TSS). For example, a Q-36 acquisition may be considered a target for indirect fire for only two or three minutes after detection. However, that same acquisition may be a target for infantry attack for two or three hours after detection. The team spells out these criteria in the form of TSS during the daily targeting meetings.

The S2 keeps a detailed event log and template. Every 12 hours, he starts a new set but saves the old ones for later review. The old overlays give him the means to identify patterns and predict target locations.

At the JRTC, one Field Artillery S2 was extraordinarily adept at pattern analysis.

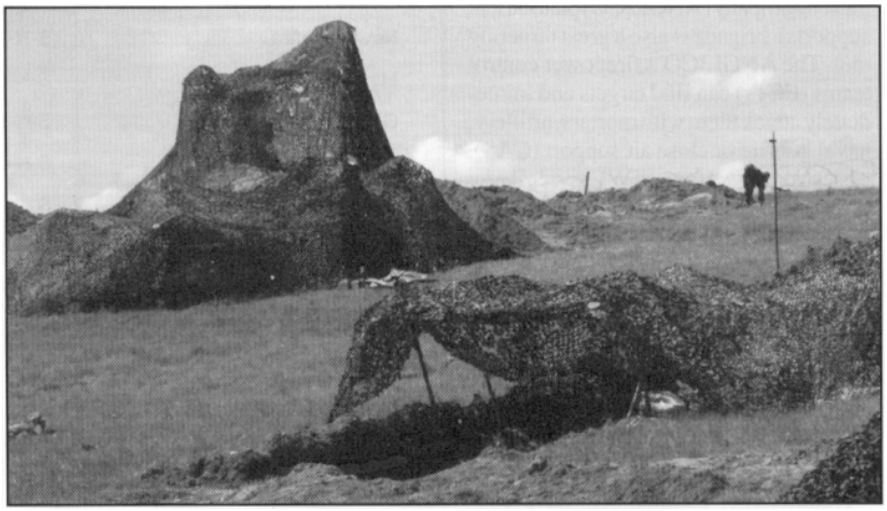
Sensor (Find/Assess)	Mortar (Firing)	Cache	Logistics Base	Forward Observer
Q-36 Firefinder Radar	T*-A	TI		TI
Scouts	T-A	T-A	T-A	T-A
Infantry	T-A	T-A	T-A	T-A
COLTS	T-A	T-A	T-A	T-A
FISTS	T-A	T-A	T-A	T-A
Helicopters	T-TI-A	T-TI-A	T-TI-A	T-TI-A
AFAC (OA-10 Warthog)	T-TI-A	TI	T-TI-A	
CAS through TACP/GLO	T-TI-A	TI	T-TI-A	
AC-130	T-TI-A	T-TI-A	T-TI-A	T-TI-A
Firepower Control Team (FCT)	T-A	T-A	T-A	T-A
Low-Level Voice Intercept (LLVI)	TI	TI	TI	TI
REMBASS	TI	TI	TI	TI
Ground Surveillance Radar (GSR)	TI	TI	TI	TI
Radio Direction Finding (RDF)	TI		TI	TI
Quick Fix	TI		TI	TI
Military Police	T-TI-A	T-TI-A	T-TI-A	T-TI-A
Special Ops/PSYOP/CA	TI	TI	TI	TI
Host Nation Forces	TI	TI	TI	TI

**A Target versus Target Indicator depends on the target selection standards (TSS) and attack system.*

Legend:

T = Target
TI = Target Indicator
A = Assess
COLTS = Combat Observation Lasing Teams
FISTS = Fire Support Teams
AFAC = Air Force Air Controller
CAS = Close Air Support
TACP = Tactical Air Control Party
GLO = Ground Liaison Officer
REMBASS = Remotely Monitored Battlefield Sensor System
PSYOP = Psychological Operations
CA = Civil Affairs

Figure 1: Counterfire Sensors. Although the Firefinder radar is the most important counterfire target acquisition asset available to the brigade, intelligence officers should use all means available to develop targets.



A Q-36 Firefinder radar inside a fortified battery position.

Using nothing but radar acquisitions, he was able to template the entire opposing force (OPFOR) cache system. The brigade then tasked other sensors to confirm or deny the templated targets and was extremely successful in finding and attacking the insurgents.

Once patterns start to emerge, the brigade S2 focuses other assets to confirm or deny the presence of firing points and caches. The artillery S2 and targeting officer work closely with the maneuver S2 in this process. After each daily targeting meeting, the brigade should publish a fragmentary order and update its collection plan and fire support execution matrix (FSEM) and target list. These actions focus the brigade on the templated enemy.

Pilots and aircrews can provide valuable targeting information. A fire support cell in the aviation CP is a great resource. Pilots often see target indicators while performing their missions but don't know they are important, so they don't report them. By briefing crews before their missions and debriefing them after, fire supporters can gain essential information. The ground liaison officer (GLO) at a tactical fighter wing can do the same with Air Force pilots and crews.

The AC-130 aircraft is an excellent platform for target acquisition and attack. With its sophisticated systems, the AC-130 can detect and attack targets at night when other systems won't work. Targeting teams should work closely with the brigade tactical air control party (TACP) to maximize the use of AC-130 aircraft for countermortar operations.

The Marine Corps' air naval gunfire liaison company (ANGLICO) platoon that supports a brigade is also a great targeting tool. The ANGLICO's firepower control teams (FCTs) can find targets and immediately attack them with mortars, artillery, naval gunfire or close air support (CAS).

Electronic warfare (EW) systems are also valuable sensors. Several of these assets, such as the AN/TLQ-17A (Traffic Jam), can attack as well as detect an enemy fire support system. Several units have used electronic direction finding and jamming very effectively against the OPFOR fire support system at the JRTC.

Attacking the Target

Traditionally, commanders have considered counterfire a Field Artillery mission and placed responsibility for the fight on the FSCOORD. In OOTW, however, Field Artillery isn't always the best attack system to use. Successful units consider all attack means and select the best one to meet the commander's intent. Maneuver forces, mortars, attack helicopters, naval gunfire, CAS and EW are all attack methods to consider. Based on the commander's intent, the targeting team decides whether to destroy, neutralize, suppress or capture enemy mortars and (or) their caches. Then the team chooses the best attack method based on the current situation (see Figure 2).

An AH-64 Apache helicopter (top) and an AH-1 Cobra (bottom) search for enemy mortars at the JRTC.

Maneuver forces or attack helicopters are often the best choice. By moving-to-contact against a Q-36 acquisition, infantry often will destroy or capture the mortar as well as several caches. The brigade S2 can then use the additional intelligence information gained in the operation to develop new targets. Maneuver forces and helicopters also provide immediate battle damage assessment (BDA) and allow the targeting team to refocus assets on other templated targets.

If the attack method is indirect fire, the system must respond very quickly. History has shown that to be effective with indirect fire against guerrilla mortars, the unit must attack the mortar within two minutes of the time the radar acquires it. Successful units at the JRTC use a counterfire battle drill to speed response and eliminate fratricide (see Figure 3).

Attack System	Mortar (Firing)	Cache	Logistics Base	Forward Observer
Infantry (Movement-to-Contact)	S-N-D-C	D-C	D-C	S-N-D-C
Air Assault Raid	D-C	D-C	D-C	D-C
Armor/Mechanized Infantry	S-N-D-C	D-C	D-C	S-N-D-C
Field Artillery	S-N-D		N-D	S-N-D
Attack Helicopters	S-N-D		N-D	S-N-D
Naval Gunfire	S-N-D		N-D	S-N-D
Mortars	S-N-D			S-N-D
CAS	S-N-D		N-D	S-N-D
AC-130	S-N-D	N-D	N-D	S-N-D
Electronic Jamming	S			S
Psychological Operations	S		S	S
Host Nation Forces	S-N-D-C	D-C	D-C	S-N-D-C

Legend of Effects:

S = Suppress **D** = Destroy

N = Neutralize **C** = Capture

Figure 2: Counterfire Attack Assets. In OOTW, Field Artillery may not be the best attack system available. The attack system employed depends on the effects the commander wants on the target and the best system available to achieve those effects.

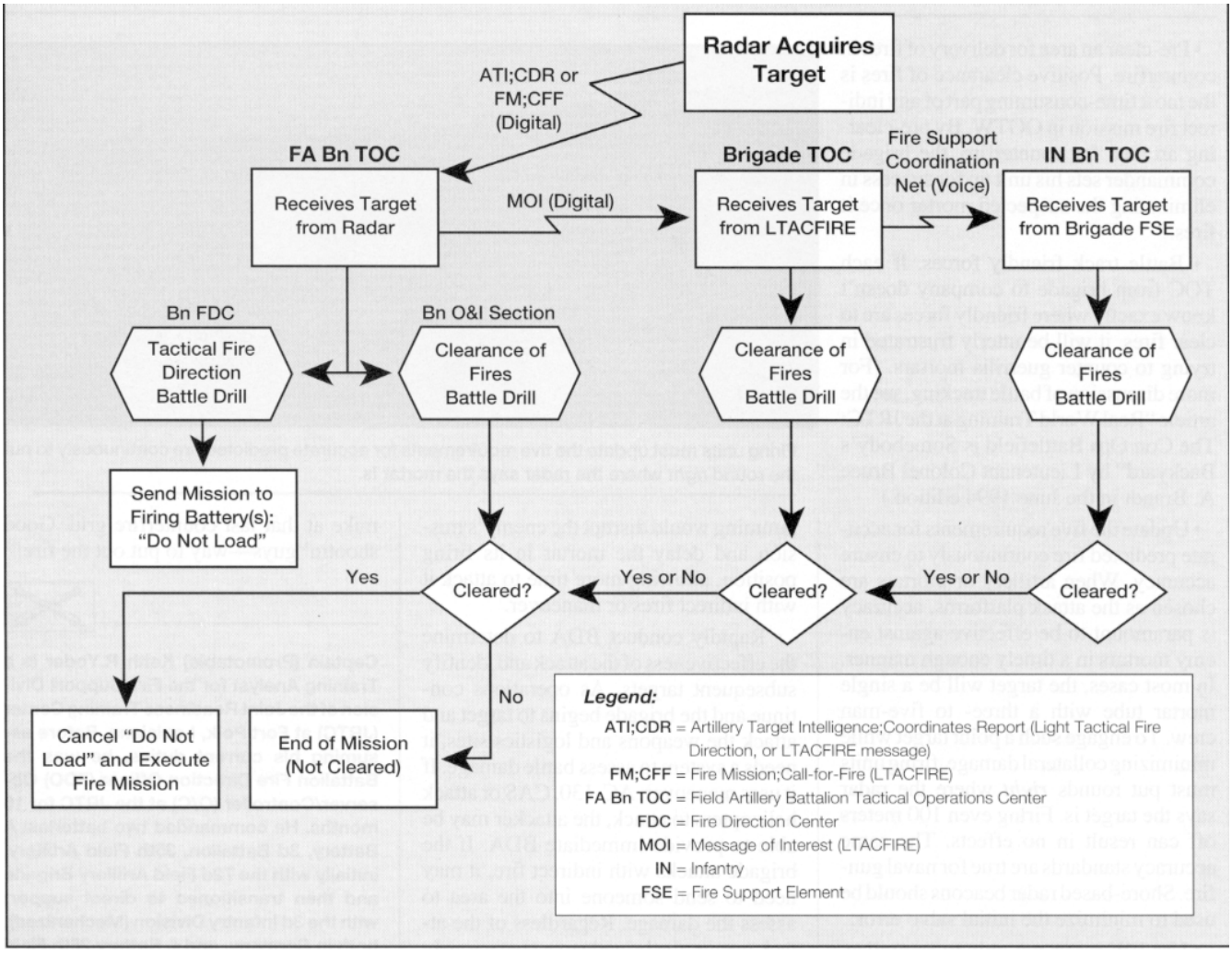


Figure 3: Battle Drill to Rapidly Fire on Mortars. A unit must fire on a mortar within two minutes of the time the Firefinder acquires it. Therefore, the actions depicted in this flow chart by the Field Artillery and maneuver elements must be executed simultaneously.

The drill includes clearance of fires and is part of the brigade tactical standard operating procedures (SOP). In addition to a good counterfire drill, there are several other steps a unit can take to speed the process.

• Establish a counterfire standard fire order and update it after each targeting meeting. The FDO may need to have two or more standard fire orders to account for differences in rules of engagement (ROE). For instance, the ROE may preclude some shell/fuze combinations if the target is, say, within a city or populated area.

• Have each firing battery prepare and place on a "ready rack" the ammunition for counterfire. The FSCOORD may establish a priority target on a templated firing position if he strongly suspects the enemy will use that position within the next few hours. This allows at least one battery to respond very quickly to an acquisition in that area.

• Rehearse, rehearse, rehearse. After each shift change, the new shift should rehearse the counterfire drill with all parties involved, including battalion and company fire support officers (FSOs). Successful units make these rehearsals a routine part of doing business.

An Infantry patrol moves out to attack a suspected logistics base.

• Pre-clear an area for delivery of fires in counterfire. Positive clearance of fires is the most time-consuming part of any indirect fire mission in OOTW. By pre-clearing an area for counterfire, the brigade commander sets his unit up for success in eliminating the suspected mortar once it fires.

• Battle track friendly forces. If each TOC from brigade to company doesn't know exactly where friendly forces are to clear fires, it will be utterly frustrated in trying to counter guerrilla mortars. (For more discussion of battle tracking, see the article "Real World Training at the JRTC: The Con Ops Battlefield is Somebody's Backyard" by Lieutenant Colonel Bruce A. Brandt in the June 1994 edition.)

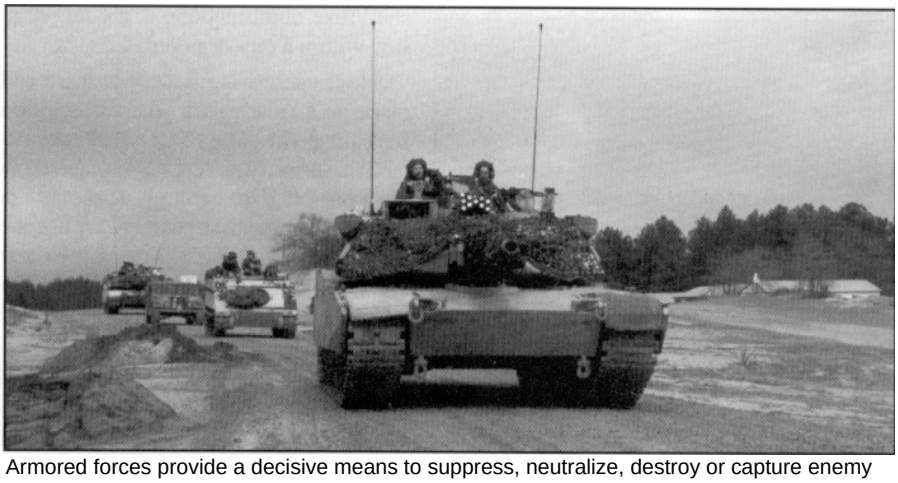
• Update the five requirements for accurate predicted fire continuously to ensure accuracy. When artillery or mortars are chosen as the attack platforms, accuracy is paramount to be effective against enemy mortars in a timely enough manner. In most cases, the target will be a single mortar tube with a three- to five-man crew. To engage such a point target while minimizing collateral damage, firing units must put rounds *right* where the radar says the target is. Firing even 100 meters off can result in no effects. The same accuracy standards are true for naval gunfire. Shore-based radar beacons should be used to minimize the initial salvo error.

• Use EW assets not only to neutralize, but also to set up an attack on the enemy's fire support system. For example, if the S2 determines that mortars are always using adjust fire techniques (the pattern), the attack method may be to jam their nets each time the Q-36 acquires a round. The jamming would disrupt the enemy's mission and delay the mortar in its firing position, allowing more time to attack it with indirect fires or maneuver.

Firing units must update the five requirements for accurate predicted fire continuously to put the round *right* where the radar says the mortar is.

• Rapidly conduct BDA to determine the effectiveness of the attack and identify subsequent targets. As operations continue and the brigade begins to target and attack the weapons and logistics sites, it needs a system to assess battle damage. If it uses maneuver, AC-130, CAS or attack helicopters to attack, the attacker may be able to provide immediate BDA. If the brigade attacks with indirect fire, it may need to send someone into the area to assess the damage. Regardless of the attack means, the brigade must tenaciously target and attack the fire support system until it meets the commander's intent.

"Foxtrot six-four, this is Golf four-eight. First battalion just reported that one of its platoons found two dead guerrillas, a mortar tube and 25 rounds of 82 mike mike at that last counterfire grid. Good shootin' guys—way to put out the fire!"



Armored forces provide a decisive means to suppress, neutralize, destroy or capture enemy assets.

Captain (Promotable) Keith R.Yoder is a Training Analyst for the Fire Support Division of the Joint Readiness Training Center (JRTC) at Fort Polk, Louisiana. Before assuming his current duties, he was the Battalion Fire Direction Officer (FDO) Observer/Controller (O/C) at the JRTC for 16 months. He commanded two batteries: A Battery, 3d Battalion, 35th Field Artillery, initially with the 72d Field Artillery Brigade and then transitioned to direct support with the 3d Infantry Division (Mechanized), both in Germany, and A Battery 25th Field Artillery (Target Acquisition), also with the 3d Infantry Division. Captain Yoder is a graduate of the Field Artillery Target Acquisition and Survey Officer's Course and the Target Processing Course, both at the Field Artillery School, Fort Sill, Oklahoma, and the Combined Arms and Services Staff School at Fort Leavenworth, Kansas.

CW4 Luke M. Thompson has been the Senior Q-36 Firefinder Radar O/C at the JRTC for more than 40 rotations. He has trained Royal Thai Army Q-36 radar crews in Thailand; assisted the 10th Mountain Division (Light Infantry) in countermortar operations in Mogadishu, Somalia; and developed countermortar tactics, techniques and procedures for mountainous terrain in Alaska. Chief Thompson has served as a Radar Technician in the 8th Infantry Division (Mechanized) in Germany, helping to field the Q-36 and Q-37 radars; 25th Infantry Division (Light) in Schofield Barracks, Hawaii; and the 4th Infantry Division (Mechanized) at Fort Carson, Colorado. He also served as a Collective Training Analyst in the Target Acquisition Department of the Field Artillery School.

MLRS Training for the Israeli Defense Forces

In July 1994, a delegation of soldiers from the Israeli Defense Forces (IDF) arrived at the US Army Field Artillery School (USAFAS), Fort Sill, Oklahoma. Although they were Israeli Field Artillerymen and well versed in the tactics, techniques and procedures (TTP) of cannon artillery, they were about to embark on a training mission unlike any they had previously experienced. They were to begin training on the multiple-launch rocket system (MLRS).

Basis of the Buy

The MLRS made its spectacular debut in Southwest Asia during Operation Desert Storm with the whole world looking on. Among the spectators and watching with more than passing interest was the government of Israel.

Based on MLRS' extremely successful "baptism under fire," Israel decided to augment its defense forces with the system. The decision to acquire MLRS was confirmed in the latter part of 1993. This foreign military sales (FMS) acquisition was the largest expenditure by the IDF on foreign military hardware in more than 20 years.

USAFAS immediately prepared a total training package to meet the specific needs of the IDF. The USAFAS mission was to train a delegation of Israeli soldiers who would serve not only as members of the first Israeli MLRS battery, but also as the nucleus of the IDF training base for MLRS operations at the Israeli Artillery School.

Training Phases

The training program was carefully planned, coordinated and executed as a combined operation by personnel in the Gunnery Department, USAFAS, and 3d Battalion, 9th Field Artillery, 214th Field Artillery Brigade, III Corps Artillery. The IDF training program had three phases: individual training for Israeli officers and senior NCOs, individual training for crew members and fire direction specialists and collective training.

The MLRS Division of the Gunnery Department conducted the first two phases of individual training. Phase I began in August 1994 and consisted of training 16 Israeli officers and senior enlisted personnel in a modified FMS version of the MLRS Cadre Course. The purpose of this course was to train MLRS platoon sergeants, platoon leaders, operations officers and commanders. The course culminated in a command post exercise (CPX) during which students filled key positions in an MLRS unit and simulated the movement and employment of MLRS assets.

The course covered all technical and tactical aspects of directing and managing an MLRS firing battery. This included command and control of the battery and firing platoons, logistics management and maintenance of MLRS equipment. Additionally, IDF students received training on the operation and supervision of the launcher fire control system (FCS) and the fire direction system (FDS).

Phase II began in September 1994. The training was conducted simultaneously by the MLRS and the Fire Direction Branches of the MLRS Division; the focus of this phase was to train MLRS crewman and fire direction specialists. Thirty-five officers and enlisted soldiers were trained in the FMS version of the MLRS Crewman Course, and 20 officers and enlisted soldiers attended the FMS version of the Fire Direction Specialist Course. The crewman courses provided the technical instruction necessary for IDF soldiers to function successfully as MLRS ammunition specialists or as an integral part of the threeman MLRS firing section.

The fire direction training focused on the operation of the MLRS FDS and the communications equipment necessary for tactical operations. The students also were trained in skills to perform operator-level preventive maintenance checks and services (PMCS) as well as the installation and operation of all ancillary equipment.

Once the IDF soldiers completed all individual training, they were ready for Phase III, collective training. Phase III was hosted by the 3d Battalion, 9th Field Artillery, and it began on 7 November. It consisted of lane training from the section through battery levels and culminated in a live-fire exercise on 7 December. The training included two battery field training exercises (FTXs) and an external evaluation.

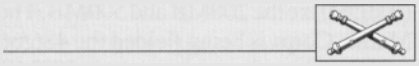
The model for this collective training was the MLRS mission training plan. Particular emphasis was placed on reconnaissance and selection of operational positions (RSOP), fire mission processing and operational area (OPAREA) activities. The climactic end-of-course, live-fire demonstration was viewed by Brigadier General Dorfmann, the IDF Corps Artillery Commander, and Brigadier General Gilboa, Israeli Deputy Chief for Logistics.

Maintenance Training Programs

Other Training and Doctrine Command (TRADOC) schools also helped train the Israelis. At Redstone Arsenal, Alabama, Israeli soldiers attended a maintenance course. It was a 14-week direct support (DS) maintenance course on the M270 MLRS launcher. Redstone Arsenal also hosted a two-week ammunition inspection course. Track and wheeled vehicle mechanics received their training at Aberdeen Proving Grounds, Maryland. At the conclusion of their respective training, these support personnel joined the IDF detachment at Fort Sill and participated in the collective training phase.

The certification of the first Israeli MLRS battery was the culmination of a massive effort on the part of USAFAS, other TRADOC schools, III Corps Artillery, the US Army Missile Command (MICOM) at Redstone Arsenal and a host of support personnel during a 10-month period. The successful completion of this mission is due also to the motivation and professionalism of the Israeli students.

Lessons learned during the planning, coordinating and directing of this project will provide the cornerstone for future FMS training events.



MAJ Thomas G. Harris, FA
Chief, MLRS Division,
Gunnery Department
FA School, Fort Sill, OK

IFSAS Update

The initial fire support automation system (IFSAS) program has progressed rapidly since its inception in 1991. This is an update for users in the Field Artillery community on several different areas of the program. Specifically, this article concentrates on IFSAS fielding, software and hardware developments, and training.

Fielding. Fielding commenced in August 1993 and is projected to be complete early in calendar year 1996. As of January 1995, approximately 60 percent of Reserve Component (RC) units, three Active Component (AC) divisions and one Marine expeditionary force (MEF) have been fielded.

Software and Hardware. The initial software fielded was Version 1.054. The lightweight tactical fire direction system (LTACFIRE) equivalent is Version 10.20. Both versions are identical except that LTACFIRE does not provide the fire planning work sheet on the screen.

The current Army version of IFSAS software is 1.16. The Marine Corps software version is 1.15, which has the same capabilities as the Army version. These versions provide three major enhancements for the user: it lets the operator use his floppy disk drive; it clears up known computer lock-up problems; and it adds additional printer drivers.

Brigade/corps/division artillery (BCD) software is scheduled for its operational test in March-April 95. Currently, BCDs are continuing to use heavy TACFIRE or they're using lightweight computer units (LCUs) with battalion-level software. With this new BCD version, all users from the battalion to the Army corps or MEF levels will be using the same software.

The current LCU being fielded is the 486/25 with a monochrome screen. On the horizon is a 486/66 with a color screen. The available removable hard disk drives (RHDD) are the 200MB and 500MB. The Marine Corps is being fielded the 486/66 LCU with color screen and 500MB RHDD.

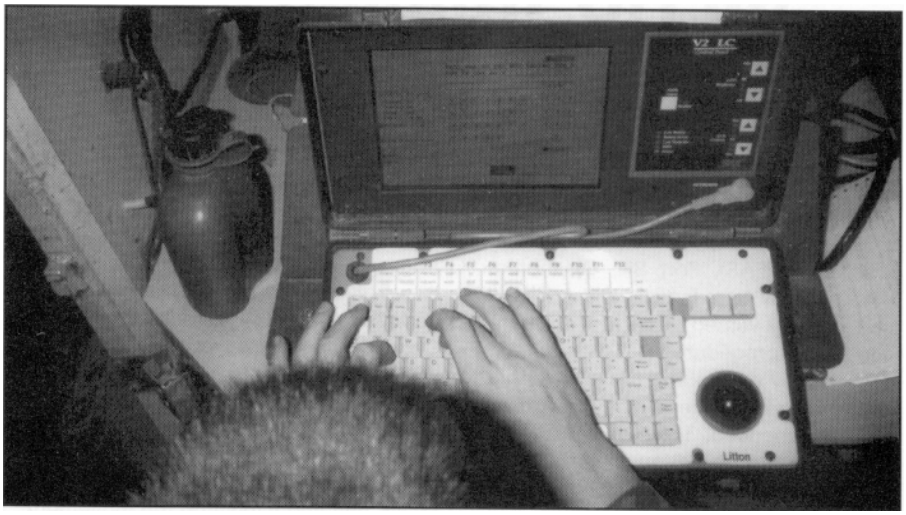
Training. IFSAS is our first experience with distributive processing. This means that we're no longer relying on a main computer to do all our processing jobs as we did with TACFIRE.

IFSAS will be found from the battalion to the corps levels in the Army fire support elements (FSEs) and Marine fire support coordination centers (FSCCs). Now battalion and brigade FSEs can develop and compute entire fire plans down to the targets in the schedule of fires (TISF). With the current version of software, all operational facilities (OPFACS) should initialize themselves as a battalion fire direction center (FDC), so they can access the full functionality of the program.

To maximize distributive processing, all data bases should be the same. This is accomplished with a good standing operating procedure (SOP) for establishing the data base and then maintaining it through message of interest (MOI) routing and processing.

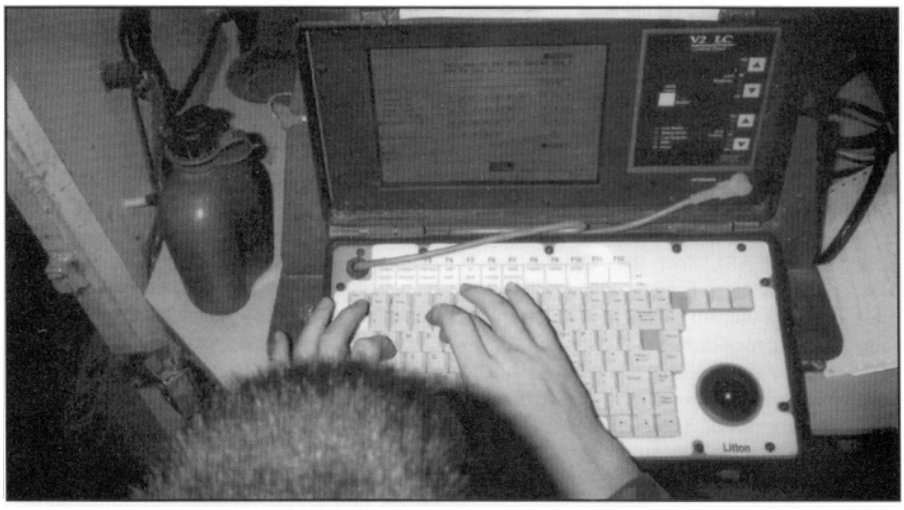
Because distributive processing allows our FSEs and FSCCs to more positively clear fires, we'll expect them to do tactical fire control through a center file; a center file is a function that allows FSEs to control weapon systems through a higher headquarters. Tactical fire control, for example, is selecting an attack system to engage the target. The earlier we can do this, the faster we'll be able to service the target.

It is paramount that commanders provide IFSAS sustainment training at all levels for their FSEs and FSCCs at every possible opportunity. Additionally, our Military Occupational Specialty (MOS) Tactical Fire Direction Specialists 13Cs need to assist the MOS Fire Support Specialists 13Fs in training. Our 13Fs need to understand the operational concepts of



Courtesy Litton Data Systems

3d Battalion, 17th Field Artillery sends a message using IFSAS plain text message (PTM) format during a 214th Field Artillery Brigade training exercise.



Courtesy Litton Data Systems

A Redleg in the 142d FA Brigade, Arkansas National Guard, trains on IFSAS during a brigade command post exercise (CPX) at Fort Chaffee.

IFSAS because, in the near future, the advanced Field Artillery tactical data system (AFATDS) will provide them even more sophisticated tools. But until we get to AFATDS, IFSAS and LTACFIRE will continue to be the automation systems we'll go to war with.

We're teaching IFSAS and LTACFIRE in many of our institutional courses: 13C Advanced Individual Training (AIT), Basic NCO Course (BNCOC) and Advanced NCO Course (ANCOC); 13F BNCOC and ANCOC; MOS Firefinder Radar Operator 13R ANCOC; Warrant Officer Basic, Advanced and Transition Courses; and the Field Artillery Officer Advanced Course (FAOAC). We also teach a two-week RC Cadre Course and the Fire Control Element Course. The latter is a course required for all MOS Fire Direction Specialists 13Es who have been selected for ANCOC to transition to MOS 13C.

We're still teaching the LTACFIRE Operators Course and will continue to provide mobile training team (MTT) support for LTACFIRE units. The Marine Corps Fire Support System (MCFSS) Training Section provides IFSAS instruction to Marine FAOBC lieutenants, Marine FAOAC graduates and for the Marine Artillery Operations Chiefs Course (MCAOCC).

If units have problems, questions or comments, call the Fire Support Automation Branch, Fire Support and Combined Arms Operations Department (FSCAOD), at DSN 639-3811/6385 or commercial (405) 442-3811/6385. Units may write the branch: Commandant, US Army Field Artillery School, ATTN: ATSF-TS (CPT Sossaman), Fire Support and Combined Arms Operations Department, Fort Sill, Oklahoma 73503-5600.

CPT Scott H. Sossaman, FA
Senior Instructor, IFSAS/LTACFIRE

Capt Douglas E. McCann, USMCR
Formerly, OIC, MCFSS Trng Sec.
Fire Support Automation Branch,
FSCAOD, FA School, Fort Sill, OK

Capt Brian T. Alexander, USMC,
USMC IFSAS/LTACFIRE/BCS NET
Marine Corps Systems Command
Fort Sill, OK

IFSAS Sustainment Training for the National Guard

The diversity and complexity of today's automated command, control and communications (C^3) systems create a tremendous challenge for Field Artillery commanders. They need a means to achieve, maintain and continuously evaluate the level of training, monitor unit progress and analyze courses of action for optimized training.

While the replacement of the tactical fire direction system (TACFIRE) by the initial fire support automation system (IFSAS) has eased the sustainment burden for the Active Component (AC), it has created new problems for the Army National Guard. The National Guard has the difficult task of training and maintaining skills without increasing its training hours.

The National Guard has limited hours it can operate each year. Each weekend allocated for training must be optimized to complete or perform the additional training without additional time. IFSAS is a complex system—without sustainment training, valuable skills will be lost and unit effectiveness will slowly decay.

The National Guard envisioned these training requirements when it purchased IFSAS. It bought the simulator/stimulator monitor analyzer recorder tester/trainer (SMART) system that interfaces directly with IFSAS software and hardware. SMART, which is also part of the lightweight TACFIRE (LTACFIRE) system, is a user friendly, menu-driven tool designed to train soldiers on IFSAS skills. The unit training officer or other designated person can easily modify SMART as training missions and priorities change.

IFSAS was designated to support both centralized and decentralized modes of fire mission processing. The commander must decide which mode is the best to accomplish his mission. SMART can be set up very quickly, allowing the commander and his staff to determine which modes of operation are best suited for both the mission and personnel assigned. As SMART generates its actions, a commander can evaluate each node (operational facility, or OPFAC), focus on shortcomings and deficiencies, and determine how to best deploy unit assets.

SMART Operations and Functions

SMART can be embedded on the IFSAS hard disk to support stand-alone training. This allows any soldier to sit in front of a single LCU and react to scenario-driven events with no other external equipment necessary.

SMART may be driven by another LCU, LTACFIRE briefcase terminal (BCT) or an IBM-compatible computer using either a DOS- or UNIX-based operating system. This provides a wide range of capabilities for all users and all training environments.

IFSAS new equipment training team (NETT) members write a scenario for SMART on the LCU.

The SMART system has seven different functions to assist all levels of training. The functions are equipment simulator, scenario simulator, monitor, analyzer, recorder, tester and trainer.

Equipment Simulator. A simulation approximates reality while minimizing cost and (or) danger. A soldier training on IFSAS can simulate all nodes he would normally communicate with through SMART's ability to simulate. SMART can simulate the advanced fire control system (AFCS); airborne target handover system (ATHS); battery computer system (BCS); Q-36 and Q-37 Firefinder radars; fire support team digital message device (FISTDMD); forward observer command and control system (FOCC); meteorological, survey and radar (MSR); IFSAS; joint surveillance target attack radar system (JSTARS); LTACFIRE; and the forward entry device (FED) with the FOCC and MSR software loads.

This function was designed to train soldiers on IFSAS as the system generates pre-set messages from simulated subscribers for realistic training. Commanders are able to evaluate different operators in the same situation to determine their soldiers' proficiency. Fire direction officers (FDOs) can be evaluated on how they handle different types of missions. Fire support officers (FSOs) can be evaluated on how fire mission flow is controlled between mortars and artillery assets. Special fire missions can be practiced until the desired solution or standard is achieved.

Scenario Simulator. SMART scenarios can be established to cause an action or reaction. The operator can further his training and be evaluated on his overall system knowledge by receiving supporting messages. With intentional errors in data (outside the area of operations, intelligence, new ammunition, ration requests etc.), the receiving node can correctly handle and disseminate the information as necessary. IFSAS can automatically transmit specific messages.

Evaluations of changing the system setup can be standardized. Examples include the following questions. Was the operator able to set up the system so the intelligence information was sent to the targeting element? (Go/No Go). Was the operator able to correct the received message so the data can be processed? (Go/No Go).

Monitor. This function receives and displays data received on all nets and stores each received message with a date-time group stamp (using the recorder function). The commander can use this function to determine the level of training being achieved at any given time. It contains a record of all messages transmitted and received on each net. A busy net may indicate a higher level of training than a quiet net. Either indication generates data for a commander to evaluate.

Analyzer. The analyzer function keeps track of all messages sent on each net—if the message was received, how many transmissions were necessary to send the message and the number of retries. This data then can be processed by the SMART program to statistically determine the number of messages per subscriber, problems indicated on the nets and the number of messages per subscriber further filtered by a specific time frame. Bad or failing radios can be isolated during this analysis.

This function also generates a fire mission summary, indicating origination and all intermediate actions to the BCS (shot/splash/rounds complete, etc.). The fire mission summary gives a clear picture of the complete fire mission flow. All aspects of tactical and technical fire control are evaluated.

Recorder. This function captures all information received or transmitted on all nets and places it on the hard disk for print-out at a later time. The hard disk can easily absorb 24 hours of extensive training time using four nets. Shorter scenarios can be saved on the 3.5 inch floppy disk.

Tester. SMART is also an automated tester that ensures procedures are run exactly the same way each time. This eliminates the human error of accidental keystrokes.

This function can be applied to a training environment when a commander must decide which type of mission flow works best. All possible missions can be attempted using the same data until the desired standard is met.

Training. The training function allows the commander to accomplish lane training, mission-essential task list (METL) training, remedial training or extra training by building, trading or sharing a scenario for a specific means. An example: if a fire unit is having difficulties with a smoke mission, a scenario may be generated and run until the soldier receives a "Go." Training printouts can be retained for comparison to track how a unit is progressing.

SMART also can generate a scenario for rescheduled training (RST). RST is primarily for soldiers who have excused absences from a monthly drill and make up time at a later date.

Conclusion

National Guard units using SMART gain three major training advantages. First, their IFSAS training is military occupational skill (MOS)-related, realistic, productive and time-sensitive. Second, section chiefs can evaluate their soldiers training simply by reviewing the printout at a later time. Finally, SMART sustainment training for IFSAS is measurable.

While this article has focused primarily on the National Guard's use of SMART for IFSAS, the program is applicable to AC units as well. Some examples of how any unit can use SMART are listed in the figure.

- Conduct collective, individualized and competitive training simultaneously.
- Train a unit for a rotation at the National Training Center (NTC), Fort Irwin, California.
- Input and execute deployment plans to determine if units can achieve the required results.
- Train for scenarios/situations in contingencies worldwide while at home station.
- Practice firing artillery across converging grid zone boundaries—a difficult task easily practiced with SMART.
- Use SMART in the classroom to eliminate training detractors.
- Use SMART outputs to conduct after-action reports (AARs).

A list of ways a unit can use SMART software for IFSAS sustainment training.

For additional information, contact the IFSAS New Equipment Training Team (NETT) at CECOM, Fort Sill, Oklahoma: DSN 639-4782/4892 or commercial (405) 442-4782/4461. The FAX number is 5612, which works with both the DSN and commercial prefixes.

Litton Data System Training Team
CECOM NETT, Fort Sill, OK

Information Note #1: Graphical Firing Tables Update

It's time to publish an update to the Gunnery Department's Information Note #1. The charts in this article give Field Artillery cannon units the most current graphical firing tables (GFTs) and tabular firing tables (TFTs). (Determining data for the M109A5/M109A6 is explained in the article "Computing Firing Data for the M109A6" on Page 40 of the April 1993 edition of *Field Artillery*.)

Armament Research, Development and Engineering Center (ARDEC) at Aberdeen Proving Ground, Maryland, along with the Gunnery Department of the Field Artillery School at Fort Sill, Oklahoma, has developed a new computer program that will generate GFTs. This is a big improvement over the old way of having a draftsman draw the GFT template. The computer-generated and draftsman-generated GFTs look exactly the same.

To get new or replacement TFTs, order them through the Adjutant General publication channels using DA Form 4569. To order GFTs, requisition them through your supply section as expendable items and cite CTA 50-970 as the requisitioning authority.

Firing tables marked with an * or with PAD or (PROV) following the listing can't be obtained through normal channels. To order them, send a letter justifying your needs to:

Commander
US Army ARDEC
ATTN: SMCAR-FST-T
Aberdeen Proving Ground, Maryland
21005-5001

If you have questions about ordering *, PAD or (PROV) tables, call ARDEC at DSN 298-3661/3880 or commercial (410) 278-3661/3880.

If you have questions about the tables, call Elton Hinson of the Concepts and Procedures Branch in the Gunnery Department (GD) at DSN 639-5523 or commercial (405) 442-5523.

Elton E. Hinson, FA Specialist
Concepts and Procedures Branch, GD
FA School, Fort Sill, OK

Current Cannon Tabular Firing Tables

Firing Table	Projectile	Remarks
105-mm M101A1		
FT 105-H-7 w/C1, 3, 4, 5, 6 & 7	Ctg, HE, M1	HE
FT 105-ADD-B-2 w/C-1	Ctg, HE, M444	ICM
*FT 105-AV-1 w/C-1	Ctg, HE, M548	RAP
*FT 105-H-6 (PROV SUPP 1)	Ctg, CS, M629	CS
105-mm M102/M119		
*FT 105-AS-3 w/C-1	Ctg, HE, M1/M760	HE
FT 105-ADD-F-1 w/C-1	Ctg, HE, M444	ICM
*FT 105-AU-1 w/C-1, 2	Ctg, HE, M548	RAP
*FT 105-AS-2 (PROV SUPP 1)	Ctg, CS, M629	CS
*FT 105-AW-0	Ctg, HERA, M913	RAP
155-mm M109/M114A2		
FT 155-AH-3 w/C-2, 3, 4, 6, 7	HE, M107	HE
FT 155-ADD-E-2 w/C-1		ICM
		ICM
		ICM
FT 155-AL-1	HE, M549/M549A1	RAP
FT 155-AK-2 w/C-1		DPICM
FT 155-ADD-G-2	HE, M483A1	DPICM
FT 155-ADD-M-1		FASCAM/ADAM
FT 155-ADD-P-1	HE, M718A1/M741A1	FASCAM/RAAM
*FT 155-ADD-S-0 (to AK-2)		SMOKE
155-mm M109A2/A3 & M198		
FT 155-AM-2 w/C-1, *2	HE, M107	
*FT 155-ADD-T-0 (to AM-2) w/C-1		SMOKE
*FT 155-AR-0 (PROV)	HE, M795	HE (LONG)
*FT 155-ADD-O-0 (to AR-O)		DPICM
*FT 155-ADD-1-2	HE, M449A1 (M449E2)	ICM
	HE, M449 (T379)	ICM
	HE, M449E1	ICM
FT 155-AN-1 w/C-1, 4, 6		DPICM
*FT 155-AN-2	HE, M483A1	DPICM
FT 155-ADD-J-1 *w/C-3		DPICM
FT 155-ADD-L-1 w/C-1, 2	HE, M692/M731	FASCAM/ADAM
FT 155-ADD-N-1 w/C-1		FASCAM/RAAM
*FT 155-AO-0 w/C-1, 2	HE, M549A1/M549	RAP
*FT 155-ADD-K-1 w/*C-1		BINARY, GB2
FT 155-AS-1	HE, M712	CPHD
FT 155-ADD-R-1		DPICM
*FT 155-ADD-Q-0 (REV) w/C-1, 2	SMK, M825/M825A1	SMOKE
*FT 155-AU-PAD w/C-1		DPICM, BASE BURN
*FT 155-ADD-U-PAD	HE, M864	DPICM, BASE BURN
203-mm M110A2		
FT 8-Q-1 w/C-1, 3, 4, 6, 7	HE, M106	HE
FT 8-ADD-F-1 w/C-1		ICM
FT 8-T-1 w/C-1	HE, M509A1	DPICM
FT 8-ADD-G-1		
FT 8-ADD-L-1 (8-Q-1)	HE, M509A1	
FT 8-S-1 w/C-1		RAP
14.5-mm Trainer		
FT 14.5-A-1	Ctgs, M181, M182, M183	

Current Graphical Firing Tables

Based on TFT	Description	NSN	No. Rules	Charges
		105-mm M101A1		
105-H-7	GFT HEM1 (LA) w/ICM	1220-01-038-0761	3	1-3, 4-5, 6-7
105-H-7	GFT HEM1 (HA)	1220-00-151-4155	1	ALL
105-H-7	GFT ILL M314	1220-01-021-7275	2	3-4, 5-7
105-H-6	GST HEM1	1220-00-815-6190	1	ALL
105-H-7	BAL SCALE HEM1 (LA)	1220-01-037-7284	1	1-3, 4-5, 6-7
		105-mm M102/M119		
105-AS-3	GFT HEM1 (LA) w/ICM	1220-01-315-7912	4	1 thru 7
105-AS-3	GFT HEM1 (HA)	1220-01-315-7913	1	1 thru 7
105-AS-3	GFT ILL M314	1220-01-315-7917	4	1 thru 7
105-AS-3	GST HEM1	1220-01-315-7915	1	1 thru 7
105-AS-2	BAL SCALE HEM1 (LA)	1220-01-037-7285	1	1-3, 4-5, 6-7
105-AS-3	GFT HEM760 (HA & LA)	1220-01-315-7914	1	8 ONLY
105-AS-3	GST HEM760	1220-01-315-7916	1	8 ONLY
		155-mm M109/M114A2		
155-AH-3	GFT HEM107 (LA) w/ICM	1220-01-038-2413	3	1-3, 4-5, 6-7
155-AH-3	GFT HEM107 (HA)	1220-00-551-3042	1	ALL
155-AH-3	GFT ILL M485	1220-01-038-7199	2	1-3, 5-7
155-AH-3	GST HEM107	1220-00-551-3041	1	ALL
155-AH-3	BAL SCALE HEM107 (LA)	1220-01-037-7287	1	1-3, 4-5, 6-7
155-AK-2	GFT HEM483A1 (LA)	1220-01-038-7204	3	1-3, 4-5, 6-7
155-AK-2	GFT HEM483A1 (HA)	1220-01-038-7203	1	ALL
155-AK-2	GST HEM483A1	1220-01-038-7202	1	ALL
155-AL-1	GFT HEM549A1 (LA)	1220-01-065-9844	1	7R (RKT ON)
155-AL-1	GFT HEM549A1 (HA)	1220-01-065-9843	1	7R (RKT ON)
155-AL-1	GST HEM549A1	1220-01-065-9842	1	7R (RKT ON)
		155-mm M109A2/A3/A4 & M198		
155-AM-2	GFT HEM107 (LA) w/ICM	1220-01-215-3929	4	2-4, 3, 5-6, 7-8
155-AM-2	GFT HEM107 (HA)	1220-01-215-3961	1	ALL
155-AM-2	GFT ILL M485	1220-01-215-3962	2	2-3, 5-7
155-AM-2	GST HEM107	1220-01-215-3930	1	ALL
155-AM-2	GFT HEM107/M825	1220-01-224-2513	3	3-4, 5-6, 7-8
155-AM-1	BAL SCALE HEM107	1220-01-037-7288	1	3-4, 5-6, 7-8
155-AN-1	GFT HEM483A1 (LA)	1220-01-039-7272	3	3-4, 5-6, 7-8
155-AN-1	GFT HEM483A1 (HA)	1220-01-038-7201	1	ALL
155-AN-1	GST HEM483A1	1220-01-038-7200	1	ALL
155-AN-1	GFT HEM483A1/M825	1220-01-224-2513	3	3-4, 5-6, 7-8
155-ADD-Q-0	GFT HEM483A1/M825	1220-01-224-2514	1	8R
155-ADD-Q-0	GST HEM483A1/M825	1220-01-224-2515	1	8R
155-AO-0	GFT HEM549A1 (LA)	1220-01-065-9845	2	7R, 8R
155-AO-0	GFT HEM549A1 (HA)	1220-01-065-9847	1	(M119A1), 8R
155-AO-0	GST HEM549A1	1220-01-065-9848	1	(M203)
155-AU-PAD	GFT HEM864 (LA)	1220-01-333-4120	1	7R, 8R
155-AU-PAD	GFT HEM864 (LA)	1220-01-333-4121	1	(M119A1), 8R
155-AU-PAD	GST HEM864 (LA)	1220-01-333-4122	1	(M203)
155-AS-0	GFT M712 (LA)	1220-01-102-7851	3	7R, 8R
155-AS-0	GFT M712 (LA)	1220-01-102-7850	1	(M119A1)
155-AS-0	GST M712	1220-01-102-7849	1	7W, 7R
155-AS-0	GFT M712 (HA) CLGP M712 CPHD	1220-01-116-3268	1	8 (M203)
155-AS-1	FOOTPRINT TEMPLATE	1220-01-224-2588		

Current Graphical Firing Tables (Continued)

Based on TFT	Description	NSN	No. Rules	Charges
		M203-mm M110A2		
8-Q-1	GFT HEM106 (LA) w/ICM	1220-01-038-2410	5	1-2, 3-4, 5-6, 7-8, 9
8-Q-1	GFT HEM106 (HA)	1220-01-021-7273	1	ALL
8-Q-1	GST HEM106	1220-01-021-7274	1	ALL
8-Q-1	BAL SCALE HEM106	1220-01-102-4202	1	1-3, 4-5, 6-7
8-T-1	GFT HEM509 DPICM (LA)	1220-01-067-7169	5	1-2, 3-4, 5G-5W, 6-7, 8-9
8-T-1	GFT HEM509 DPICM (HA)	1220-01-067-7170	1	ALL
8-T-1	GST	1220-01-067-7171	1	All
8-S-1	GFT HEM650 (LA) w/M753	1220-01-070-8970	7	1-2, 3-4, 5G-5W, 6-7, 8-9, 7R, 8R, 9R
8-S-1	GFT HEM650 (HA)	1220-01-067-7172	2	ALL
8-S-1	GST HEM650	1220-01-067-7173	1	ALL w/1 extra slide
		14.5-mm Trainer		
14.5-A-1	GFT	1220-00-442-2446	1	
14.5-A-1	GST	1220-00-221-6328	1	
14.5-A-1	BALLISTIC SCALE	1220-01-038-1226	1	

BCU and LCU Solutions to the M825 Smoke Problem

Cannon 155-mm units are having problems with the M825 smoke rounds impacting on the ground instead of creating an air burst. This is especially true at the National Training Center (NTC), Fort Irwin, California, where units can fire smoke rounds at ranges greater than 10,000 meters.

The problem is not with the battery computer system (BCS). The problem is with the BCS' Version 10 software. Version 10 incorporated AN-2 fire control input (FCI) data, eliminating the need for the improved conventional munitions (ICM) work-around. Unfortunately, Version 10 software causes the M825 to have a low height-of-burst (HOB) or impact on the ground.

We're re-evaluating the FCI and project we'll have the solution this spring, giving us the correct firing data for a revision of the BCS software. Until then, units must use a BCS/lightweight computer system (LCU) work-around or compute the firing data manually, as outlined in this article.

Before computing firing data, fire direction personnel still have to determine the appropriate Pasquil weather category, R1/R2 values and aim point selection as outlined in the revised version of *FM 6-40 Tactics, Techniques and Procedures for Manual Cannon Gunnery*.

BCS/LCU Solution

To correct the firing data, you—

(1) Estimate/determine the range to the target.

(2) At ranges less than 10,000 meters, add 50 meters to the target altitude.

(3) At ranges greater than 10,000 meters, add 100 meters to the target altitude.

(4) Determine the firing data for the shell M825.

Manual Solution

The manual solution requires the use of two tabular firing tables (TFTs). Firing Table (FT) 155-AN-2 to determine quadrant elevation (QE) and fuze setting (FS) for M483A1 and FT 155 ADD-Q-0(REV) with Change 2 to determine M825 firing data and to correct the HOB.

The following is an example of the computation. Given that the charge is 5 Green Bag, shell is smoke M825 and range is 6100 meters, site +12, you—

1. Use FT 155-AN-2 to determine M483A1 data: elevation from Table F, Column 2, 333.4 expressed 333, site +12 = QE 345 mils. The FS is 21.5. Use this M483A1 data to determine the M825 data.

2. Use FT 155 ADD-Q-0 Table A, Columns 1, 2 and 3 to determine M825 QE.

- In Column 1, "QE for Projectile M483A1," enter QE (345).
- Column 2 gives a correction to the QE for M825 (+3).
- Use Column 3 to determine a correction to the QE for a 50 meter increase in height (9.1).
- M825 QE = 357 (345 + 3 + 9).

3. Use Table A, Column 8, to determine the correction for the M825 deflection (R 0.2). This would not be applied in this situation because it takes a minimum of 0.6 to change the deflection by 1 mil. Column 8 becomes important at extended ranges and must be considered.

4. Use Table B, Columns 1, 2 and 3 to determine the M825 FS.

- In Column 1, enter with the M483A1 FS (21.5), which falls between 19.8-30.8.
- In Column 2, determine the correction for the M825 FS (-0.8).
- In Column 3, determine the correction for an increase of 50 meters in height (+0.1).
- M825 FS = 20.8 (21.5 - 0.8 + .1).

Note: If the range were greater than 10,000 meters, then Table A, Column 3, would be doubled and added to the QE, and Table B, Column 3, would be doubled and applied to the FS.

If units have questions about these workarounds for the M825 smoke round, call the Concepts and Procedures Branch, Operations Division of the Gunnery Department at DSN 639-5523 or commercial (405)-442-5523 or write the branch at Commandant, US Army Field Artillery School, ATTN: ATSF-GO, Gunnery Department, Fort Sill, Oklahoma 73503-5600.

Elton E. Hinson, FA Specialist
Gunnery Department, FA School
Fort Sill, OK