Field Artillery

A Professional Bulletin for Redlegs

October 1991

REDLEGS IN THE GULF

Special Desert Storm Edition

A Professional Bulletin for Redlegs

October 1991 HQDA PB6-91-5

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

SUBSCRIPTIONS: May be obtained through the US Field Artillery Association, P.O. Box 33027, Fort Sill, OK 73503-0027. Telephone numbers are AUTOVON 639-5121/6806 or commercial (405) 355-4766/8745. Dues are $16.00 per year ($31.00 for two years and $46.00 for three years) to US and APO addresses. All others add $11.00 per subscription year for postage.

SUBMISSIONS: Mail to Editor, ***Field Artillery***, P.O. Box 33311, Fort Sill, OK 73503-0311. Telephone numbers are AUTOVON 639-5121/6806 or commercial (405) 351-5121/6806. Material submitted for publication is subject to edit by the ***Field Artillery*** staff; footnotes and bibliographies may be deleted due to space limitations.

POSTMASTERS: Second-class official mail postage is paid by the Department of the Army at Lawton, OK 73501. Send address changes to ***Field Artillery***, P.O. Box 33311, Fort Sill, OK 73503-0311.

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AUTOVON 639-4020
Commercial (405) 351-4020

ARTEP/MTP Hotline:
AUTOVON 639-5004
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ON THE MOVE

MAJOR GENERAL FRED F. MARTY

FA On Target in the Storm

> ***"Not since World War II has fire support in general and FA in particular proved such a major force for the combined-arms team."***

Operation Desert Storm feedback and observations continue to filter into the Field Artillery (FA) School here at Fort Sill. But one fact already is abundantly clear: fire support played a *dominant role* in Desert Storm.

During a six month period, Total Army FA forces deployed to Southwest Asia to support American and coalition maneuver forces—the largest contingent of US artillery since World War II. Our artillery force consisted of 43 cannon, rocket and missile battalions organized into seven division artilleries and seven FA brigades. Two corps artillery headquarters provided overall command and control. The units came from both heavy and light forces, from the continental US and Germany and from the Active and Reserve Components. Our National Guard FA brigades were the only large Reserve Component combat units to see action in the Kuwaiti Theater of Operations. The result was timely and devastating massed fires both before and after the ground war started.

Doctrine. Desert Storm confirmed our war-fighting thrust is on target: our fire support principles are sound and, most importantly, our doctrine, tested under fire, is effective.

Maneuver commanders and fire support coordinators (FSCOORDs) executed fire support doctrine and the decide-dètect-deliver methodology brilliantly during Desert Storm. The commanders expressed their intent for fires clearly, making the *decide* phase effective and efficient. Then, understanding the commanders' intent, FSCOORDs identified high-payoff targets, prioritized targets for engagement in the overall fire support effort and assured connectivity between sensors and shooters. These actions by senior leaders allowed fire support systems to engage enemy forces responsively and accurately.

In the *detect* phase, Redlegs integrated a multitude of organic and supporting platforms, complemented by national-and theater-level target acquisition assets. These assets included satellite imagery at the national level; US Air Force aircraft, such as the joint surveillance and target attack radar system (JSTARS), at the theater level; and Firefinder radars, unmanned aerial vehicles (UAVs) and other organic systems at the division and corps levels. All were networked into fire support operations with our targeteers insightfully analyzing the information produced.

In the final phase, we *delivered* massed fires. Massed artillery fires provided the maneuver commander combat power at the time and place he needed it. This gave him overwhelming fire superiority and allowed him to maneuver to exploit the effects of fire.

Executing our counterfire doctrine in combat was another "first" for the FA. The Firefinders rapidly identified targets for counterfire and sent the data digitally or by voice to the shooters. Our cannon and multiple launch rocket system (MLRS) assets silenced the Iraqi artillery by delivering very "convincing" fires. In fact, Iraqi prisoners called MLRS dual-purpose improved conventional munition (DPICM) bomblets "Steel Rain"—the most terrifying threat they faced.

Training. Desert Storm proved our soldiers are the best trained in the world. Our young soldiers displayed confidence in themselves, their leaders and their equipment.

Soldier confidence can be attributed to our rigorous, realistic training at the Combat Training Centers(CTCs). Each CTC provides soldiers and leaders the forum to hone their skills and integrate them into a truly combined-arms effort.

Modernization. The MLRS and Army tactical missile system (Army TACMS) both had their "baptism by fire" in Desert Storm. The launching of the first Army TACMS on January 18th ushered in the Arm's new age of rocket and missile artillery. The devastating concentration of firepower of MLRS and Army TACMS made them invaluable combat multipliers for the maneuver forces. While MLRS struck the enemy's artillery and command and control and logistical sites with massive volumes of DPICM sub-munitions, the Army TACMS destroyed deep targets well beyond the rang of ground weapon systems. Commanders are *unanimous* in their praise for our rocket and missile firepower.

The surgical, point-kill capability of the Copperhead projectile also was combat tested for the first time. Despite the degrading effects of the desert on our laser designators, this point killer achieved its aim in the vast preponderance of more than 90 engagements.

Leader Development. In Desert Storm, the Army's leader development process proved to be very effective from both the institutional and field perspectives. Our leaders displayed initiative, decisiveness, innovativeness and technical and tactical competence in employing their weapon systems and organizations.

Leaders at all levels showed remarkable flexibility. Senior leaders provided sound guidance to help maneuver commanders synchronize the battlefield. Junior officers and NCOs displayed fundamental leader skills and war-fighting knowledge far beyond their years of experience.

Conclusion. Fire support was a decisive partner with maneuver in Southwest Asia. Not since World War II has fire support in general and the FA in particular proved such a major force for the combined-arms team.

Field Artillery—*On Time, On Target!*

Field Artillery Desert Facts

"How do you defeat a battle-toughened, well-equipped Iraqi force on his own turf in 90 hours? The answer is simple: better fires—with maneuver exploiting the effects of fires and fires exploiting the effects of an enemy reacting to maneuver."

Brigadier General Creighton W. Abrams
Commanding General, VII Corps Artillery

What We Sent

A Total Of:

108 M102 (105-mm, Towed) Howitzers
642 155-mm Howitzers
96 M110 (203-mm) Howitzers
189 M270 Multiple Launch Rocket System (MLRS) Launchers*

Organized Into:

7 Division Artilleries
2 Corps Artilleries
7 Field Artillery Brigades

*Includes 18 Army Tactical Missile System (Army TACMS)-capable launchers.

Outgunned, Outranged

Despite a significant Iraqi range advantage and superiority in number of tubes, our fire support "system of systems" overwhelmed the threat. The integration of target acquisition; command, control and communications; and cannon, rocket and missile systems took away his "eyes," fixed him in position and silenced all Iraqi artillery that dared to fire.

Massed artillery fires provided the maneuver commander responsive, overwhelming firepower superiority. Rapidly moving artillery formations maneuvered fires where and when ground units needed them most—a key factor in the success of their decisive, offensive maneuver operations. Field Artillery bridged the gap (both in time and space) between air support and the closing of the maneuver force with the enemy. When fires were needed, we were there.

Success Stories

In its first use in combat, MLRS became the "weapon of choice" to silence the enemy's artillery. With each rocket carrying 644 submunitions and more than 17,000 rockets fired by US forces, massed volleys created the "Steel Rain" of more than 11 million submunitions that demoralized the enemy and rendered him and his equipment ineffective. The Army TACMS variant, by nature of its extreme range, superior accuracy and phenomenal kill radius, reached out and destroyed all targets it engaged.

The execution of our counterfire doctrine was another "first" in a hostile environment. Fast, accurate and responsive, our Firefinder target-locating radars, linked by voice or digitally to MLRS and cannon units, delivered rapid and devastating results. Once engaged with counterfire, no enemy artillery fired again.

The exploitation of any and all available sensors allowed fire support coordinators (FSCOORDs) to find and kill enemy formations before they could influence the close battle. This "proactive" counterfire destroyed the enemy's will to fight, allowed maneuver forces to maintain the rapid pace of their attack and saved friendly lives. During the 1st Infantry Division's breaching operation along the Iraqi border, more than 6,000 cannon rounds and 414 rockets were fired by three Field Artillery brigades and two division artilleries. The result: no enemy counterfire, no resistance and no casualties during the breach.

The surgical, pinpoint kill capability of the Copperhead projectile also received its "test by fire." More than 90 rounds were fired with a better than expected kill ratio, considering the degrading desert effects on our laser designators.

One anecdote describes an Iraqi position attacked by massed dual-purpose improved conventional munition (DPICM) fire. The defenders scurried to a nearby bunker only to have a Copperhead round fly into the laser-designated door of the bunker. Realizing the futility of flight, the rest of the enemy unit surrendered.

Command, control and communications systems were stretched to the limit by extended distances and the phenomenal pace of maneuver. The flexibility of our command and control (C^2) systems and the initiative of leaders and soldiers proved exceptional in overcoming any inadequacy.

Massed artillery fires were the norm during Desert Storm. The coordinated

fires of upwards of 11 battalions on enemy positions proved time after time to be absolutely devastating. The great advances in the accuracy of our cannon and missile systems ensured rounds on target. These factors, coupled with the simultaneous engagement of positions in the enemy's rear, on his flanks, to his front and on top of him, not only destroyed his equipment, but also broke his will to fight. There was nowhere to hide—day or night, rain or wind.

As related by a captured Iraqi artillery commander, before the Ground War he had lost only 10 percent of his cannon tubes, but in the initial phase of the ground assault, he lost all of his remaining guns to massed indirect fires.

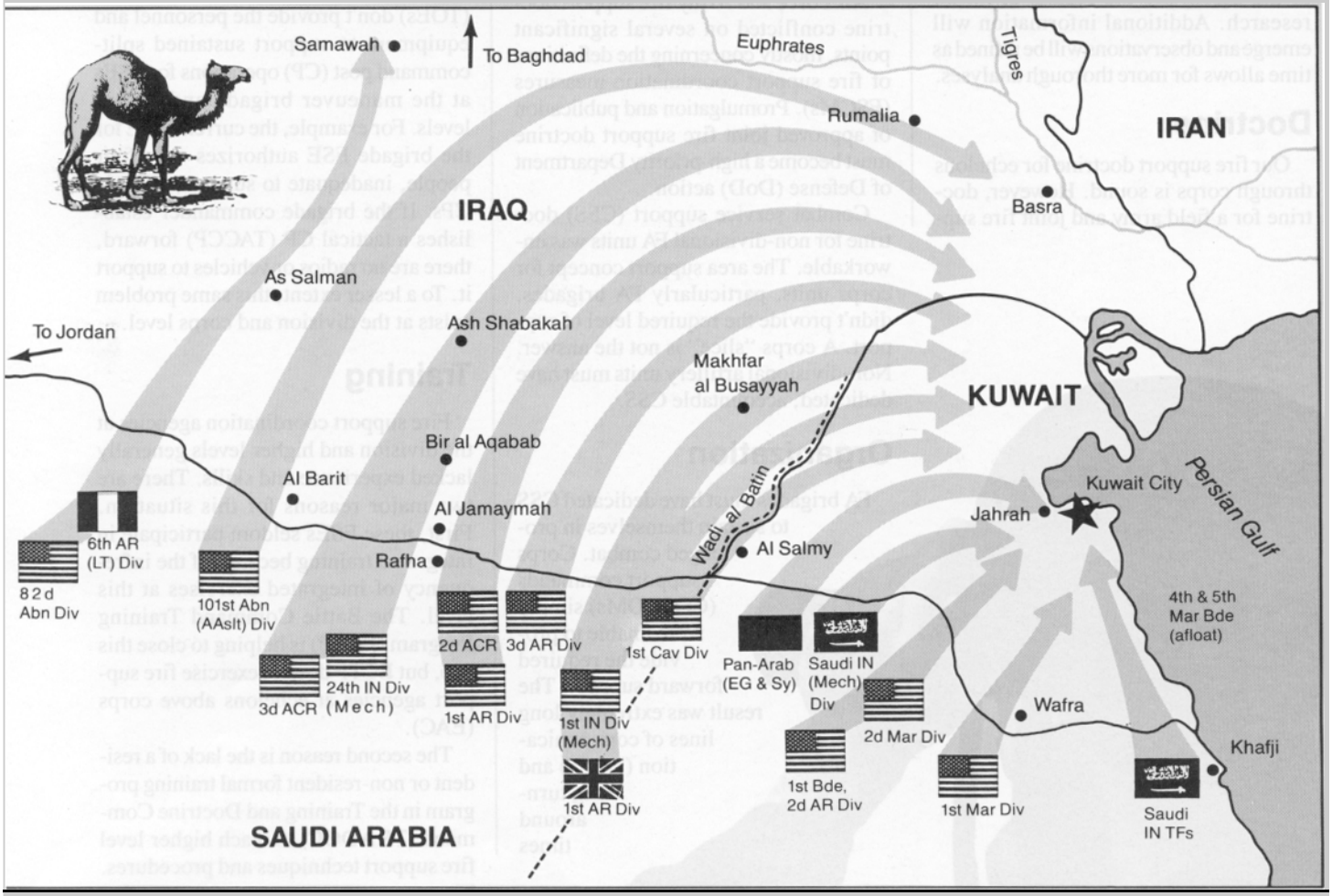
A Final Comment

The equipment, doctrine, training and leadership of the artillery force proved a decisive partner to maneuver in battle. The initiative and adaptability of our soldiers and their leaders is the real success story. The comments of the Commanding General of the 24th Infantry Division praising the Division Artillery are representative of praise for all the US Artillery in Desert Storm and provide the maneuver commander's perspective:

All of us appreciate the tremendous contribution of the artillery. Our enormous success was due, in large part, to the artillery. The success of your counterfire limited our casualties. You traveled more than 370 kilometers in 100 hours and went from a seven-battalion artillery force to an 11-battalion force.

I can't estimate the number of lives the artillery saved. Before the ground offensive, I had estimated we'd have 2,000 KIAs [killed in action]. We had only six in the division. Our success is a tribute to your equipment, your doctrine and, mostly, to your soldiers and their fine NCO and officer leadership. Historians will study this fight and wonder how we did it. The destruction was awesome. A very fine performance.

Major General Barry R. McCaffrey
Commanding General
24th Infantry Divison (Mechanized)



The Ground War of Operation Desert Storm started 24 February 1991 and ended with the cease fire on 28 February. During that time, seven US divisions (Divs), one French and one British division, and two US armored cavalry regiments (ACRs) were organized with supporting brigades into two corps: XVIII Airborne (Abn) and VII Corps. The corps forces, arrayed along the Saudi Arabian-Iraqi border, faked an attack up the historic avenue of approach of the Wadi al Batin and rapidly swept west and then north into Iraq in a flanking operation to envelop the Iraqi Republican Guards divisions near Basra and northwestern Kuwait. Simultaneously, the Pan-Arab forces, comprised of an Egyptian (EG) armored (AR) corps and a Syrian (Sy) mechanized (mech) infantry (IN) division; two US Marine (Mar) divisions with the US 1st (Tiger) Brigade (Bde) of the 2d Armored Division; and a Saudi National Guard mechanized infantry task force (TF) rapidly drove north across the Saudi-Kuwaiti border, completing the trap sprung for Saddam Hussein's army.

A View of the Storm: **Forward Observations**

by Colonel David A. Rolston

In July 1991, the US Army Field Artillery School (USAFAS) summarized FA observations in Operation Desert Storm. These observations were based on interviews with soldiers who fought in the Gulf War and after-action reports from combat units, which were submitted immediately after Desert Storm.

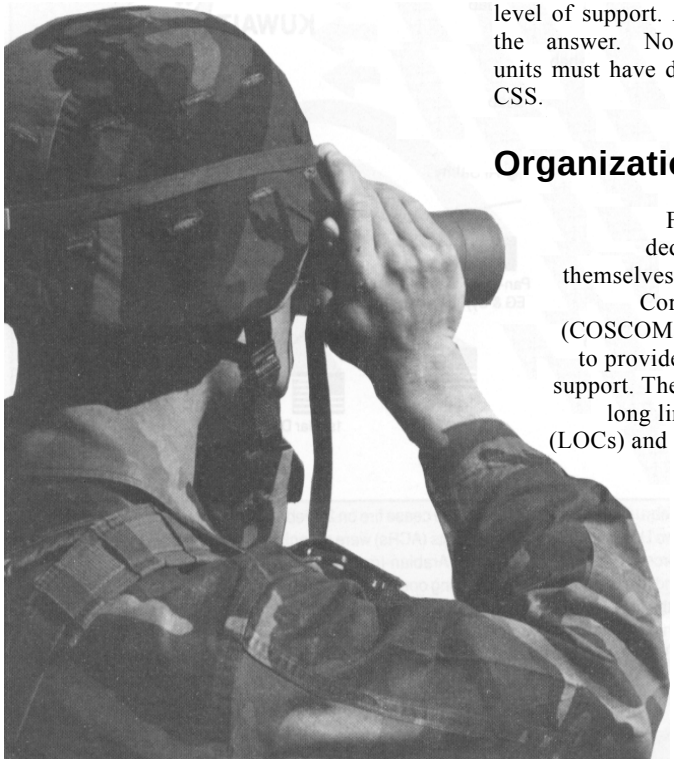
The comments early in the aftermath of the Storm are the results of initial research. Additional information will emerge and observations will be refined as time allows for more thorough analyses.

Doctrine

Our fire support doctrine for echelons through corps is sound. However, doctrine for a field army and joint fire support was virtually non-existent. Until the later stages of the operation, no fully capable fire support element (FSE) existed at the Army Central Command (ARCENT). Though required by basic fire support doctrine to establish an FSE, no tactics, techniques and procedures (TTPs) or organizational guidelines existed to help the ARCENT staff build one.

Air Force and Army fire support doctrine conflicted on several significant points, mostly concerning the definitions of fire support coordination measures (FSCMs). Promulgation and publication of approved joint fire support doctrine must become a high-priority Department of Defense (DoD) action.

Combat service support (CSS) doctrine for non-divisional FA units was unworkable. The area support concept for corps units, particularly FA brigades, didn't provide the required level of support. A corps "slice" is not the answer. Non-divisional artillery units must have dedicated, accountable CSS.



Organization

FA brigades must have dedicated CSS to sustain themselves in prolonged combat. Corps support commands (COSCOMs) simply were unable to provide the required forward support. The result was extremely long lines of communication (LOCs) and long turnaround times for logistics. Many of our units had run out of or almost run out of supplies when the cease fire was declared. FA brigades require a CSS structure similar to the forward support battalion (FSB) for a maneuver brigade. This structure must include the transportation assets necessary to support the CSS requirements of FA in AirLand Battle.

Tables of organization and equipment (TOEs) don't provide the personnel and equipment to support sustained split-command post (CP) operations for FSEs at the maneuver brigade and higher levels. For example, the current TOE for the brigade FSE authorizes only four people, inadequate to support multiple CPs. If the brigade commander establishes a tactical CP (TACCP) forward, there are no radios or vehicles to support it. To a lesser extent, this same problem exists at the division and corps level.

Training

Fire support coordination agencies at the division and higher levels generally lacked experience and skills. There are two major reasons for this situation. First, these FSEs seldom participate in integrated training because of the infrequency of integrated exercises at this level. The Battle Command Training Program (BCTP) is helping to close this gap, but BCTP doesn't exercise fire support agencies at echelons above corps (EAC).

The second reason is the lack of a resident or non-resident formal training program in the Training and Doctrine Command (TRADOC) to teach higher level fire support techniques and procedures. There are no programs of instruction (POIs) to train the targeting team, the FA intelligence officer (FAIO), the battlefield coordination element (BCE) or the FSEs at division, corps, and EAC. We must develop and implement instruction to formalize and standardize TTPs for these elements.

The good news was that Desert Storm validated the value of the Combat Training Center (CTC) concept. Our commanders at all levels credited BCTP and the CTCs with helping to develop the skills that contributed to the success they enjoyed in Southwest Asia. This was especially true in the fire support arena where the synchronization skills learned in simulated combat provided commanders a fully integrated fire support system.

Two shortfalls were observed. The existing system doesn't integrate EAC play in BCTP exercises. Additionally, FA brigades aren't exercised at the CTCs, and the brigade headquarters are not always integrated into BCTP.

Another problem identified was that the support of the intelligence system for the Army targeting effort was inadequate. Intelligence information must meet specific requirements for timeliness and accuracy to make the targeting process work. Division and corps acquisition systems were unable to routinely meet these criteria. National and Central Command (CENTCOM) assets were only occasionally prioritized to satisfy corps and lower unit targeting requirements.

Much of the intelligence effort was focused on situation development and battle damage assessment (BDA) for EAC. Further, there's minimal published doctrine or TTPs for targeting at the EAC and joint levels.

Information flow from ARCENT and CENTCOM to lower echelons was slow and seldom accommodated the immediate needs of the corps. The targeting process at these levels must be formalized and incorporated into Army and joint doctrine. The procedures for allocating intelligence resources and processing and disseminating intelligence data must be defined as a part of that process.

Procurement of an unmanned aerial vehicle (UAV) would provide a system capable of meeting the time and accuracy requirements for corps and division targeting.

Materiel

There were a number of notable FA materiel success stories. In its first use in combat, the multiple launch rocket system (MLRS) decisively demonstrated its ability to shoot, move and survive while inflicting tremendous damage on the enemy's morale and materiel. Though still in development, the Army tactical missile system (Army TACMS) provided the corps commander the means to attack critical deep targets. Despite some mobility problems, the Firefinder radar system allowed fire support to quickly locate and silence enemy artillery. Improved conventional artillery munitions proved to be even more lethal than anticipated, and precision-guided munitions (Copperhead) performed with pin-point accuracy, despite the degrading effects of the desert environment.

Though not specifically FA systems, the heavy expanded-mobility tactical truck (HEMTT) and the high-mobility multipurpose wheeled vehicle (HMMWV) contributed greatly to the logistical sustainability and C^2 of the fire support system.

On the whole, the FA weapon systems were sufficiently mobile and lethal to support the maneuver forces, despite the fact that most of the cannon systems represented 1960s or earlier technology. Materiel shortcomings were overcome by detailed planning and initiative on the part of our leaders. The events of Desert Storm highlighted some known deficiencies.

● **Several parts of the Field Artillery system weren't mobile enough.** FA CPs must be at least as mobile as the tactical CP of the maneuver force it supports. FA headquarters, burdened with 5-ton expandable vans and trailer-mounted 15-kilowatt generators and lacking track laying C2 vehicles, were sometimes unable to keep pace.

The M981 fire support vehicle (FSV) was too slow to stay up with the Bradley fighting vehicle and Abrams tank units. Further, an excessive amount of time is required to employ the ground/vehicular laser locator designator (G/VLLD), and the turret was difficult to maintain.

Fire support officers (FSOs) and fire support coordinators (FSCOORDs) at the maneuver battalion and higher levels require either dedicated space, radios and equipment in existing maneuver C^2 vehicles or dedicated combat vehicles of their own.

The M548 ammunition carrier lacks mobility and, when fully loaded, is often the slowest vehicle in the force. The speed of the M548 was sometimes the determining factor in the maneuver rate of advance.

The FSV must be upgraded or replaced, preferably with a Bradley variant. The M548 must be replaced.

● **The lack of range capability for cannon systems relative to the Iraqis' was a potential problem.** This disadvantage was negated by the Iraqis inability to target beyond their forward line of own troops (FLOT) and by the effectiveness of our counterfire operations. This can't be assumed to be the case in all future scenarios. It's likely that any enemy force encountered in the future will have range capabilities at least equal to those of the Iraqis. Extending the range of both cannon and rocket systems must be a high priority.

The lethality of our improved conventional munitions was a real success story. Current munitions proved to be even more lethal than our models predicted. The down-sizing of the force and the consequent reduction in the potential number of artillery systems available to the maneuver commander make developing and fielding "smart" and "brilliant" munitions more essential than ever.

● **We lack a reliable means of secure long-range communications for highly mobile operations.** This is particularly true of digital communications. Mobile subscriber equipment (MSE) worked well during Desert Shield training for voice command and control, but the area common-user communications system (ACCS) wasn't mobile enough to support AirLand Battle operations. Under optimum conditions, the ACCS doesn't support data traffic well. This limits the FA's ability to make maximum use of its automation capabilities when beyond FM radio range. Fielded AM radios are scarce, unreliable and unsuitable for digital traffic.

An effective data communications network, improved high frequency radios, and access to tactical satellites (TACSATs)

down to the missile battalion, division artillery, FA brigade and corps artillery CPs are urgent requirements.

● **The global positioning system (GPS) was one of the real heroes of the war.** It has been universally praised by commanders at all levels. GPS enhances C^2 by freeing the commander from the burden of land navigation. GPS locations were found to be accurate enough for all the requirements of accurate, predicted artillery fire. Also, GPS was invaluable in providing positions to artillery systems that need periodic position updates—MLRS and the position and azimuth determining system (PADS). It also enhanced CSS by allowing units to maintain extended LOCs across terrain in which navigation was difficult. The only complaint about GPS was that there weren't enough of them.

Leadership

Desert Storm validated our training and leader development efforts here at USAFAS and in the FA community as a whole. Our units and individual soldiers were well led and fully combat ready. The high state of individual training and the cohesion and high morale of our units are testimonies to the extraordinary efforts of the NCO corps. Our officers consistently demonstrated both technical and tactical competence and the ability to adapt to unanticipated situations. Commanders Army-wide have created command climates in which capable, creative junior leaders are nurtured and thrive.

Conclusion

The United States Army FA School will continue to identify and evaluate Desert Shield and Storm issues relating to doctrine, training, organization, materiel and leadership development on behalf of the FA community. We stand ready to assist in any way to keep the FA—the Greatest Killer on the Battlefield.

Colonel David A. Rolston is the Director of the Fire Support and Combined Arms Operations Department of the FA School, Fort Sill, Oklahoma. Before becoming the Director in December 1990, he commanded the 24th Infantry Division (Mechanized) Artillery, Fort Stewart, Georgia, and deployed his unit to Southwest Asia in Operation Desert Shield. He also commanded the 1st Battalion, 21st Field Artillery, 1st Cavalry Division, Fort Hood, Texas; 1st Target Acquisition Battery, 25th Field Artillery, I Corps Artillery, Korea; and the Howitzer Battery, 3d Squadron, 6th Armored Cavalry Regiment, Fort Meade, Maryland.

Redlegs of the 82d Airborne Division hustle to load their 105-mm howitzer to fire during training in Saudi Arabia.

Myths and Lessons of Iraqi Artillery

by Captain Michael D. Holthus, USAR, and Steven M. Chandler

The initial euphoria over the performance of coalition forces during Desert Storm operations has now given way to after-action analyses and follow-on recommendations. These processes will play a critical role in determining the future of the US Field Artillery (FA).

However, there appear to be a number of artillery myths spawned by the success of US and coalition artillery operations during the conflict. But improper conclusions today could have catastrophic consequences tomorrow.

This article isn't meant to detract from the outstanding success of Desert Storm and the exceptional performance of US troops during that conflict. Rather, it joins the ongoing discussions about the war and counters some of the emerging myths about the artillery of our potential adversaries.

Myths: False Beliefs

Simply stated, Desert Storm success appears to be leading some individuals to the dangerous conclusion that the artillery systems fielded by Iraq were incapable of inflicting massive damage on opposing forces. A small number of these individuals are going even further to apply this false conclusion to a broad range of potential artillery threat situations.

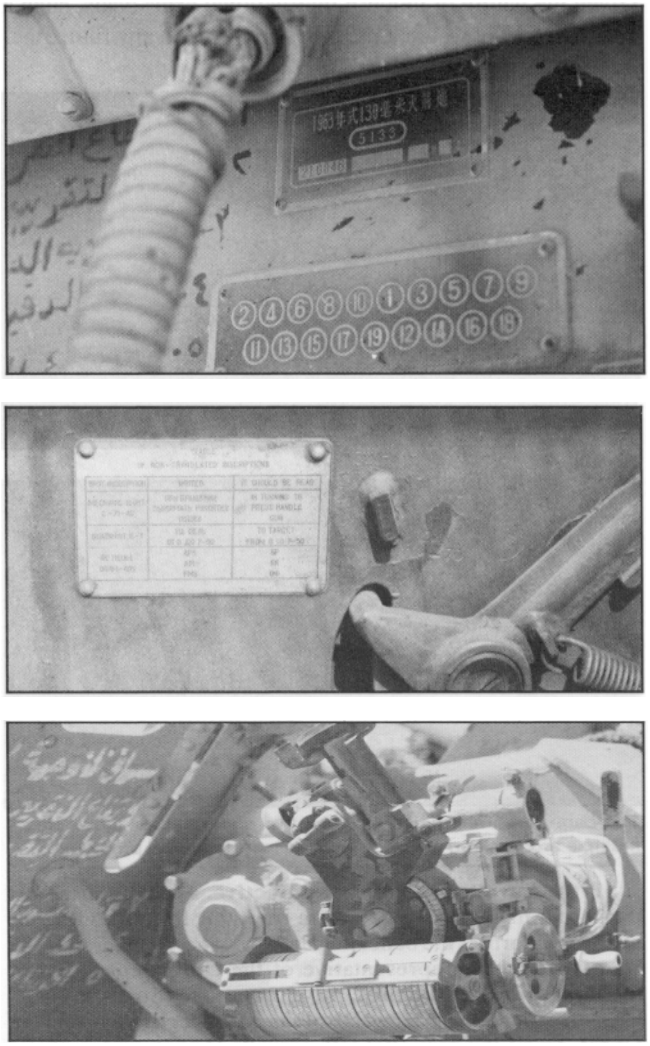
For example, the spectacular success of US indirect fire assets has already prompted some to reconsider recent assessments of Soviet artillery systems. Because of the percentage of Iraq's systems that are traceable to Soviet origins, these same observers may be tempted to declare that Soviet military technology isn't as effective as they have been led to believe.

While such a revisionist interpretation is perhaps understandable, it's based on a number of incorrect assumptions and conclusions. Moreover, such jumps in illogic only will foster a complacent attitude that could have devastating effects on future US FA modernization programs.

Myth: Iraqi Equipment and Munitions Equal Soviet. The first myth is that Iraqi artillery was the same as Soviet artillery. This is simply not true. Iraq fielded a plethora of artillery systems that had been captured, copied and procured on the world market. While some of these systems were Soviets, others had a "mixed bag" of capabilities. A few of them were quite inferior to Soviet designs in areas like mobility and ammunition options. Other Iraqi systems had superior performance capabilities in terms of range and rates of fire, which have serious implications.

The failure of the Iraqi artillery to perform was, in part, due to the geographically mixed collection of its systems, which led to serious difficulties with training. At the lowest levels, the large number of international systems created challenges in crew training. Several captured weapons feature hasty Arabic translations of instructions painted on weapons above the data plates, the originals in Chinese, Russian or English. There were other indications that Iraqis weren't well-trained on their equipment.

But it would be a serious mistake to assume another enemy in a future tactical scenario would have the same poor training standards.



Challenges to Operator Training. In these three photographs, you can see hasty Arabic translations of instructions painted on Iraqi foreign-made weapons.

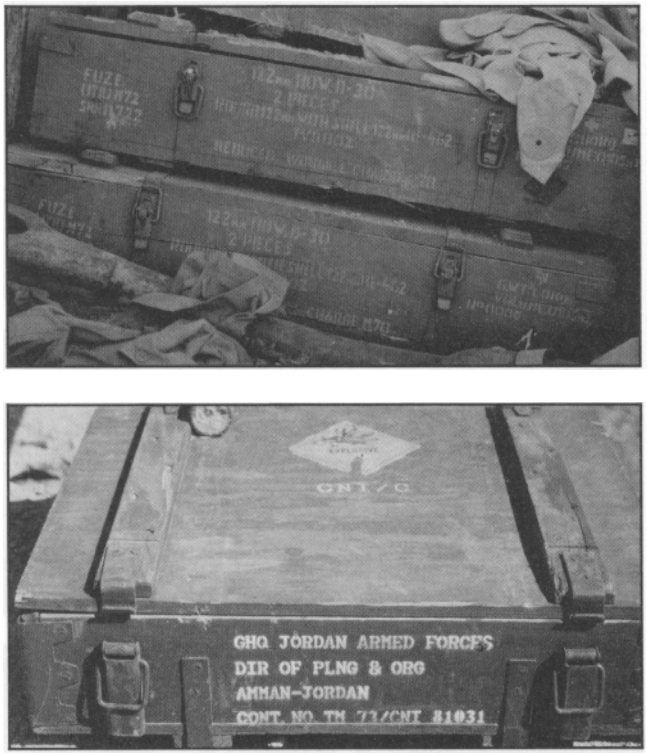
Of equal importance and affecting training was the apparent lack of leadership present in Iraqi combat operations. Anecdotal reports comparing Iraqi units "overrun" versus ranks of prisoners captured indicate some relatively high percentages of senior leaders "beating feet."

Additionally, because of the Iraqi's mixed bag of artillery systems, adequate command and control was difficult to achieve. The weapons weren't designed to operate in an overall tactical

structure—there was no system of systems—and were packaged together in a confusing network that decreased overall battlefield effectiveness.

Iraqi difficulties were further heightened by the fact that they bought multiple ammunition options, also from a wide range of suppliers. This situation led to serious logistical problems that Soviet artillery forces simply wouldn't face.

Not only was Iraq faced with ammunition logistical challenges, but also initial reports indicate its artillerymen were denied the most sophisticated ammunition combinations. For example, the reports indicate a complete lack of improved conventional munitions (ICMs) in Iraqi battlefield inventories. Given the nature of modern international arms deals, such a lack of lethality would hardly be applicable to any future tactical scenarios.



The captured ammunition in these two photographs shows Iraq's multiple ammunition option, which led to its logistical problems.

Myth: Soviet Artillery's Ineffective. Perhaps the most dangerous myth that appears to be emerging from the victories of Desert Storm is the belief that the Soviet hardware fielded by Iraq is somehow representative of the equipment found in modern Soviet units. In fact, the most modern Soviet military hardware found in Iraqi inventories is no longer produced in the USSR. Iraq's 152-mm, 2S3 self-propelled howitzers have been replaced in many Soviet units by the 152-mm gun-howitzer 2S19. The 2S19 features a 52-caliber long cannon as well as advances such as automated loading and semiautomatic fire control. Similar examples can be found in Soviet multiple rocket launchers (MRLs) and fire control equipment.

Myth: Iraqi's (Read Soviet) Artillery Mix Limited Its Maneuverability. A related myth that must be disproved involves the mix of weapons fielded by Iraq. The Iraqi weapons and ammunition were not of pure Soviet manufacture or supply, and the fielded systems did not approximate a Soviet weapons mix.

For example, a large percentage of Iraq's artillery systems were towed models. These systems frequently were placed in permanent defensive positions. Their dug-in configuration, combined with a lack of enough or appropriate prime movers, precluded the possibility of "shoot-and scoot" operations and facilitated the job of US and other coalition target planners.

Myth: Iraqi Counterfire Capabilities Limited. A fourth myth involves hostile target acquisition and targeting capabilities. Specifically, the relative lack of hostile counterfire received by coalition artillery forces could be mistakenly interpreted as a reflection of limited counterfire potential.

The fallacy of this belief is evident with a look at the number of Iraqi military pieces we captured. Many precious target acquisition assets appear to be both undamaged and unused. Unused equipment says absolutely nothing about equipment effectiveness. Reports indicate that the systems that were employed—such as counterartillery radars—were used without the most basic operational survivability precautions.

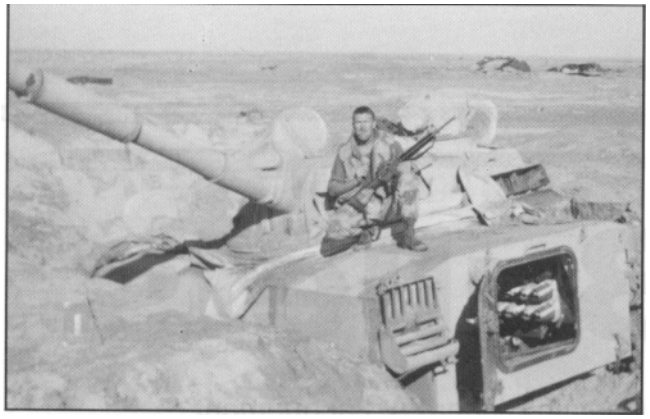
An Undamaged (or Unused) Iraqi Radar. Unused equipment says absolutely nothing about its effectiveness.

Some Desert Storm Lessons

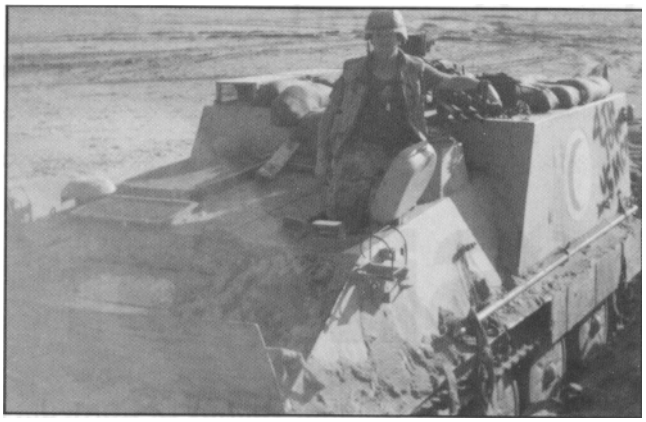
We must expose the myths about Iraqi artillery operations, but we also can draw from our experiences.

Capitalize on Our Strongpoints. To begin with, there's the general opinion that US and coalition forces were able to defeat Iraqi forces through a combination of teamwork, tactics, training, technology and leadership. As with all positive trends, it's hoped that US artillery decision makers will continue to exploit and expand our strengths in these areas.

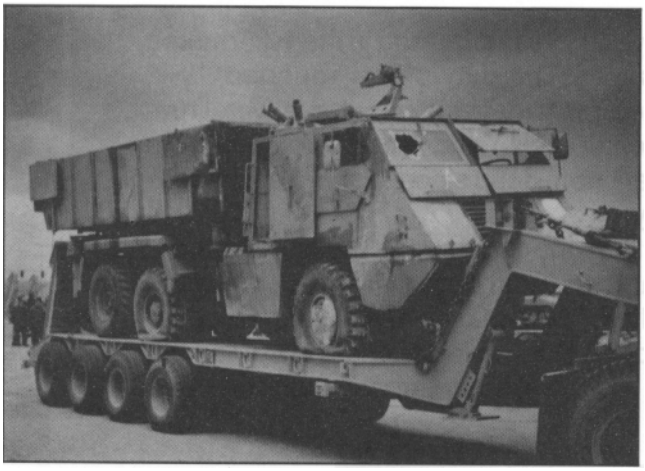
Emphasize International Artillery Expertise. Desert Storm also provides Western artillery planners some specific points to ponder regarding future worldwide contingencies. For example, the mix of Iraq's artillery inventory emphasizes the international nature of modern arms procurements. It no longer will be enough for artillerymen to identify the capabilities of



A dug-in Iraqi 2S1 152-mm howitzer is captured by coalition forces. Note the unexpended rounds in the ammunition rack inside.



A Chinese-made armored personnel carrier-ambulance abandoned by the Iraqis.



An Iraqi Astros II, a multiple rocket launcher made in Brazil, is damaged in Desert Storm.

A Soviet-made BM21 destroyed by a US air attack.

the 2S1, 2S3 and one or two Soviet MRLs. Artillerymen must take a much broader outlook in analyzing threat data.

Continue and Improve Our Survivability Techniques. Many of these international systems have range and rate-of-fire capabilities far superior to US or Soviet systems. This is particularly significant when viewed from a potential counterfire perspective.

The worldwide arms market not only includes an impressive array of cannon and rocket systems, but also a variety of sophisticated target acquisition assets. When properly employed, the potential combinations could be devastating to unprepared US forces. We'd be very foolish to assume that a future enemy with such artillery systems also would perform as poorly as the Iraqis; therefore, we must continue to train on and devise survivability techniques.

The Bottom Line

Artillery planners must seize this opportunity to broaden their threat outlook. At the same time, they must realize that the poor performance of Iraqi artillery using "Soviet" equipment says little about the multiple modernization programs taking place in Soviet artillery circles. We must be aware the Soviets undoubtedly also are studying the lessons of Desert Storm. As developers of and international arms dealers for some of the most sophisticated artillery systems in the world, our continued awareness and appreciation of the true capabilities of Soviet systems is critical.

In the final analysis, there's little doubt that the US artillery can take credit for tremendous success during Desert Storm. But now is the time to hone our performance edge. US artillerymen can't allow success to lead to complacency and smugness—it could be a deadly combination.

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Mr. Steven M. Chandler, an ROTC student at Michigan State University (MSU), worked as a student trainee in the Combat Arms Division of the Foreign Science and Technology Center this past summer. He was selected for this summer assignment under the Department of the Army Science and Engineering (DASE) Co-op Program. Next summer, when Mr. Chandler graduates from MSU, he intends to choose Field Artillery as his branch.

"Silver Bullets"

by Colonel Vollney B. Corn, Jr., and Captain Richard A. Lacquemont

At 0230 (Saudi Arabia time) on 17 January 1991, the phone rang in the 1st Armored Division Artillery (Div Arty) Commander's tent. The duty officer reported, "Sir, Tomahawks are away; the [air] war has started." In a matter of minutes, several runners left the Div Arty tactical operations center (TOC) and raced throughout the assembly area to pass the word. Soldiers went from deep sleep to sharp awareness that their world had just changed drastically.

At 0800 on 28 February, just over 43 days later, the 1st Armored Division stopped. With lead units just inside western Kuwait and the main body still in Iraq, the same soldiers listened as the tracked vehicles halted, firing ceased and a calm descended on the battlefield. During the next few hours, many soldiers finally resumed the comfortable rest so sharply interrupted a few weeks earlier, satisfied they had succeeded.

During ground operations against the Iraqi Army between 24 and 28 February, the 1st Armored Div Arty played a key role. We began with a well-developed plan accompanied by rehearsals before the attack, conducted a fluid movement-to-contact and a series of hasty attacks and ended by destroying the Medinah Division of the Republic Guards Forces Command (RGFC).

In the course of an 87-hour, 218-mile attack, the 1st Armored Division Force Artillery delivered 1,213 rockets and more than 9,500 rounds of cannon fire against formations of the Iraqi Army, to include the vaunted RGFC. To themselves, their maneuver counterparts and the world, the soldiers of the 1st Armored Division Artillery had, once again, proven the awesome power of the FA.

As we look back on our experiences during Operation Desert Storm, we find several critical aspects of our force structure and equipment need improving or reassessing. These "Silver Bullets," as we call them, should be addressed with an eye toward taking the FA into the 21st century with the ability to perform our mission as the "King of Battle" as well as we have in the past. The recommendations in this article are based on our experiences in the war with the Iraqi Army and present the changes that will most benefit us in the future.

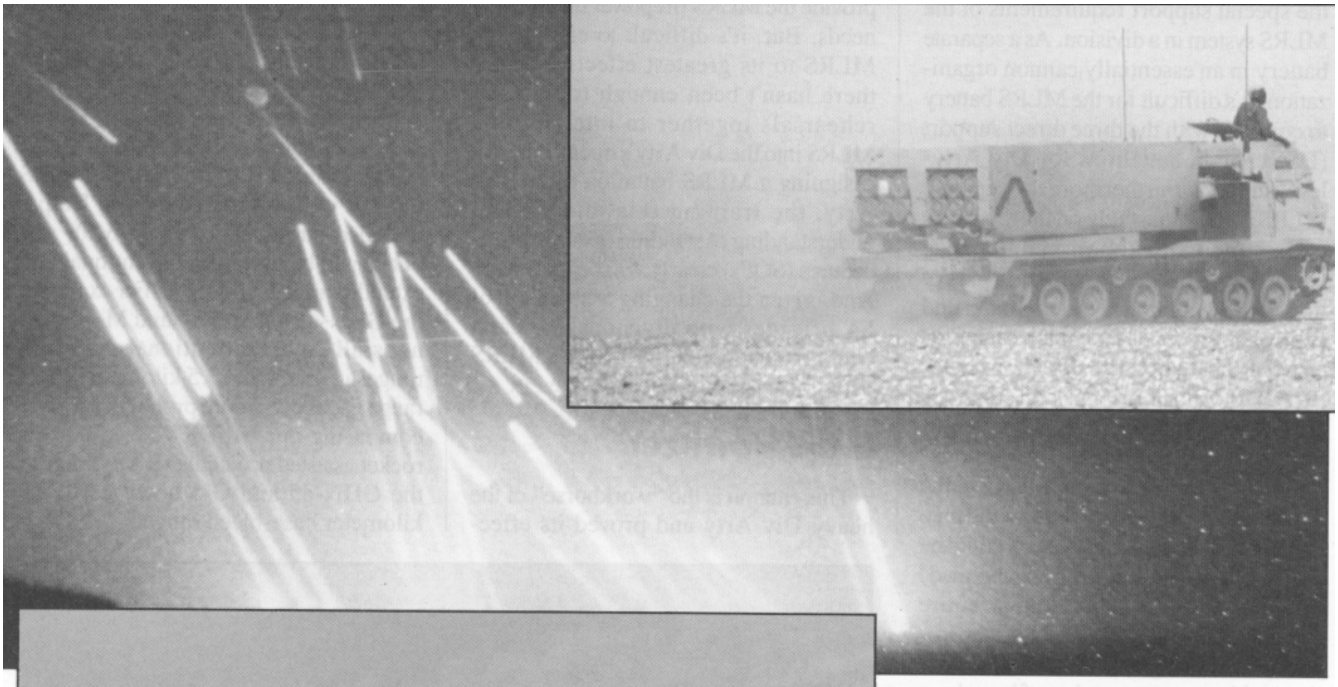
MLRS

In its first combat test, the multiple launch rocket system (MLRS) performed superlatively. The system's accuracy and lethality quickly established itself as a critical part of our force artillery firepower. In particular, we relied on the MLRS as our primary counterfire weapon, and in this role, we silenced all enemy artillery that fired at us. But three improvements will make this system even more valuable to the FA. We need to harden the system to reduce maintenance down time, increase the range of the weapon to 50 kilometers and increase the force structure of all heavy Div Artys to include an MLRS battalion (as opposed to the current MLRS battery).

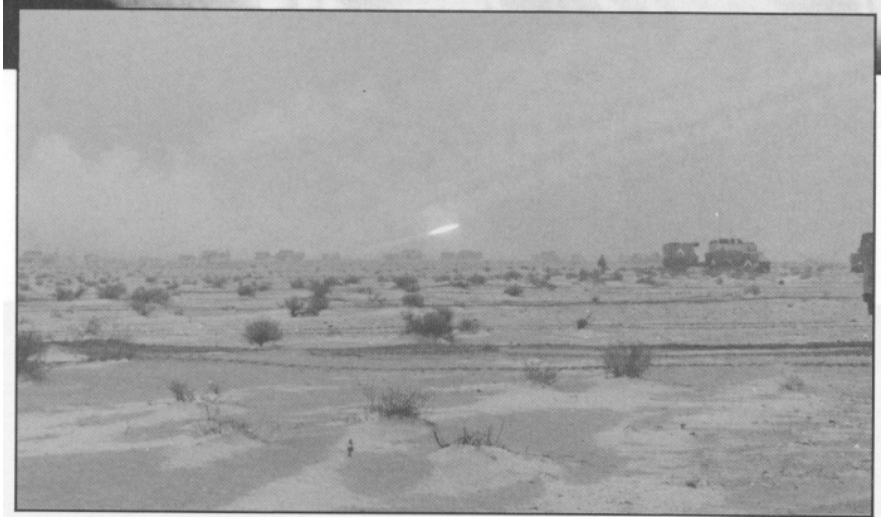
Harden the system. During training before the ground war, we spent considerable time and effort keeping the MLRS launchers operational. The complexity of the system was evident in the myriad of electronic and firing mechanism faults that needed constant attention.

In live-fire training and then in the MLRS raid our launchers fired before the ground war, the launchers went down because of firing damage to various components. Limit switches, line replacement units (LRUs) and resolver couplings frequently had maintenance problems. To the credit of our maintenance soldiers, most problems were fixed quickly. Although it may be a sign of the relative youth of the system, we had to spend too much time on maintenance, especially with problems caused by live firing.

Using information generated from the extensive live firing of the system during the war, we can focus on those parts with



During Desert Storm, MLRS launchers light up the sky with rockets that streak toward Saddam Hussein's forces.



MLRS Firing in Desert Storm. The US needs to increase the MLRS' range to 50 kilometers to counter the range of existing and developing international systems.

the most maintenance trouble. With some improvements, we can harden the system to significantly reduce the number of firing-related faults.

Increase MLRS Range. In spite of the poor performance of the Iraqi Artillery in the war, it's significant to note they had four cannon systems (GHN45, G-5, GCT and M-46) and two tactical multiple rocket launch (MRL) systems (BM-21 and ASTROS) that could outrange MLRS. In the hands of a better trained and more intelligent foe, these systems could have made it extremely difficult for us in a counterartillery battle.

In this war, Allied air supremacy made up for our lack of conventional artillery range. The Iraqis also lacked a good target acquisition system, which undercut their ability to use the range they had. Coupled with our outstanding intelligence and target acquisition capability, our FA system far outclassed the Iraqis'.

However, the weak link in the fire support system is our weapons' limited range. To stay ahead of our potential adversaries, we must ensure the ranges of our weapons support the stand-off capabilities we rely on for success. Considering the ranges of the Iraqi systems and the improvements likely in international weapons over time, the Army needs to increase the MLRS range to 50 kilometers.

Maybe, like the Brazilian ASTROS system, the answer is to create another size rocket that falls somewhere between the MLRS rocket and the Army tactical missile system (Army TACMS) missile. But, whereas the Army TACMS provides for operational depth, lending itself to theater-level command and control, we need to improve the MLRS' ability to influence the division fight, in particular the deep and counterartillery battles.

Div Arty MLRS Battalion. As currently structured, heavy Div Artys have one battery of MLRS. These nine launchers, though valuable, provide little flexibility or depth to the Div Arty's organization. Furthermore, the nature of a separate battery causes some command and control problems.

In the war against Iraq, we were fortunate to have an MLRS battalion (minus one of its organic batteries) assigned to our Div Arty. This allowed the MLRS battalion headquarters to control our battery, eliminated the command and control problems inherent in having a separate battery and gave us additional firepower and flexibility. This structure should be the standard for all heavy Div Artys.

From a command and control standpoint, the MLRS battalion headquarters is a more appropriate agency to deal with

the special support requirements of the MLRS system in a division. As a separate battery in an essentially cannon organization, it's difficult for the MLRS battery to compete with the three direct support (DS) cannon battalions for Div Arty-level support. Furthermore the separate MLRS battery must rely on the division's main support battalion maintenance while maintenance is an organic part of the MLRS battalion. For command and control of fires, it's also much easier for an MLRS battalion fire direction center (FDC) to control fire missions than for the Div Arty Headquarters to try to control one battery.

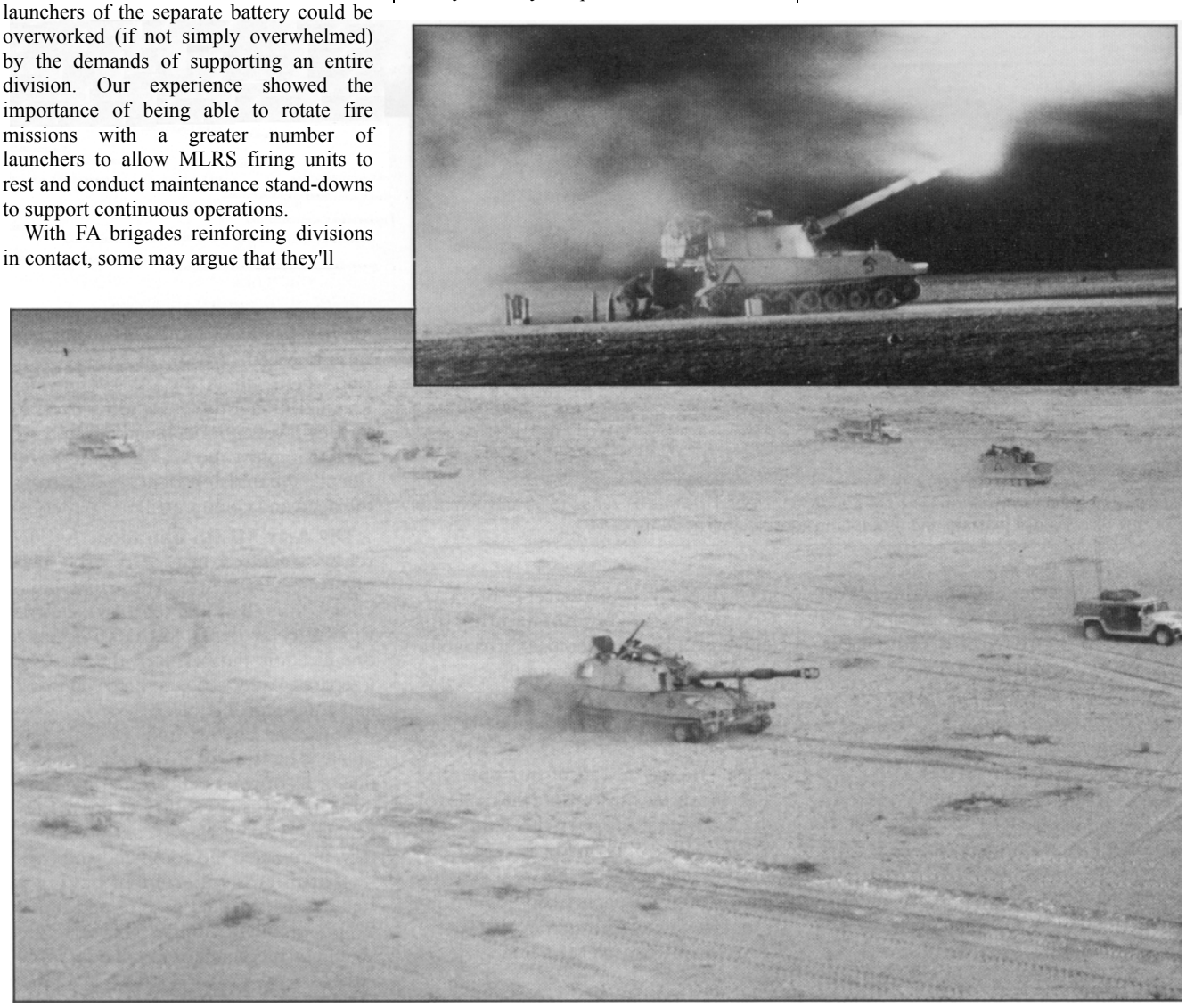
Given the importance of MLRS to the division fight, it's easy to see how the nine launchers of the separate battery could be overworked (if not simply overwhelmed) by the demands of supporting an entire division. Our experience showed the importance of being able to rotate fire missions with a greater number of launchers to allow MLRS firing units to rest and conduct maintenance stand-downs to support continuous operations.

With FA brigades reinforcing divisions in contact, some may argue that they'll provide the MLRS firepower the division needs. But, it's difficult to employ the MLRS to its greatest effectiveness if there hasn't been enough training or rehearsals together to integrate the MLRS into the Div Arty's operations. By assigning a MLRS battalion to the Div Arty, the training relationship and understanding of standing operating procedures (SOPs) clearly will be improved. And, given the changing association of FA brigades with divisions, we can't count on having the FA brigade MLRS battalion available when we need it.

M109 Howitzer

This cannon is the "workhorse" of the heavy Div Arty and proved its effectiveness in every battle with the Iraqi Army. As with the MLRS, increasing the M109's range will greatly enhance the system's value and effectiveness.

Like the MLRS, the M109 howitzer was easily outranged by several Iraqi artillery systems. Although the MLRS mainly was outranged by the Iraqi's extended-range munitions, the M109 was outranged by both the conventional and extended-range munitions. For example, the GHN-45, G-5, GCT and M-46 cannons all have conventional munition ranges in excess of 23.5 kilometers. The range gap is even more pronounced when comparing our M109's 23.5-kilometer rocket assisted projectile (RAP) range to the GHN-45 and G-5 howitzers' 39.6 kilometer base-bleed range.



Top: An M109 howitzer fires into the night during Desert Storm. Bottom: The M109, the workhorse of the heavy Div Arty, needs a range of up to 50 kilometers with RAP to be most effective against potential international adversaries.

To redress this imbalance, future munition and howitzer programs should strive to achieve a conventional munitions range of about 40 kilometers with extended munitions ranging out to 50 kilometers. As with the MLRS range increase, this should give us the artillery standoff firepower we need.

Target Acquisition

Firefinder Radars. In general, the Q-36 and Q-37 Firefinder radars performed well during the war. The Q37, in particular, had no significant faults and was an extremely reliable source of enemy targeting information. It provided many more enemy artillery acquisitions during our counterfire battle than the Q-36 did.

The problem with the Q-36 was not that it didn't pick up artillery or mortar fire, but that it picked up too many other targets, thus confusing the situation. Many Q-36 acquisitions simply didn't make sense. We speculate the radar is too sensitive and thus tends to pick up secondary explosion fragments and other trajectory producing objects, showing these as acquisitions. In a more developed situation where we can establish and control radar zones better, these false targets may not be as troublesome; however, because of our rapid offensive operations, we had to carefully examine all the radar acquisitions to assess their logic and priority of engagement.

With the Q-36s, we often received acquisitions from behind our front line and many from the areas where maneuver direct-fire battles were taking place. We usually could weed out the erratic acquisitions and focus on the real targets. But, when using Q-36 acquisitions we had to be more careful before we fired upon them. For the most part, we could rely on the Q-37s to confirm any questionable Q-36 acquisition.

To remedy this situation, the trajectory assessment routine of the Q-36 software should be re-examined to improve the radar's ability to discriminate amongst different trajectories. By introducing a better set of filtering assessments, the number of extraneous or false acquisitions generated by the Q-36 should decrease.

Remotely Piloted Vehicles. One of the most effective target acquisition means used in the theater was the British remotely piloted vehicle (RPV). With the death of the Aquila RPV program in the US Army, we were without a similar capability during this war.

CW4 Kenneth D. Brooks

Q36 and Q36 radar crews pose in the Saudi desert. Both radars performed well, with the Q37 the most reliable source of targeting information.

The British RPVs were extremely valuable to the British forces, providing outstanding real-time intelligence—not just for artillery targeting, but also for their maneuver forces. We need to get on with developing a similar capability for the US Army.

For the artillery in particular, an RPV would be the perfect partner for the Q-37 and Q-36 radars. Whereas the radars support the counterfire battle, an RPV would significantly improve our ability to acquire enemy artillery before it fires, thereby supporting the counterartillery battle.

Fire Support Team Vehicle (FIST-V). It's clear from this war the FIST-V is inadequate. The chassis is based on the old M113 family of vehicles and can't keep up with the current M1 Abrams tank and M2/3 Bradley fighting vehicle fleet. The sights of the FIST-V are inferior to both the Bradleys' and the Abrams', making it difficult for the FIST to identify targets in a timely manner. At 3,000 meters, many of our FISTs had not even seen the enemy vehicles, but the Bradley and Abrams crews were already engaged in direct-fire fights. Furthermore, as we were on the offense, the constant fire and maneuver of the tanks and infantry fighting vehicles created a fluid situation, hampering the FIST-V crew's ability to elevate the hammerhead (holding the ground/vehicular laser locator device, or G/VLLD) and use it.

We need a fire support vehicle that can move as fast as the maneuver units it supports, that has sights at least as good as those on the direct-fire systems and that can perform its mission on the move. The FIST-V doesn't meet these standards.

Cargo and Transport Vehicles

Although not a very glamorous part of the Army inventory, our basic cargo and transportation vehicles are the "back bone" of moving and sustaining our fighting force. Unfortunately, our overall fleet of vehicles suffers from some critical deficiencies.

General-Purpose Trucks. In our force structure, every cargo vehicle has a specified haul mission. At the same time, we have many requirements that don't have dedicated vehicles to support them.

During this war, we were forced to take many vehicles "out of hide" to support unresourced haul requirements. For example, we had to take some heavy expanded-mobility tactical trucks (HEMTTs) designated for ammunition carrying (MLRS and cannon) to haul the meals-ready-to-eat (MREs) and bottled water required to sustain our operations. In addition, because the load designations of our trucks don't account for items such as soldiers' TA-50 and tentage or mail pickup, we had to use vehicles designated for other purposes.

The solution to this problem is to give each battalion a few general-purpose cargo trucks to support these previously unresourced missions.

Support Vehicle Mobility. In a heavy division, we have tracked vehicles for

mobility off road. The wheeled vehicles that support our tracked vehicles must be able to operate on the same terrain. The wheeled vehicles that performed the best in the often difficult desert terrain were the high-mobility multipurpose wheeled vehicle (HMMWV) and the HEMTT. Other wheeled vehicles, such as the commercial utility cargo vehicle (CUCV) and 2 1/2-ton and 5-ton trucks, had a lot more trouble negotiating the terrain, especially pulling a trailer.

We should change our force structure so all trucks that operate forward of a division's rear are either from the HMMWV or HEMTT family of trucks. In addition to improving the cross-country mobility of the division's combat and combat support units, this would greatly simplify maintenance by having a more standardized fleet of vehicles.

Improvements for All Vehicles. Every vehicle in the US Army, tracked or wheeled, needs three critical items of equipment: an air-ground friendly identification device similar to the Air Force's identification friend or foe (IFF) system, an independent navigational device and a radio. These three items would go a long way toward eliminating some of the most critical problems we face on the modern battlefield.

The main function of the IFF device is to prevent fratricide. If every vehicle had a passive identification beacon, our compatibly outfitted weapon systems could query a target to determine whether or not it's friendly. Even on a confused battlefield, Air Force aircraft, tanks, attack helicopters and other highly lethal weapon systems could quickly determine if a vehicle is ours or the enemy's before attacking it.

Our experience in the virtually featureless desert proved the value of navigational devices such as the global positioning system (GPS) and long-range aid to navigation (LORAN) devices. Although most valuable in places such as the desert, such devices are important in any terrain in the world.

Freed from relying completely on error-prone map and compass work, these devices increased our ability to navigate from one location to another immeasurably. The most obvious navigational applications are for maneuver forces. But the critical masses of support vehicles that shuttled back and forth to sustain the combat formations were the most likely to get lost or disoriented on the fluid battlefield.

With LORAN and GPS, it's feasible to have these or similar devices in every vehicle. Small and easy to use, they easily solve navigational problems that have been the bane of armies since time immemorial.

In addition, every vehicle should have a radio. For most vehicles, a short-range radio (one to two miles) is enough for convoy and movement control. For key command and control vehicles, the radios would be the tactical ones needed for longer range communications. And approximately one in every five support vehicles should have a tactical radio for communications in support missions. All radios should be able to function on the same frequencies for internal communications and be secure.

We should change our force structure so every truck that operates forward of a division's rear is either a HMMWV or HEMTT.

Logistics

Organic Support for FA Brigades. One of the most critical deficiencies we encountered was that FA brigades don't have organic support. Each FA brigade should have its own support battalion to plug into either a corps or division's support system. This would allow the FA brigade much greater flexibility in changing its support relationship in accordance with the scheme of maneuver.

As it was, we spent a lot of time and energy trying to figure out how to provide enough support to the FA brigades associated with our Div Arty. With their own support battalions, the FA brigades wouldn't be at the mercy of the constantly changing support relationships they encounter.

Munitions. Throughout the war, dual-purpose improved conventional munitions (DPICM) for the howitzers and MLRS and Army TACMS all proved enormously effective against the Iraqi Army. Unfortunately, the dud rate of the submunitions, while low, left many unexploded bomblets that later caused some injuries and death to friendly forces. After the cease fire, these dud submunitions (along with Air Force cluster bomb submunitions) caused the most casualties among our forces.

We must improve the submunition to either drastically reduce the dud rate or render the submunitions harmless a few hours after they're fired. We could include a timed self-destruct mechanism on each submunition—as we do with family of scatterable mines (FASCAM) submunitions. Or, we could create a deliberate weak link in the firing mechanism that, after a few hours outside of the projectile's protective casing, deteriorates and render the submunitions ineffective.

Improve M109/FAASV Fire Extinguishers. After the war but before returning to Saudi Arabia, we had two FA ammunition supply vehicles (FAASVs) catch fire and burn. In both instances, the crews immediately evacuated the vehicles, and the fire spread to the ammunition

storage area totally destroying the vehicles. As a result, it was impossible to determine what caused the fires and why the automatic fire extinguishers failed to contain the fire. It appears one fire started in the engine compartment and one in a blower motor in the ammunition compartment.

In both fires, the halogen fire extinguishers activated correctly, but the fires re-ignited after the extinguishers finished. This is probably because briefly starving the engine compartment of oxygen (as the halogen extinguishers do) doesn't eliminate the cause of the fire (most likely a hot engine component in contact with spilled fuel). Therefore, the fires can re-ignite and, ultimately, spread from the engine compartment to the rest of the vehicle.

A combined carbon dioxide and halogen fire extinguisher would work better. It could cut off the oxygen (thus stopping electrical fires) and cool heat sources (the likely source of fuel fires).

Conclusion

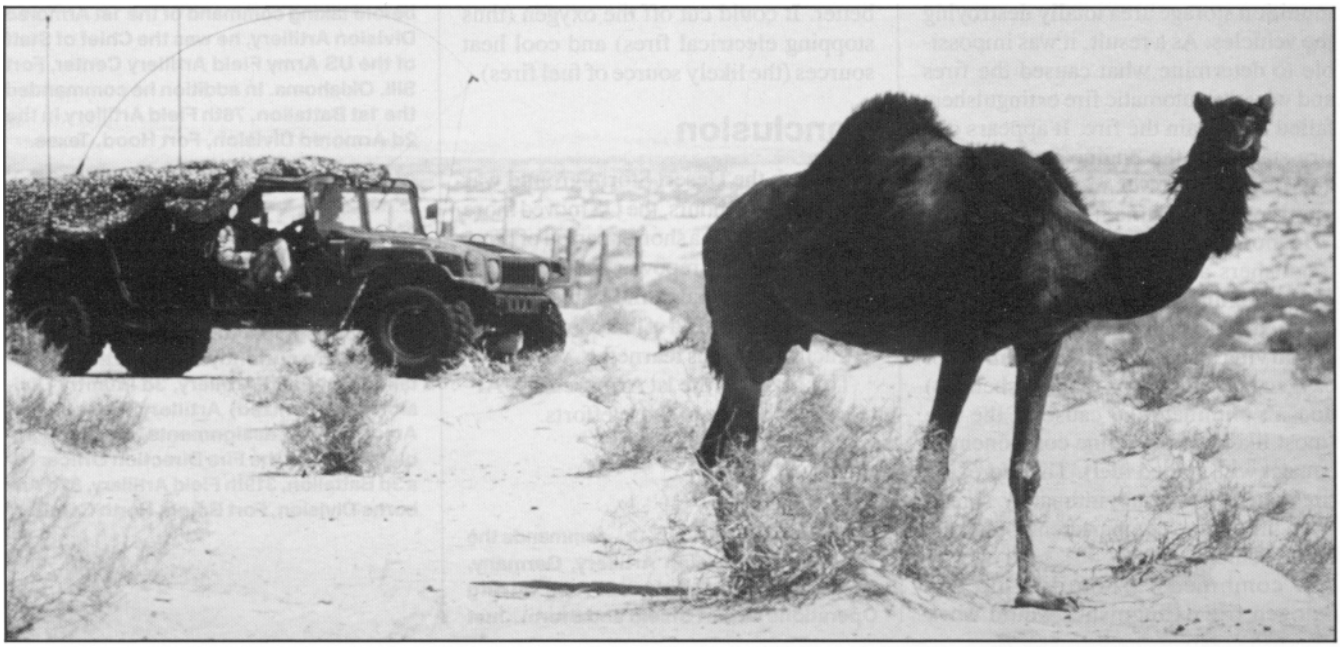
Though the Desert Storm ground war lasted only 100 hours, the US moved more forces, farther, in a shorter period of time, bringing more firepower on the enemy than in any campaign in US history. We must capture the data of that campaign and extract the lessons learned.

This article is the 1st Armored Div Arty's contribution to those efforts.

Colonel Vollney B. Com, Jr., commands the 1st Armored Division Artillery, Germany, deploying it to Southwest Asia during Operations Desert Shield and Storm. Just before taking command of the 1st Armored Division Artillery, he was the Chief of Staff of the US Army Field Artillery Center, Fort Sill, Oklahoma. In addition he commanded the 1st Battalion, 78th Field Artillery in the 2d Armored Division, Fort Hood, Texas.

Captain Richard A. Lacquemont was the Assistant S3 of the 1st Armored Division Artillery during Operations Desert Shield and Storm. He's currently the S4 of the 3d Battalion, 1st Field Artillery, 3d Infantry Division (Mechanized) Artillery in Germany. Among other assignments, Captain Lacquemont was the Fire Direction Officer for a 3d Battalion, 319th Field Artillery, 82d Airborne Division, Fort Bragg, North Carolina.

Using MLRS rockets, the 18th FA Brigade sends Saddam Hussein a message: "Have a bad day!"



Lessons from the BattleKings in the Desert

by Major John M. House

Sand as far as the eye could see—with camels, bedouins in pickup trucks, plateaus, villages and heat. Such were the companions of the "Battlekings," 3d Battalion, 41st Field Artillery (3-41 FA) of the 24th Infantry Division (Mechanized) Artillery while we lived and trained in Saudi Arabia and fought in Iraq. The desert and war were no picnic, but we learned many lessons. The highlights of our experience are in this article so other Redlegs can learn from our trials.

The Battalion Box

The Battalion Box. One significant lesson we learned was the art of moving the battalion in mass during a deep envelopment. When initially faced with the daring Central Command (CENTCOM) plan to launch the 24th Infantry Division north to the Euphrates River valley, we were awed by the scope of the operation. We asked ourselves, "How can we keep up with an armor-heavy brigade attacking across hundreds of kilometers of desert sand, rocks and wadis?"

We knew from three National Training Center (NTC) rotations at Fort Irwin, California, the previous year and months of training in Saudi Arabia that we'd never be able to keep up if we "leapfrogged" batteries to maintain a continuous artillery umbrella over the Abrams tanks and Bradley fighting vehicles. The "Victory Division's" 2d Brigade (Vanguard), the brigade we were in direct support (DS) of, was just too fast. It would use speed and the shock action to strike deep and unhinge a defender. But the 2d Brigade Commander also understood the need for fire support. We were determined to find a way not to slow down his attack. The solution was simple and very effective.

We formed a battalion "box" about two kilometers square so the battalion

moved as one entity. (See the figure.) This ensured we always could mass the battalion's fires. We'd stop to shoot only if we encountered a target large enough to warrant firing the entire battalion. By keeping the battalion moving together, we simplified command and control (C^2) and survey requirements. We kept up with the maneuver force by remaining in constant contact with our battalion commander riding with the brigade commander and with the task force (TF) fire support officers (FSOs).

This formation also simplified logistics because the battalion trains (ie., service battery) stayed with the battalion. We left a large signature of tracks in the sand and occupied a large piece of ground. But instead of having to find the support battalion and five separate batteries, our battalion logisticians only had to find and run supplies between the support battalion and our battalion.

Order of Formation. The battalion S3 headed a "Jump TOC" (tactical operations center) of four high-mobility multipurpose wheeled vehicles (HMMWVs) that led the battalion and provided tactical fire control. The Jump TOC consisted of the S3 and the S2 in the S3's HMMWV followed by a survey platoon HMMWV carrying an AN/PSN-9 satellite signal navigation set (global positioning system, or GPS) to provide location data. The S3, equipped with an AN/VRC-46 radio, used the battalion command net for C^2 and monitored the fire support net to track the battle. The survey HMMWV AN/VRC-46 radio remained on the command net.

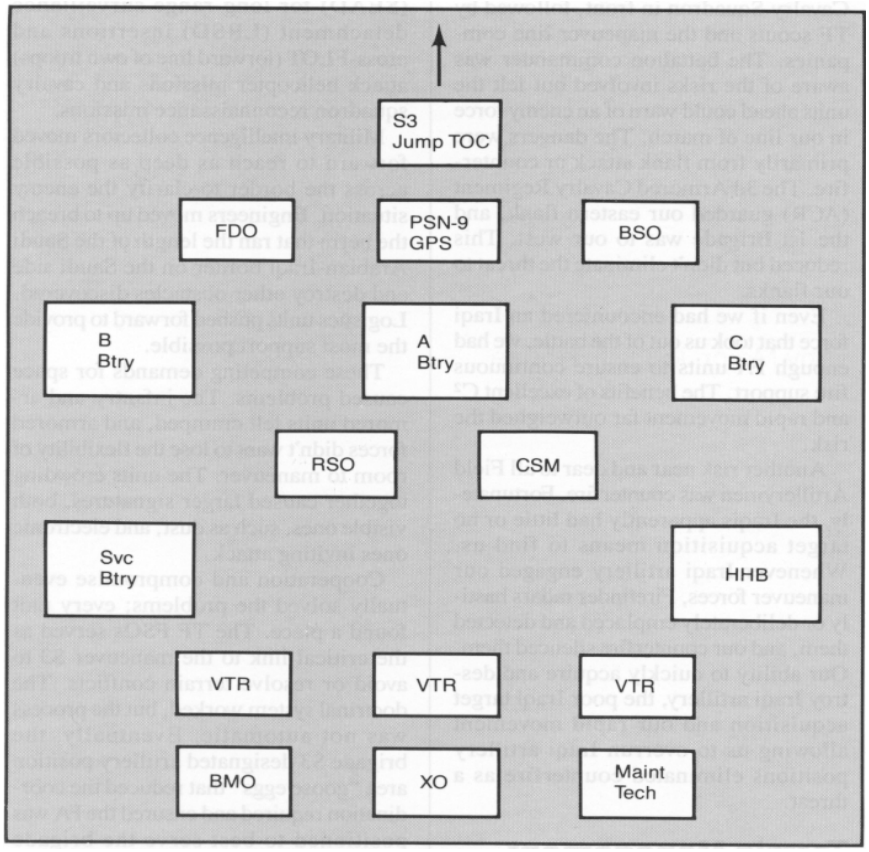
Whenever the S3 needed a battalion position, he only had to say "Grid" on the command net. The survey NCO then responded with the grid. If a failure in satellite coverage occurred, another GPS in the battalion invariably had a grid, though location accuracy was slightly less than that usually achieved. Everyone on the command net immediately knew where he was.

The next HMMWV was the battalion's retrans HMMWV reconfigured as a tactical fire direction center (FDC). The battalion fire direction officer (FDO) and one 13C NCO rode in the back seats with a fabricated plywood mapboard between the rear and front seats. The FDO maintained tactical fire control on the fire support net and stayed in contact with the S3 on the command net. Two communications platoon soldiers rode in the front seats, alternately driving and providing some physical protection in case of a fire fight.

The last HMMWV was a communications platoon HMMWV with two AN/VRC-46s and carried the battalion signal officer (BSO) and a wire team. The BSO radios provided contact with the maneuver brigade on its command net. The second radio remained on the 3-41 FA command net for contact with the S3. The wire team riding in the cargo compartment had a machinegun and provided security for the Jump TOC.

The three firing batteries followed the S3's Jump TOC on line. Battery B was on the left flank and had the battalion's AN/TPQ-36 Firefinder radar attached. Battery A traveled directly behind the Jump TOC with C Battery on the battalion's right flank. The Headquarters and Headquarters Battery (HHB) followed C Battery.

The battalion command sergeant major (CSM) and the reconnaissance and survey officer (RSO) with two position and azimuth determining system (PADS)



The 3-41 FA's Battalion Box Formation for Movement in Desert Storm. The battalion commander rode with the maneuver brigade commander as his fire support coordinator (FSCOORD).

MAJ John M. House

The 3-41 FA BattleKings move toward the Iraqi border.

vehicles followed the three firing batteries. The CSM provided an experienced set of eyes to evaluate the situation of the three firing batteries and solve problems. The RSO continuously transferred survey control as an alternative to GPS position locations to solve problems with satellite coverage. He also could provide common direction through simultaneous observations and mark routes using standard marking signs, as required.

The battalion TOC M577 command post carriers and the tactical fire direction system (TACFIRE) shelter, on a heavy expanded-mobility tactical truck, (HEMTT) for improved mobility, moved with the HHB. The TOC plans and operations and special weapons officers manned radios in the S3's M577 as a mobile planning and coordination center. The battalion assistant S2 (an unauthorized but very useful diversion of a lieutenant) and intelligence sergeant monitored the 2d Brigade operations and intelligence (O&I) net in the S3 M577. They retransmitted critical intelligence on the 3-41 FA command net.

Service Battery followed B Battery and served as the battalion trains. The battalion administrative and logistics operations center (ALOC) moved with Service Battery. All ammunition HEMTTs were under the operational control (OPCON) of the battalion ammunition officer (BAO) as part of Service Battery. However, each firing battery kept one HEMTT with sufficient rounds for a 400x400 two-aim point, medium density family of scatterable mines (FASCAM) minefield on board.

The trail element was the battalion executive officer (XO), battalion motor officer (BMO) and maintenance technician with the three M578 recovery vehicles (VTRs). They served as a maintenance and recovery detachment.

This formation was instrumental in our success and was mission-oriented for our deep strike behind enemy lines. The S3 could see the entire battalion during most of the movement. Although terrain occasionally blocked one battery from view, every battery always could see an adjacent battery for navigational assistance, and the three firing batteries always could see the S3. The size of the formation contracted and expanded as the visibility and terrain conditions dictated.

Rapid movement was possible because the entire battalion stayed together, wasting no time searching for lost batteries. Consolidating the battalion allowed us to capitalize on all battalion logistical elements to rearm, refuel and recover any vehicle in need.

Formation Risks. Certainly there were risks associated with this formation. Had we run into an Iraqi unit in a defensive position or in a counterattack, we could have had the entire battalion in a direct-fire fight. We minimized this risk by staying behind a maneuver unit (at least most of the time) and moving rapidly.

The 2d Brigade had portions of the 2-4 Cavalry Squadron in front, followed by TF scouts and the maneuver line companies. The battalion commander was aware of the risks involved but felt the units ahead could warn of an enemy force in our line of march. The dangers were primarily from flank attack or counterfire. The 3d Armored Cavalry Regiment (ACR) guarded our eastern flank, and the 1st Brigade was to our west. This reduced but didn't eliminate the threat to our flanks.

Even if we had encountered an Iraqi force that took us out of the battle, we had enough FA units to ensure continuous fire support. The benefits of excellent C^2 and rapid movement far outweighed the risk.

Another risk near and dear to all Field Artillerymen was counterfire. Fortunately, the Iraqis apparently had little or no target acquisition means to find us. Whenever Iraqi artillery engaged our maneuver forces, Firefinder radars hastily or deliberately emplaced and detected them, and our counterfire silenced them. Our ability to quickly acquire and destroy Iraqi artillery, the poor Iraqi target acquisition and our rapid movement allowing us to overrun Iraqi artillery positions eliminated counterfire as a threat.

Terrain Management

Another critical lesson we learned was the difficulty of managing terrain coupled with clearing fires. The maneuver unit owns the space in its area of operations (AO). It bears the responsibility of managing units and the area it occupies. Every unit needing occupation space must coordinate with the maneuver unit that owns that ground. Failure to follow this simple rule causes great confusion and risks fratricide.

Defensive Operations. During the defense, positioning was a special problem. The desert didn't seem very large when everyone demanded space. Infantry and armor units needed room to maneuver in a defensive framework and engagement areas that maximized the long-range capabilities of anti-armor systems.

Additionally DS, reinforcing (R) and general support (GS) artillery battalions needed positions to allow target attack beyond the frontline maneuver units to support division and brigade deep operations. These operations included scouts, suppression of enemy air defense (SEAD) for long-range surveillance detachment (LRSD) insertions and cross-FLOT (forward line of own troops) attack helicopter missions and cavalry squadron reconnaissance missions.

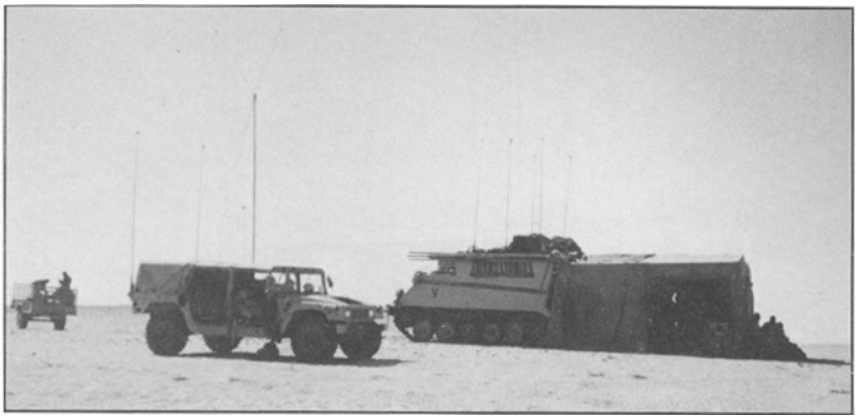
Military intelligence collectors moved forward to reach as deep as possible across the border to clarify the enemy situation. Engineers moved up to breach the berm that ran the length of the Saudi Arabian-Iraqi border on the Saudi side and destroy other obstacles discovered. Logistics units pushed forward to provide the most support possible.

These competing demands for space caused problems. The infantry and armored units felt cramped, and armored forces didn't want to lose the flexibility of room to maneuver. The units crowding together caused larger signatures, both visible ones, such as dust, and electronic ones inviting attack.

Cooperation and compromise eventually solved the problems; every unit found a place. The TF FSOs served as the critical link to the maneuver S3 to avoid or resolve terrain conflicts. The doctrinal system worked, but the process was not automatic. Eventually, the brigade S3 designated artillery position area "goose eggs" that reduced the coordination required and ensured the FA was positioned to best serve the brigade commander.

Offensive Operations. Clearing positions during the offense was much easier. Once the attack started, we rarely stayed on a piece of ground long enough to get into a lengthy discussion over which unit should be positioned where. We oriented on the enemy once we found him, stopping only long enough to fire, attack and collect prisoners. The entire force vacated ground so fast, clearing positions for occupation wasn't a problem.

However, managing terrain to clear fires was another matter. Our rapid



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The 3-41 FA's TOC at Faisal Training Range, Saudi Arabia, in December 1990.

movement made keeping track of every friendly unit location very difficult. Clearing fires, especially across brigade boundaries, was time-consuming and not always exact.

Keeping track of friendly mortars was particularly difficult. More than once our Q-36 radar detected friendly mortars as hostile targets. Due to several quickly developed double-checks on radar acquisitions by the battalion commander, TF FSOs and the battalion FDO, friendly casualties didn't occur. But the opportunity to err and injure friendly troops certainly existed.

Even when we thought we knew where every unit was, the danger of engaging a friendly target was always present. On one occasion, a friendly company moved out of its parent TF sector across the front and into an adjacent TF sector. Scouts initially misidentified the company as a hostile one. Fortunately, "cross talk" identified the company as friendly before casualties occurred.

This problem of tracking friendly units and clearing fires is one we must address. The desert battlefield was non-linear, a battlefield we'll encounter in the future. The division's deep attack made us have to be prepared to fight in any direction. As units maneuver at will across a battlefield and a frontline becomes impossible to plot, tracking units and the size and shape of the space they occupy is essential if we're to clear fires. Failure to clear fires will guarantee fratricide.

Gunnery Issues

Several gunnery issues also require comment. Accurate, predicted fire is a prime component of FA support. Massed fires reduce the enemy's reaction time compared to engaging him with adjust-fire missions. It also reduces the time needed to attack a target.

Time versus Absolute Precision. Intentional or not, the desire for absolute accuracy has, at times, driven artillerymen into such a frenzy that timeliness suffers. The tradeoff between a minimal increase in accuracy while adding one or more minutes to the processing time makes the additional accuracy not worth the time. The slower time for GS units firing a preparation or for a time-on-target or at-my-command mission may be appropriate, but a DS battalion can't afford the extra time. Infantry and armored units want steel on the target *now* rather than "the world" later, after the critical moment has passed.

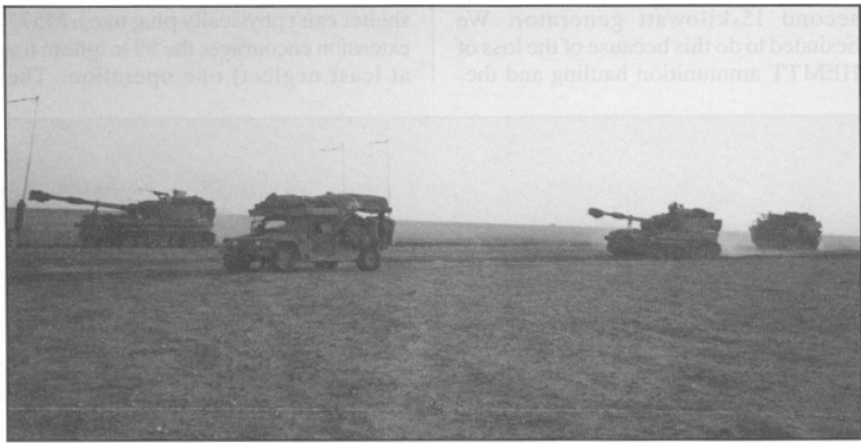
FA cannons are area-fire weapons. Yet today we demand individual howitzer data to shoot a tight, converged sheaf. We have junior officers who believe their training teaches them to demand a PADS grid for every howitzer or they shouldn't shoot. This just isn't true. Battery center (a term some junior officers have difficulty understanding) and one deflection and quadrant for all howitzers to shoot works. It has for years, including in Iraq.

We realized that accurate fire was essential. We also realized we'd never have the time to rely on more than a battery center grid and one deflection and quadrant. Therefore we focused our training on battery operations and firing a standard battery sheaf, which worked extremely well.

We used GPS to obtain a grid and our aiming circles to determine magnetic direction. We continually prepared and executed simultaneous observations and declinated our aiming circles as time in position allowed. We brought forward PADS data and, eventually, updated it off our GPSs. This location and direction accuracy was sufficient. We repeatedly engaged targets with battalion fire-for-effect missions. Invariably, the targets were so large (airfields, ammunition storage areas and division defensive positions) we used multiple aim points to engage the enemy positions.

Battery-Based Operations. We also operated exclusively as batteries during Desert Storm—not platoons. This simplified C^2 and provided key leader redundancy: two sets of battery XOs, platoon leaders, FDOs and FDCs, chiefs of firing battery and gunnery sergeants. The redundancy made 24-hour operations feasible and provided replacements if casualties had made them necessary.

Virtually every mission was a battalion hasty occupation. The S3 commanded "Battalion occupy, azimuth of fire xxxx." The battalion halted immediately, occupied



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The BattleKings move near Basra, Iraq, in March 1991.

and shot according to the battalion FDO's fire order. This worked and provided rapid response to calls for fire.

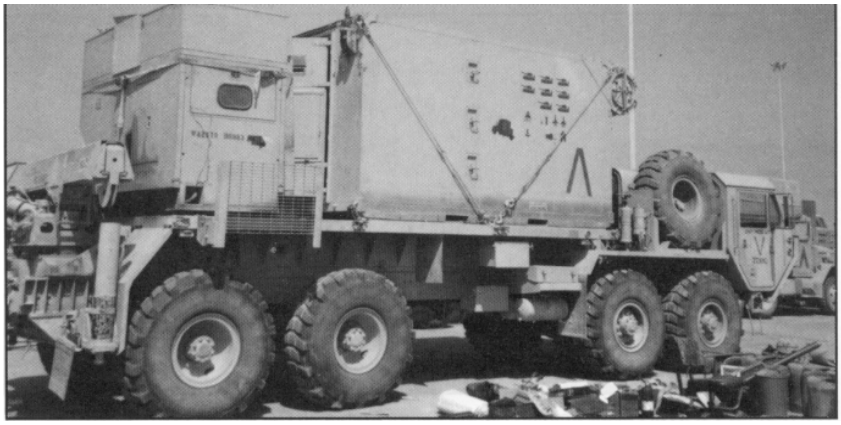
To execute this plan, we conducted numerous rehearsals. Batteries held "walk-throughs" with drivers and key leaders as well as sand table discussions and battery movement exercises. The brigade FSO and the battalion FDO held countless fire support rehearsals. The battalion commander and S3 rehearsed battalion and battery actions with battery officers and the battalion staff time and again. Rehearsals were critical to our preparation for war.

Navigational Aids for the Fire Support System. Each of our fire support teams (FIST) and firing batteries had access to a GPS through either FA or maneuver distribution. The survey platoon had two. These devices were essential because obtaining accurate location was difficult, at times impossible, in the desert.

Navigation aids must be available for all key leaders and components of the fire support system. Their accuracy supports accurate, predicted fires, the train-up is simple and the systems are available now at a reasonably inexpensive cost.

Battalion Meteorological Sections. To ensure up-to-date weather data, each DS battalion had a meteorological (Met) section attached. Users needing Met support only had to contact one of the forward deployed Met sections with the requirements. We flew Met balloons on a flexible schedule, based on the weather, our movement plan and the tactical situation. The Met section moved with the battalion FDC and responded directly to the needs of the battalion S3 and FDO.

Chronograph Maintenance. Before the war, we could get muzzle velocity data while firing at the division's range complex in Saudi Arabia. The M90 chronographs proved their worth; however, maintenance problems left us with only three of our six M90s operational. In this case, more is better. Authorizing one per howitzer would, of course, make getting muzzle velocities that much easier and ensure continuous updates during combat operations.



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The 3-41 FA's FDC mounted on a HEMTT stops in Saudi Arabia in March 1991.

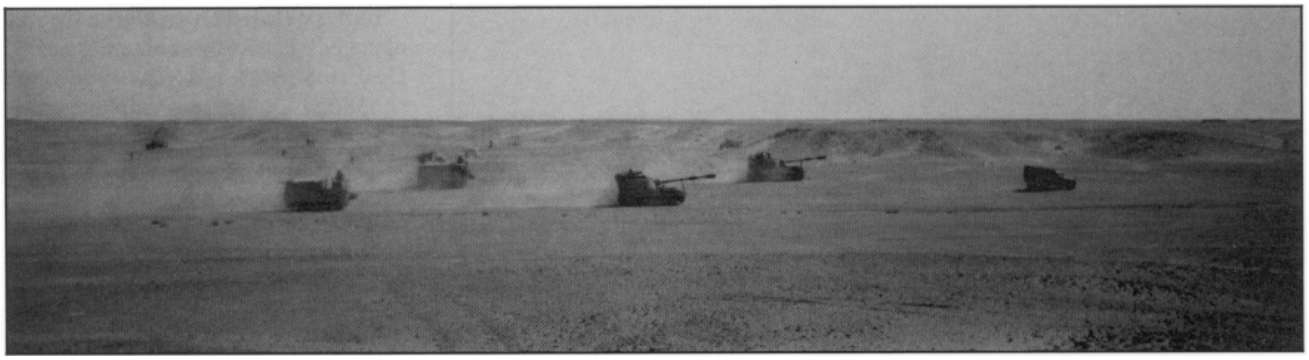
Vehicle Recommendations

Several vehicle lessons learned warrant discussion. Our battalion had some mobility problems, lacked some important haul capabilities and had some maintenance problems.

HEMTT TACFIRE Shelters. A 5-ton truck carrying the battalion FDC isn't a good vehicle for much cross-country or desert movement. The FDC must be able to go anywhere the TOC M577s can go and at the same speed.

We solved this problem by mounting the TACFIRE shelter and one 15-kilowatt generator on a HEMTT, which towed the second 15-kilowatt generator. We hesitated to do this because of the loss of HEMTT ammunition hauling and the need to retrain the FDC section on maintaining a new vehicle. But several other FA battalions mounted their TACFIRE shelters on HEMTTs, and it worked well for them. Looking back, this diversion of a HEMTT was a wise decision because of the increase in mobility it provided. The HEMTT is a "workhorse." We need more to carry cargo and for their cross-country mobility. Expecting a 5-ton truck to carry a TACFIRE shelter and keep pace with maneuver elements in the desert is expecting too much.

Common Vehicle for FA TOC Elements. Related to the FDC vehicle problem is another C^2 issue. The battalion S3, S2 and FDC (in other words, the TOC) should be in the same type of vehicles. The battalion S3 is the TOC officer in charge (OIC). He must ensure the battalion is positioned to deliver fires in an accurate, timely manner. The S3 and S2 M577s serve as "the heart" of battalion planning and operations. However, separating the FDC from the rest of the TOC because a TACFIRE shelter can't physically plug into a M577 extension encourages the S3 to ignore (or at least neglect) one operation. The



A 3-41 FA battery moves in a wedge formation across the Saudi desert.

TACFIRE's remote communications monitoring unit (RCMU) doesn't keep the S3 or TOC shift officer abreast of the delivery of fires.

All TOC elements must be in vehicles that facilitate the S3, section OICs and section NCOICs meeting for quick updates. Having a "feel" for the battlefield is important for leaders to make proper decisions. Hearing the radio traffic, seeing each section's maps, looking at the faces of those in each TOC element—these are essential. War is part art and part science. The art requires human interaction. Our battalion TOC layout should help, not hinder, this interaction.

The ideal solution would be a new C^2 vehicle (wheeled or tracked) with the cross-country mobility of the maneuver units we support. Current combat developments studies are working to provide a common chassis for multiple vehicles in the Armored Systems Modernization (ASM) Program. That effort should include putting the FA TOC elements in the same vehicles.

Fuel Tankers. Our three HEMTT fuel tankers didn't provide enough fuel haul capacity. The rapid movement and decision to attack a day ahead of schedule stretched our logistics capability to the limit.

At one point, the lack of fuel almost forced us to stop moving or give the fuel only to the howitzers. Fortunately, we received fuel, but a little "safety margin" would have relieved a lot of pressure on the battalion leadership and logisticians. One additional tanker per howitzer battery is a must. The six tankers per battalion would ensure fuel resupply for sustained combat operations.

Decontamination Vehicle. For hasty decontamination, water was a constant source of concern. We resolved this by leasing two civilian flatbed trucks, each carrying two 200-gallon water tanks. We mounted an M17 lightweight decontaminating apparatus (or Sanator) on each to make mobile chemical decontamination vehicles. Unfortunately, those vehicles didn't make the trip back to Fort Stewart, Georgia. The battalion doesn't have sufficient cargo haul capacity to carry the Sanators or water for hasty decontamination.

If we're serious about decontamination in mobile armored warfare, we better produce a battalion decontamination vehicle. A simple fix would be commercial flatbed or side-panel 4x4 trucks for units to carry Sanators and water tanks or blivits.

M548 Ammo Carrier Replacement. The M548 was a unique challenge. Six months in the desert reaffirmed that our M548s were incapable of performing their mission. They couldn't consistently carry 96 rounds and keep up with M109A2 howitzers without experiencing severe maintenance problems. Reducing the M548 load to 56 rounds (seven pallets) significantly increased its operational readiness rate and helped it keep up with the battalion.

Intense maintenance and this reduced load resulted in the battalion's 24 M548s completing the 370-kilometer attack with no breakdowns. However, the additional maintenance and the extra burden on the HEMTTs call for replacing the 548s; HEMTTs would make excellent ammunition carriers.

HMMWV Maintenance. We found the HMMWV to be a reliable, sturdy vehicle with superb mobility. However, the rough terrain caused the generator mounting bolts to break, steering gearbox seals to leak and tires to flatten. The first two problems might be solved with more durable parts. The flat-tire problem could be solved by providing a spare tire mounted on a rim for all HMMWVs.

Many of our HMMWVs carried spare tires tied to 4x8 sheets of plywood on the tops of the vehicles, but we didn't have rims for most of the spares. We also carried extra cargo on the plywood, which significantly increased our HMMWVs' haul capacity.

"Dirty Battlefield"

Munitions that contain bomblets were a hazard to friendly troops. Dual-purpose improved conventional munitions (DPICM), multiple launch rocket system (MLRS) and Air Force cluster bombs left a dirty battlefield although only a small percentage of their sub-munitions were duds. We drove through areas previously hit by such munitions several times. Firing rounds with sub-munitions was a conscious risk because we wanted to achieve the effects possible from such weapons. Two of our howitzers and one M548 ran over duds that detonated and caused minor damage.

Several soldiers in the theater were injured when they handled the duds or accidentally stepped on them. Most maneuver personnel had never considered this potential hazard. Pre-war discussions and rehearsals brought the hazard to their attention. The obvious result is that DPICM might not be an appropriate shell choice for certain operations where high-explosive (HE) or Copperhead rounds can achieve the same results without leaving a dirty battlefield.

Chemical Protection

The last problem is wearing chemical protective overgarments (CPOGs). Concern over chemical attacks prompted our donning CPOGs before the air war began and then replacing them with our second suit when the ground war began. We stayed in mission-oriented protective posture gear (MOPP) Levels I or II for 59 days. We experienced the obvious discomfort of wearing the same outer garment for weeks, but one characteristic of the CPOG should change. We must modify the CPOG's charcoal lining so it won't rub off on the wearer. Daily showers weren't possible, and the charcoal coating made a bad situation worse. The good point was that we learned it was possible to wear CPOGs for 59 days.

The Most Important Lesson

There were other lessons that we and other artillerymen learned. They'll fill the pages of many editions of our Bulletin. Certainly some of our lessons were situation dependent. War in Europe or the Far Fast wouldn't be exactly like war in the desert. A more resolute enemy also would have made a profound difference.

All of us must learn from Desert Storm but be smart enough to selectively apply the lessons. With well-trained soldiers, good equipment and doctrine as a guide, We must select the appropriate course of action for each combat situation. That may well be the most important lesson of Desert Storm.

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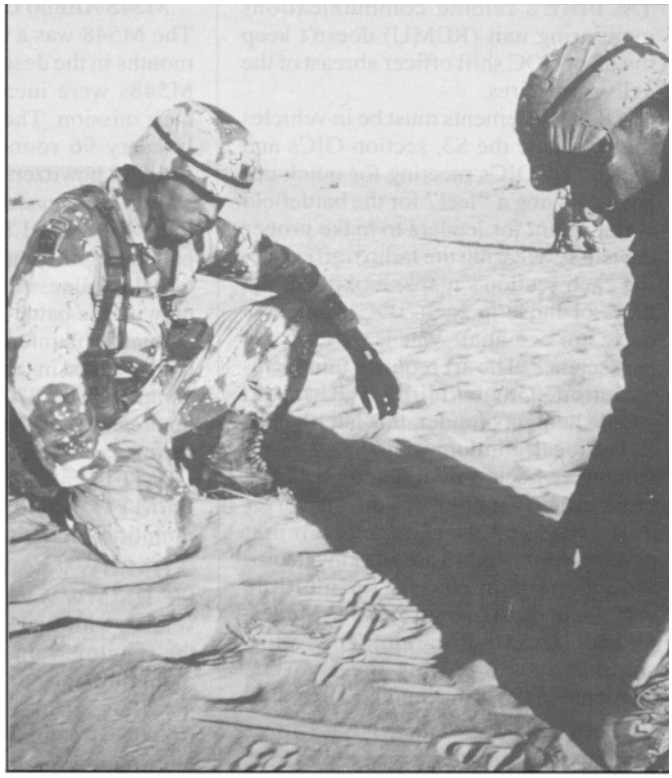
Company Fire Support Operations

by First Lieutenant John A. Ford and
Second Lieutenant William Lockard



Throughout Operation Desert Storm, Field Artillery (FA) played a critical role in the speedy victory. The 24th Infantry Division (Mechanized) relied heavily on its artillery assets to prepare and, in some cases, solely defeat objectives during its assault into the Euphrates River valley. At the basic level of artillery, the company fire support officer (FSO) and his fire support team (FIST) were at the heart of the battle and were responsible for triggering the effects of the FA.

FSOs in Desert Storm saw firsthand how fire support doctrine played out in AirLand Battle doctrine. We learned what did and didn't work and found new ideas for developing our teams. Hopefully, other FSOs and their teams can gain from our experiences.

With six months in the desert before the war began, there was time to wargame different ways to conduct fire support operations. Several areas proved to be of utmost importance: the FSO's relationship with his maneuver company, and the need for precise standing operating procedures (SOPs) and for several technical "tricks of the trade" to make operations run more smoothly.

The Maneuver Company

Once you, as the FSO, are attached to the maneuver company, you must become an active, contributing member. The company commander must realize the importance of your work and just what the FA can do for him—Desert Storm showed just how devastating the artillery can be. For example, our preparation fire on one of the 24th Infantry Division's brigade objectives, Jalibah Air Field, 270 kilometers into Iraq, was so massive that enemy prisoners of war (EPWs) later said they believed they were under a full scale air attack. These fires made it possible for elements of the 24th Division to roll up to the perimeter of the airfield without being detected.

In Desert Storm, we learned several lessons about FSO relationships with our maneuver companies that helped us provide this excellent fire support in combat. First, don't be intimidated by your maneuver commander. You're the fire support expert. When there's a question about company fire support, the FSO should have the answer. Tell the commander what you know—and then abide by his final decision.

This responsibility demands you be completely familiar with the capabilities of all artillery assets. Some will expect the FSO to rattle off facts and figures at a moment's notice. But don't be afraid to use references. A good FSO won't meet with the maneuver commander unless he has a copy of the *Fire Support Handbook (ST 6-20-20)* in his hip pocket.

Perhaps the best way to demonstrate expertise is by educating the maneuver unit. Key leaders must understand artillery capabilities and doctrine, and every soldier must know how to call for fire. With this knowledge, the unit will better understand how the artillery works

and have the skills to execute a fire support plan in the absence of the FIST.

When teaching calls for fire, try to make the classes simple and realistic. One method is to start with the basic immediate suppression mission. When the FIST isn't present, this is the type of mission a maneuver soldier will need the most. You can teach more advanced missions once the leaders and soldiers grasp the basics. If you're training in garrison, you can use the observed fire trainer for realism. However, we found the field environment also provides opportunities for realistic training. We traced a makeshift grid system on the ground. Then we simulated artillery rounds by throwing rocks at various "targets." We complemented this system by using AN/PRC-77 radios to give the soldier the feeling of talking to a fire direction center (FDC).

Your unit must have a basic understanding of FA capabilities and doctrine. But try to keep the discussions limited to what company-level personnel will have to deal with. In terms of capabilities, subjects should include weapon systems and the FIST vehicle (FIST-V). Doctrinal discussions must include topics such as artillery radio nets, target numbering systems and the FA organization for combat. In addition, key leaders need to understand the principles of the commander's intent and priorities of fire. These subjects help them understand why we fire artillery at certain targets and times.

Another subject which is critical for discussion among key leaders is the employment of the FIST-V and the FSO. Artillery is the most vital combat multiplier available to the company. The leaders must understand it's their job to provide security and protection for your vehicle. The FIST-V can be the commander's wingman when enemy contact isn't likely, but once in contact, the FIST-V must drop back to a concealed position where the FIST can best see the battle. In terms of FSO employment, the FSO needs to ride where he has quick access to all his assets. In other words, the FSO rides in the FIST-V.

It's important to establish with your company commander where you'll ride if your vehicle isn't mission capable. One recommendation is in the executive officer's (XO's) vehicle, either in the loader's hatch of an M1A1 Abrams tank or the gunner's hatch of an M2A1 Bradley fighting vehicle. We don't recommend the commander's vehicle because that puts too many company assets in one place. You then must discuss with the XO how much equipment you can carry in his vehicle. Take the time to prioritize the equipment needed for the mission and ensure your team and the XO rehearse the scenario.

Team Operations and SOPs

Desert Storm was a fast-paced operation that required FISTs to be well-rehearsed in all procedures. Every team needs to have a set of SOPs to use from receipt to completion of a mission. Each team will have a unique approach to collective tasks based on the size and individual abilities of the team. The following ideas are meant to serve as basic guidelines that you can refine to suit the capabilities of your team.

One method for easy dissemination of a fire plan is by using a company fire support matrix. A blank matrix written on a 5x8 index card works well. (See the example in the Figure 1.) The card is designed according to the needs of the unit. At a minimum, the card should contain a target list execution matrix and signal operating instructions (SOI). The target list negates the need for overlays that can be very time-consuming on extended and rapidly changing missions. You can put additional information on the card, such as the commander's intent, close air support (CAS) available and

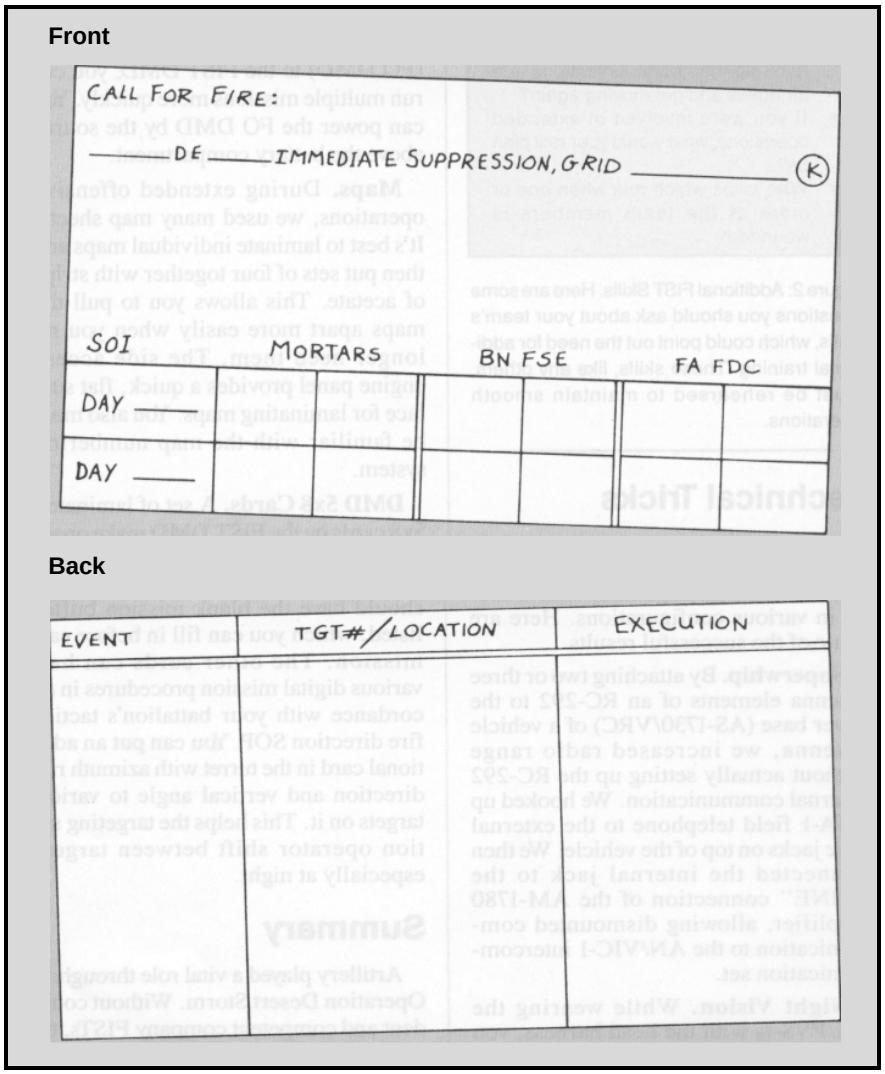


Figure 1: Example of a Company Fire Support Matrix on a 5x8 Index Card.

priorities of fire. This is the card the key leader will look at when he needs fires, so keep it simple.

The FSO and his NCO need to take the time to establish the procedures their team will use in a particular situation. An easy way to do this is to make a list of various scenarios and then list what each team member will do. A quick reference for these scenarios is the *Mission Training Plan For The FA Cannon Battalion Fire Support (ARTEP 6-115—20-MTP)*. Once a routine is established, it's absolutely essential to rehearse it so each team member fully understands his role in any situation. (For some additional team skills you need to develop, see Figure 2.)

- How well can your team operate the FIST-V while it's buttoned-up?
- How quickly can your team stop the vehicle, don their protective masks, hook up their communications and air hoses and get moving again?
- If you were involved in extended operations, what would your rest plan be?
- Who takes which role when one or more of the team members is wounded?

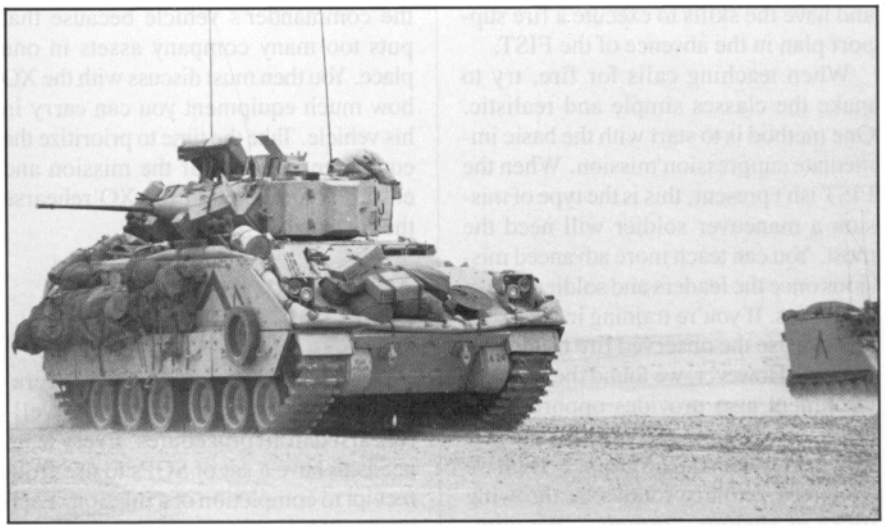
Figure 2: Additional FIST Skills. Here are some questions you should ask about your team's skills, which could point out the need for additional training. These skills, like any others, must be rehearsed to maintain smooth operations.

Technical Tricks

The length of Operation Desert Shield allowed us time to experiment with FIST-Vs in various configurations. Here are some of the successful results.

Superwhip. By attaching two or three antenna elements of an RC-292 to the lower base (AS-1730/VRC) of a vehicle antenna, we increased radio range without actually setting up the RC-292 external communication. We hooked up a TA-1 field telephone to the external wire jacks on top of the vehicle. We then connected the internal jack to the "LINE" connection of the AM-1780 amplifier, allowing dismounted communication to the AN/VIC-1 intercommunication set.

Night Vision. While wearing the AN/PVS-7s with the head harness, you can use a hand-held AN/GVS-5. This allows for magnified night vision and nighttime lasing capabilities.



An M2A1 Bradley moves out in Desert Storm. If the company FSO has to ride in a Bradley, one recommendation is to ride in the gunner's hatch of the company executive officer's vehicle.

Dual Digital. By running a wire from a forward observer digital message device (FO DMD) to the FIST DMD, you can run multiple missions more quickly. You can power the FO DMD by the source above the battery compartment.

Maps. During extended offensive operations, we used many map sheets. It's best to laminate individual maps and then put sets of four together with strips of acetate. This allows you to pull the maps apart more easily when you no longer need them. The side access engine panel provides a quick, flat surface for laminating maps. You also must be familiar with the map numbering system.

DMD 5x8 Cards. A set of laminated 5x8 cards by the FIST DMD make operations more efficient. The top card should have the blank mission buffers listed, which you can fill in before each mission. The other cards can have various digital mission procedures in accordance with your battalion's tactical fire direction SOP. You can put an additional card in the turret with azimuth ring direction and vertical angle to various targets on it. This helps the targeting station operator shift between targets, especially at night.

Summary

Artillery played a vital role throughout Operation Desert Storm. Without confident and competent company FISTs, the FA wouldn't have been as effective as a combat multiplier.

While serving in Southwest Asia, we learned many lessons about conducting FIST operations. Above all, the FSO's ability to work with his maneuver commander is key to success. You must establish a habitual relationship with your company commander. Also, you need working SOPs. With the non-stop pace encountered in the Southwest Asian desert, there's no time to have doubts about what each team member must do. So train and rehearse now. Finally, with seven months in the field, we discovered many tricks of the trade to help FISTs run more efficiently.

What your FIST does or doesn't do can have tremendous impact on the FA's effectiveness and, more immediately, the effectiveness—even survivability—of your maneuver company. We hope that new FSOs will benefit from our experiences and help continue the FA's tradition of awesome firepower, on time and on target.

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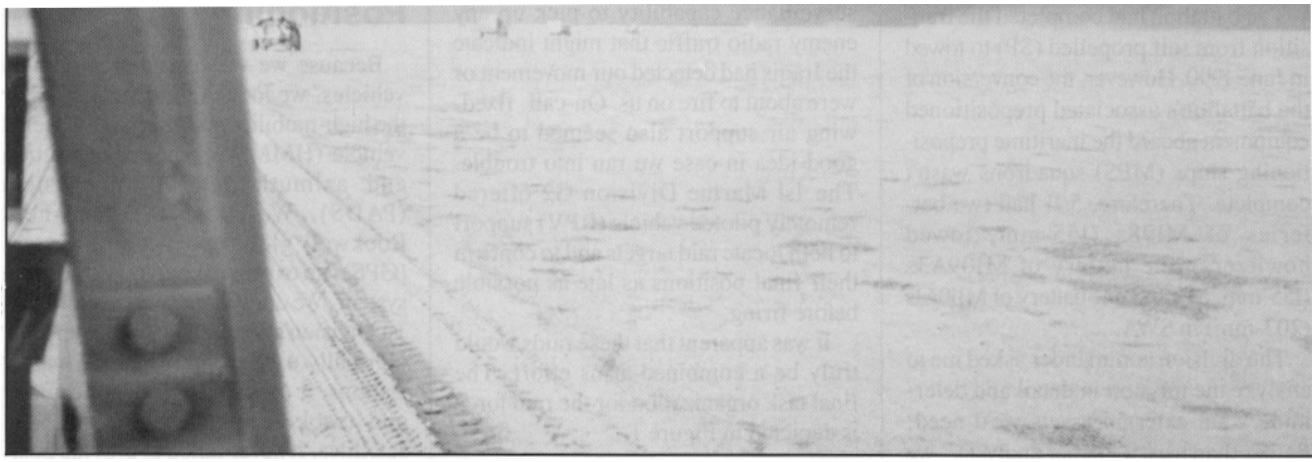
Second Lieutenant William Lockard, assigned to the 3d Battalion, 41st FA, was an FSO attached to D Company, 3d Battalion, 15th Infantry during Desert Shield. He's currently a Company FSO for 3-41 FA at Fort Stewart.



CW4 Kenneth D. Brooks

Artillery Raids in Southwestern Kuwait

by Lieutenant Colonel James L. Sachtleben, USMC

The artillery raid has been an insignificant "footnote" during my two tours as a student at the Field Artillery School, Fort Sill, Oklahoma, and 10 years in Fleet Marine Force (FMF) artillery organizations. It receives little mention in print or professional discussions among artillerymen. In fact, the only mention of it I've been able to find in our doctrinal publications is in *TC 6-50 Field Artillery Cannon Battery*, and that deals strictly with the air assault raid. As a battery commander, I don't recall ever training for the raid mission, and as the commander of 5th Battalion, 11th Marines, I never thought it significant enough to warrant dedicated training time—that is, until we deployed to Southwest Asia (SWA).

This article describes how the artillery raid was transformed from an insignificant footnote to a significant combat multiplier in Operations Desert Shield and Storm.

During early January 1991, the commanding general of I Marine Expeditionary Force (I MEF) decided that ground forces would be involved in pre-G-Day operations to deceive and disrupt Iraqi forces operating in the defensive belts along the southwestern Saudi-Kuwaiti border. As the 1st Marine Division analyzed its portion of this mission, the artillery raid seemed tailor-made for the situation. It allowed for surprise, maximum destruction of enemy equipment and a certain psychological impact on the Iraqi troops. If conducted from Saudi Arabia, we could accomplish all this without the political ramifications of having ground forces conduct cross-border operations before G-Day.

Forces

As the 1st Division Commander discussed the mission with the commanding officer of the 11th Marines (the division's artillery regiment), it became apparent that the logical unit for the raid mission was the 5th Battalion, 11th Marines (5/11), the division's general support (GS) battalion.

This was true for two reasons. First, as the GS battalion, 5/11 had more positioning flexibility than the direct support (DS) battalions that had to remain in a position to provide fires for their supported maneuver task forces. Secondly, 5/11 had an M109 battery. At this point, because we still respected the Iraqi counterfire capability, it seemed wise to employ the

M109 battery because of its overhead protection, on-board ammunition storage and rapid displacement capability.

The battalion had completed the transition from self propelled (SP) to towed in June 1990. However, the conversion of the battalion's associated prepositioned equipment aboard the maritime prepositioning ships (MPS) squadrons wasn't complete. Therefore, 5/11 had two batteries of M198s (155-mm, towed howitzers) one battery of M109A3s (155-mm, SP) and one battery of M110A1s (203-mm) in SWA.

The division commander asked me to analyze the mission in detail and determine what external assets we'd need. Rather than trust a "paper analysis," we ran through some practice missions to determine what our needs would be.

Security for the raid force became the most obvious. Fortunately, Task Force (TF) Shepherd, composed of elements of the 1st and 3d Light Armored Infantry (LAI) Battalions was already screening in our proposed operating area. TF Shepherd provided a company for security and a very close relationship developed. The commanding officer of Company B of TF Shepherd was integrated into the planning effort early-on and provided invaluable assistance both during planning and execution of the raids. This close association was to prove valuable later on as 5/11 supported TF Shepherd during a pre-G-Day Iraqi spoiling attack and, again, during the attack into Kuwait.

We also needed help moving our SP howitzers over the long distances from the battalion's position area to the final raid assembly area. Reliable navigational aids were a must. We'd be operating well outside the position, location and reporting system's (PLRS') range, and accurate information was critical.

We asked for an electronic warfare surveillance capability to pick up any enemy radio traffic that might indicate the Iraqis had detected our movement or were about to fire on us. On-call, fixed-wing air support also seemed to be a good idea in case we ran into trouble. The 1st Marine Division G2 offered remotely piloted vehicle (RPV) support to both locate raid targets and to confirm their final positions as late as possible before firing.

It was apparent that these raids would truly be a combined-arms effort. The final task organization for the raid force is depicted in Figure 1.

Training

After receiving a warning order from the 11th Marines Commander, Sierra Battery began training for the raid mission. Because we had yet to receive a specific target for the first raid, the battery only had my commander's intent: be prepared to move under an LAI screen during hours of darkness to a point within one or two kilometers of the Kuwaiti border, fire approximately 15 rounds per howitzer at a high-value target and withdraw when rounds are complete. Some restrictions applied: no lights would be used—no vehicle blackout lights, flashlights or collimator lights; VHF radio silence was imposed; no advance party would be used; no soft-skinned vehicles would go forward of the final assembly area; and speed was essential.

Battery S honed skills to perfection, and soon it was occupying in complete darkness in less than half the Marine Corps combat readiness evaluation (MCCRE) time standard for daylight occupation.

Raid Force

Two Batteries 5/11*
Company B, TF Shepherd (LAI)
Detachment, 3d Assault Amphibian Battalion
Detachment, Motor Transport Battalion, 1st FSSG (HETs)
Detachment, Communications Company, 1st Marine Division (GPS and SATCOM)
Detachment, 1st Radio Battalion, 1st Surveillance, Reconnaissance and Intelligence Group (Mobile Electronic Warfare Surveillance)

Supporting Forces

On-Call Fixed Wing Air Support (Close Air and Electronic Warfare Support)
On-Call MEDEVAC Helicopters

*Assignments rotated between the four firing batteries of the battalion.

Figure 1: Raid Force Task Organization of 5/11.

In addition, the battery employed several innovative techniques.

Positioning

Because we wanted no soft-skinned vehicles, we looked for a substitute for the high-mobility multipurpose wheeled vehicle (HMMWV)-mounted position and azimuth determining system (PADS). We chose the hand-held Rockwell global positioning system (GPS), an expensive but totally reliable system. We drew it and an operator from 1st Division's communications company. Normally used to survey PLRS master stations, it provided 10-meter accuracy and tracked up to 16 navigational satellites. It never failed to provide positioning data.

A reliable navigational aid was critical in helping the raid force move into position in the darkness. Just imagine the challenge of navigating across as much as 25 miles of trackless desert on a moonless night with your ultimate destination within one or two kilometers of enemy territory. The reliability of the Rockwell GPS was worth the price. We could have used cheaper, more readily available GPS models, but they occasionally suffered outages due to bad satellite "health" or signals interference. We simply couldn't take the chance.

Directional Control

With its 10-meter accuracy, the Rockwell GPS was good enough for establishing battery location but not good enough for establishing an accurate known direction for laying the battery. So the battery trained for two methods of lay. The first option, if stars were visible, was celestial. If there were no visible stars, the battery laid magnetically.

Celestial skills were honed to perfection. A computer program was used to determine azimuths to easily identifiable stars. In a few days, the battery was establishing directional control in less than one minute, and accuracy, when compared to PADS, checked within one mil. The battery used the magnetic method of lay as a backup to celestial when stars were obscured by clouds or oil smoke. We established a declination station using PADS at the final assembly area to ensure that aiming circles were as accurate as possible.

Because speed was essential, howitzers were positioned in very close proximity to each other, expediting the laying

process. This also simplified control and provided a good, tight position, making it easier for the LAI company to provide security.

Security

Company B of TF Shepherd provided a screen from the final assembly area to the firing point and cover while the battery was in position. The night vision and superb weapons capabilities of the light armored vehicle (LAV) were invaluable. They spotted enemy movement and provided covering fires as the battery withdrew after its first raid. Additional security was provided by the .50 caliber and MK19 machineguns mounted on the M109s.

Providing another layer of security and adding to the combined-arms nature of the raids was fixed-wing aviation from the 3d Marine Aircraft Wing. Under control of Company B's forward air controller (FAC), EA-6B Prowlers jammed Iraqi ground surveillance radars as soon as the raid force entered a radar capabilities fan and continued jamming until the raid was completed. F/A-18, AV-8B and A-6E strike aircraft were on call to provide support if the raid force ran into trouble and to attack certain targets in coordination with the artillery when it was appropriate. The F/A-18s were exceptionally valuable in a later raid as we refined concepts and devised more innovative methods.

Meteorological Support

We needed accurate meteorological data if our fires were to be effective. It would have been very simple to "fly a Met" balloon in the position area near Al Qaraah before the raid force departed, but the accuracy would have been poor for two reasons. Some of the raids were conducted as far as 70 kilometers from Al Qaraah, and the raid force often departed as early as eight hours before the scheduled firing times. The separation in both time and distance would have rendered the Met useless.

The solution was for the raid force to take the meteorological data system (MDS) as far as the final assembly area, usually 10 to 15 kilometers from the planned firing point. In the assembly area, MDS set up and ran a Met, and delivered the data to the battery fire direction centers (FDCs) before they departed for the firing points.

The only problem we encountered with Met was one instance when the MDS tracking frequency was jammed as a Met balloon was being flown, causing us to loose the top three lines of Met data. We confirmed the jamming was coming from the Iraqis and devised procedures to work through the jamming should it happen again. We weren't jammed again on a raid, but interference with Met frequencies was a common occurrence in several Marine Corps artillery units.

Communications

The raid force used only limited communications. Checkpoints were reported and emergency messages, such as mission abort codes, were the only traffic passed. Because of the very long distance involved, the raid force commander's only link to higher headquarters was via satellite communications (SATCOM) to the division forward command post (CP), initially some 75 miles away. SATCOM was used to report the occurrence of key events on the execution checklist (see Figure 2) and to confirm target location just before the force departed the final assembly area.

Command and Control

When we added a second firing battery to the raid force, we also added a command element to control the activities of the two-battery force. The command element had to be very small and light. It consisted of the battalion commander or executive officer as the raid force commander, a driver, the battalion sergeant major (doubling as radio operator and navigator) and the SATCOM radio operator. The command element led the raid force to the final assembly area and reported, as necessary, to the division forward CP via SATCOM.

All raids were well-rehearsed and timelines were established, based on detailed time and distance studies. Radio transmissions from the command element to the raid force were seldom needed. All required actions were executed on the established timeline, and radios were used only by exception. This detailed planning proved to be the key to success.

Logistics

The raid force carried only essential items, including only enough artillery ammunition for one mission. Medical evacuation (MEDEVAC) helicopters were on strip alert. Two assault amphibian vehicles (AAVs) were part of the raid force; one carried the FDC, and one was a MEDEVAC vehicle.

To reduce the chance of breakdown, the raid force used heavy equipment transporters (HETs) to move the tracked vehicles from the initial battalion position in the vicinity of Al Qaraah to the final assembly area. The 1st Force Service Support Group (1st FSSG) provided the HETs, and although their operators weren't specifically trained for such a tactical mission, they performed very well.

Special care had to be taken, however, because some of the tractors were commercial vehicles provided by the Saudis. They had no blackout systems, so the raid force had to disconnect electrical wires to prevent the inadvertent illumination of a brake light or the honking of a horn at a time when the enemy could detect it.

On 18 January, 5/11 moved from its position 30 kilometers south of Safaniya, Saudi Arabia, to the vicinity of Al Qaraah (see Figure 3). Al Qaraah was to later become quite a busy place, occupied by most of 1st Division and a sizeable combat service support detachment. However, when 5/11 first arrived, there were only empty revetments built by Seabees in anticipation of the coming "population explosion." We were very glad to see the revetments because of the security they provided. At the time, there were no other units in the vicinity except

Codeword	Event
Apple	Raid Force arrives in Assembly Area
Orange	Raid Force at Firing Position
Peach	Target Confirmed
Cherry	Commencing Attack
Grape	Withdrawing Raid Force
Banana	Mission Complete; Returning to Battalion Position Area
Chicken Hawk	Mission Abort

Figure 2: Sample Artillery Raid Execution Checklist of 5/11.

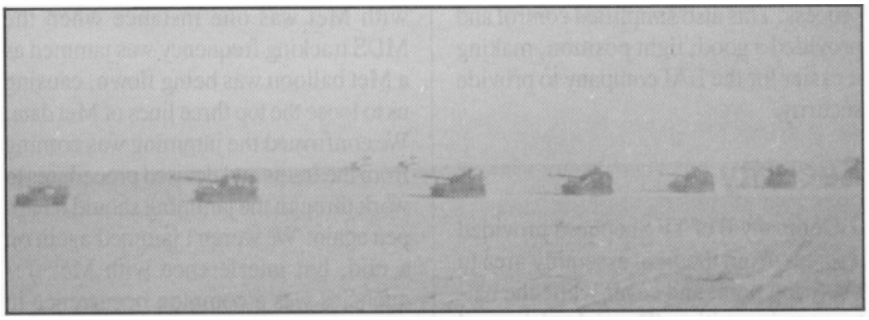
TF Shepherd, which was screening to the north. The remainder of the division was still at least 75 miles to the southeast.

We settled into the revetments, made liaison with TF Shepherd and waited for our first mission. It came on 23 January.

The Raids

Raid 1: The Police Post at Qalamat. The target was an Iraqi infantry brigade CP near Al Manaqish. To range the targets, the battery had to be near the border, in this case, very close to the Kuwaiti border police post at Qalamat, which was occupied by Iraqi troops. Because of the possible threat from the police post, Battery Q (M198) was added to the raid force to fire on enemy positions closest to Battery S.

After midnight, both batteries moved out under LAI screen for their firing points. Battery Q stopped, laid the howitzers and waited for Battery S to occupy its position near the berm that marked the border. Battery S started firing as soon as possible after arriving in position. The first rounds went down range at 0053, just seconds off the time estimated in the plan. Battery Q fired as soon as it saw Battery S's muzzle flashes. A 5/11 forward observer posted on top of the berm spotted enemy activity at another location and quickly shifted Battery Q's fires.



USMC M109A3 howitzers move out for a staging area.

A very unlucky group of Iraqis had just driven into the target area when Battery Q's rounds impacted on the second target. The dual-purpose improved conventional munitions (DPICM) destroyed three vehicles and caused two others to disperse very rapidly. One hapless Iraqi drove across the border into Saudi Arabia and into Company B's machinegun fire. We couldn't believe the success we were having but decided to cut it short when mortar rounds started falling on the friendly side of the berm near Battery S. We shifted Battery Q's fires to a third target, a suspected D-30 battery, and as S Battery withdrew, the FAC with B Company called in a pair of F/A-18s with Rockeye bombs on the brigade CP and the police post just for added security.

We had agreed early-on that enemy incoming would be cause to abort the mission, at the battery commander's discretion. The assets were too valuable and the ground war hadn't even started yet; we could raid again another day.

Raid 2: Police Post at Umm Hujul. This was really not an artillery raid but an LAI raid with artillery in direct support, or as it came to be known, the "drive-by-shooting." The same division fragmentary order that established the 5/11 as the raid force also tasked 5/11 to be prepared to support TF Shepherd in any raids it might execute. The raid on the police post at Umm Hujul was such a raid.

Considerable Iraqi activity had been noted near the police post, and the raid was intended to disrupt enemy activity, spoil his intelligence-gathering efforts and discourage any further buildup in the area. The concept was very simple. TF Shepherd slipped up to the border and fired on the police post with mortar and 25-mm cannons while 5/11 isolated the objective area by firing on an enemy position behind a low ridgeline just to the east of the post. The police post and adjacent positions were heavily damaged, and the raid force received no return fire from the Iraqis.

Raid 3: SIGINT Near Umm Gudair. Iraqi signals intelligence (SIGINT) and ground surveillance radars in the vicinity of the Umm Gudair oil field were the

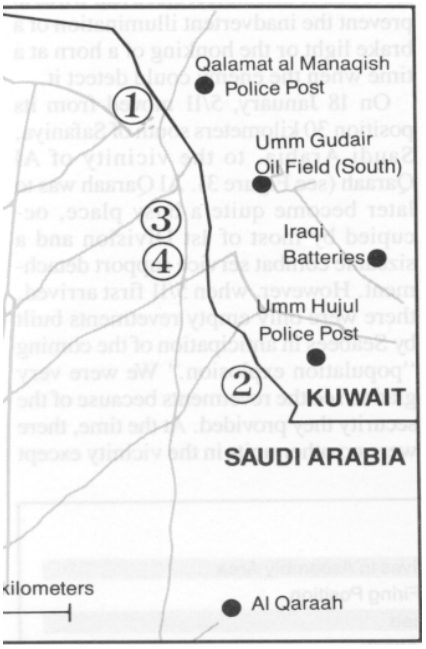
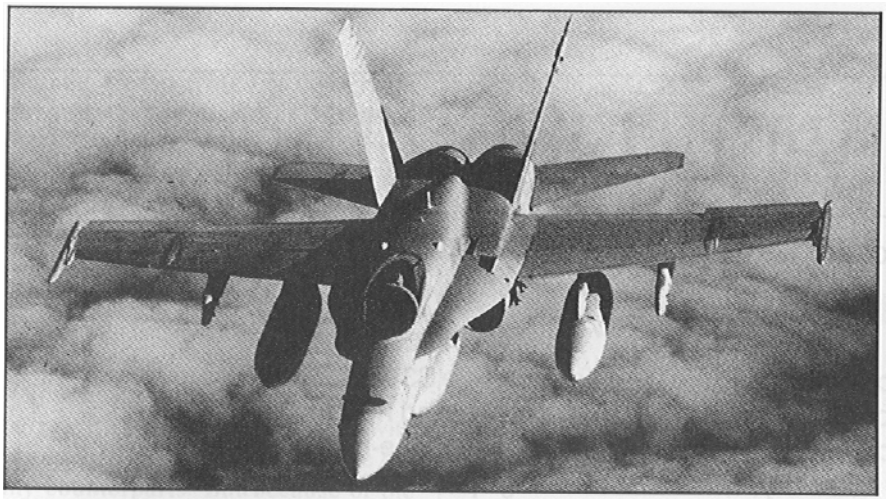


Figure 3: Batteries of 5/11 participated in four artillery raids to help deceive Iraqis as to the location of IMEF's intended attack into Kuwait. The very successful raids also demoralized the Iraqi forces in the defensive belts along the Kuwaiti border.

An 11th Marines M198 howitzer in Desert Storm, the same type of howitzer Q Battery, 5/11, used in Raid I.



An F/A-18 aircraft in flight. A pair of F/A-18s dropped Rockeye cluster bombs on Iraqi targets in two of the 5/11 raids.

target of this raid. Battery T, the M110A2 battery, and Battery Q, an M198 battery, had the mission. We needed DPICM for these targets, but one was outside the range of the M109 and M198. The 22,500-meter range of 8-inch DPICM, as compared to the 17,500 meters of the M109 and M198, proved invaluable here as well as later in the ground campaign.

I was a little concerned about the M110A2 as a raiding piece. Its slower rate of fire and longer emplacement times meant the battery would be in position longer and, thus, at a greater risk from counterfire. However, the larger payload of the 8-inch as compared to the 155-mm DPICM meant the battery could fire fewer rounds and achieve equal or greater effects. Also, by this time, we started to question the Iraqi counterfire capability.

We had taken mortar rounds on the first raid, but there was no evidence the Iraqis could find us with anything other than forward observers in frontline infantry units who could spot our muzzle flashes. We trusted the EA-6Bs to handle the Iraqi ground surveillance and counterbattery radars, and they obviously did. But why were the Iraqis so ineffective with the sound-ranging systems that were supposed to be so good? We weren't sure, but our confidence was growing. We decided to fight the urge to stay and shoot all night and continued to "shoot and scoot." The real ground war was still days away, and we couldn't afford to risk assets needed later.

Raid 4: Iraqi Batteries. This one appeared to be the most effective—it was a true combined-arms effort. The targets were two Iraqi artillery batteries. Two M198 batteries (Q and R) conducted the raid, again moving into position under an LAI screen. The idea was to stay in position longer than on previous raids, fire more rounds and see if we could draw some Iraqi counterfire for the F/A-18s to attack. We did no electronic jamming with the EA6Bs. This time we wanted the Iraqi ground surveillance and counter-battery radars to find us.

It was a calculated risk, but we had analyzed the enemy artillery in the area and were pretty sure he couldn't range us with his systems. We were firing rocket assisted projectiles (RAP), giving us greater standoff distance and reducing his chances of ranging us.

The plan worked *beautifully*. Shortly after our rounds impacted, we saw his artillery lighting up in counterfire. It appeared to be rockets, and we assumed it to be Astros multiple rocket launchers (MRLs). The airborne FAC spotted the flashes immediately, and within seconds, the Iraqi rocketeers were visited by a pair of screaming F/A-18s delivering Rockeye. Because of the flat terrain, we could see the Rockeye impacts from our battery positions. It was heartwarming, especially knowing that the targets the Rockeyes were hitting had been trying to put rockets on *us*.

After 10 February, we stood down from the raid mission and rejoined the rest of the 1st Division, moving into Al Qaraah and making final preparations for the attack into Kuwait. The raids had been very demanding on both personnel and equipment, and we needed at least a short rest.

Results of the Raids

The goals of the raids were to deceive the enemy as to the location of the coming attack and destroy the morale of the Iraqi forces in the defensive belts along the border. In the context of the very successful attack into Kuwait, the raids accomplished their goals. Although the raids were a small part of the overall deception plan, they can't be gauged by the amount of damage they inflicted on the enemy. The raid force appeared in the middle of the night and fired from positions the enemy had every right to believe were unoccupied. This had to shake his confidence in his intelligence capabilities.

Target surveillance by RPVs and other assets showed the raid fires, with rare exception, to be very accurate. While the Iraqi target acquisition capability grew more suspect, their frontline troops were being subjected to fires that were accurate to a degree they couldn't comprehend.

The coordinated counterfire effort between artillery and aviation displayed in the fourth raid undoubtedly had a demoralizing effect on Iraqi artillerymen.

Was it partially responsible for the complete inability of the Iraqis to mount a counterfire threat or to mass fires later during the attack into Kuwait? This question can only generate speculation, of course, but put yourself in the place of the Iraqi rocketeers: they fired a counterbattery volley in response to our artillery fires, and within seconds of their first and only volley, they were hit by very effective aviation ordnance. Their morale *undoubtedly* suffered.

It'll remain difficult to quantitatively measure the effects of these artillery raids. But there's no doubt that during Operation Desert Storm the previously insignificant artillery raid became a very significant combat multiplier.

Lieutenant Colonel James L. Sachtleben commands the 5th Battalion, 11th Marines, 1st Marine Division, Marine Corps Air/Ground Combat Center, Twentynine Palms, California, which he deployed to Operations Desert Shield and Desert Storm. He also has commanded an M109 battery and a headquarters and service company. He has served as S4, 2d Battalion, 10th Marines, and Weapons Employment Officer, 2d Marine Division, both at Camp Lejeune, North Carolina; Plans Officer, US Central Command at MacDill AFB, Florida; and as deputy G3, 7th Marine Expeditionary Brigade, Twentynine Palms.

100 Hours with Light TACFIRE

by Captain Richard A. Needham and Major Russell Graves

"This is going to be close," the 142d Field Artillery Brigade S3 said, "I can't believe it. We've been working on this prep for more than a week, and now *this*."

The brigade S3 had good reason for concern. The two-and-one-half-hour preparation fires to support the 1st Infantry Division's breaching operations into Iraq planned for ground war day plus one (G+1) had been changed to a one-half-hour prep and moved up a day. The division's current G-Day advance had gone faster than expected.

The preparation started in less than an hour. Both 142d Brigade cannon battalions were still moving and wouldn't be in place for at least 30 more minutes.

Deleting the two-and-one-half-hour preparation, the brigade operations cell recomputed the fire plan from a completely new target list. The sweat beaded on the Assistant S3's forehead as he shouted orders and coached the operations section to complete the computations—thank God for light TACFIRE (LTACFIRE). He had reason to sweat—this wasn't another exercise or Army training and evaluation program (ARTEP), it was combat in Operation Desert Storm.

A few short weeks ago, the task would have been impossible. The brigade would have computed the preparation manually and then sent the information to the battalions by voice communications. The battalions then would have sent it to their firing batteries by voice. At each battery fire direction center (FDC), the battery computer system (BCS) would have computed the data and sent it to the guns. But there wasn't time for that now.

The minutes ticked by too fast. Suddenly the radio broke squelch on the brigade command fire net 2 (CF2). It wasn't voice . . . it was the eerie sound of digital communications. The operations section started transmitting the preparation to the moving battalion tactical operations centers (TOCs).

As the battalion acknowledgements ("Acks") came resounding back, the S3 smiled for the first time in hours. "That has to be the sweetest sound in the world right now," he said.

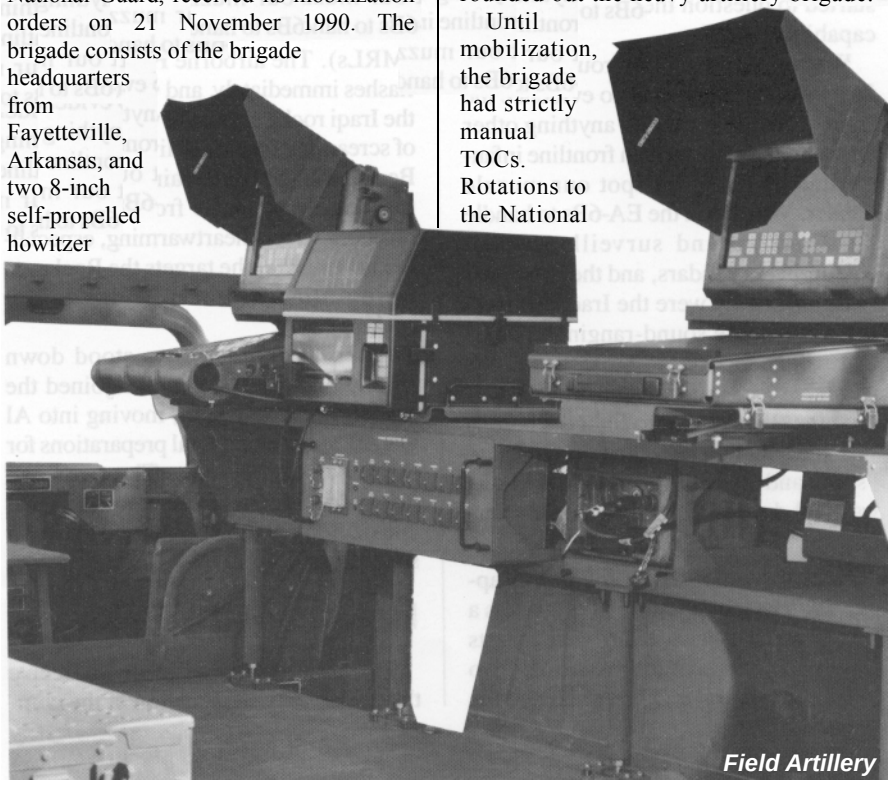
Minutes later, a printer came alive in the operations van. AFU:UPDATES (ammunition and fire unit updates) from the battalions started coming in. Everyone watched the clock and held his breath. The concussions rocked the vans before the radio announced, "Shot Over."

The S3 looked up from his watch—"Right on time."

LTACFIRE had passed the first of many tests it would face in the next 100 hours.

The 142d FA Brigade, Arkansas Army National Guard, received its mobilization orders on 21 November 1990. The brigade consists of the brigade headquarters from Fayetteville, Arkansas, and two 8-inch self-propelled howitzer battalions: the 1-142d FA and 2-142d FA, from Harrison and Fort Smith, respectively. The 1-158th FA (MLRS) from the 45th Oklahoma National Guard Division, Lawton, Oklahoma, rounded out the heavy artillery brigade.

Until mobilization, the brigade had strictly manual TOCs. Rotations to the National



Training Center (NTC) at Fort Irwin, California, with the 1st Infantry Division (Mechanized) and the 3d Armored Cavalry Regiment (ACR) had uncovered a serious flaw in the Army's Total-Force concept. Manual TOCs don't have a place in the digital realm. Heavy TACFIRE-equipped units don't have the time or assets to interface with manual TOCs.

To keep up during NTC rotations, we borrowed a heavy TACFIRE system with operators to interface with our active Army counterparts. But because of the deployment of artillery units to the Persian Gulf, we couldn't "borrow" heavy TACFIRE systems with operators.

Getting LTACFIRE

The brigade's only hope was to find enough LTACFIREs for the brigade headquarters and two battalion TOCs. The search began immediately. Litton, the LTACFIRE manufacturer, sent instructors to train our operators with LTACFIREs on loan. On 10 December, the search ended. Then on 28 December, less than a month before we deployed to Southwest Asia, the equipment arrived.

The LTACFIRE briefcase terminals (BCTs) are very lightweight, mobile and self-contained. They require only a printer as a peripheral device. The BCT operates with either a commercial or a heavy TACFIRE's electric line printer (ELP). One much needed peripheral device was a separate keyboard. Without the keyboard, our operators would have to perform all operations by finger-pushing the screen, much like the digital message (DMD) device. This slows down most operations, especially plain-text messages (PTMs).

The BCTs at the operations and counterfire cells have marked advantages over the variable format message entry device (VFMED) in the heavy TACFIRE system. The BCT's software contains its own message formats and memory storage files, alleviating reliance on the FDC computer for this capability.

Their ability to operate independently of the FDC computer added redundancy to our operations. When problems occurred with one BCT, another could do its tasks with minimum loss of operational capabilities. This reduced the likelihood of operating in a degraded mode.

At the brigade TOC, each BCT had four modems or net capabilities, except the counterfire BCT, which had two modems. This allowed the brigade TOC to operate on 14 separate digital nets, either directly or through the relay function.

We were breaking new ground. To our knowledge, we were the only brigade-sized unit to use LTACFIRE.

Initially, we operated by trial and error. We first configured the BCTs for TOC operations. The package we received included one dual-station and six single-station BCTs. Our young group of soldiers, specialists through staff sergeants, trained intensively at Fort Sill, Oklahoma, to learn to operate the LTACFIRE system.

Interfacing with Heavy TACFIRE

The first critical problem was to interface with heavy TACFIRE. Our battery BCSs were using Version 9 software tapes, and Litton conducted our LTACFIRE training with Version 9 software. But the already deployed VII and XVIII Corps were using Version 7 software, which wouldn't interface with our Version 9 tapes.

The LTACFIRE's current Version 5 software was inadequate. While it could interface with heavy TACFIRE's Version 7, it had serious shortcomings in its capabilities. Litton developed Version 8.5 software for us, which was a revision of LTACFIRE's Version 8 software that was never fielded. By deployment time, it was approved for our use. Although it isn't as good as Version 9, it interfaces well with heavy TACFIRE systems.

One major shortcoming of Version 8.5 is it doesn't have the capability to operate as a division artillery (Div Arty) or brigade computer system. Therefore, the brigade FDC had to operate as a "battalion" computer. The Version 8.5 software did include an FM;CENTER file, allowing us to mass fires.

Another software deficiency for the brigade FDC computer was the lack of an artillery target intelligence (ATI) memory storage capability. This meant we had to rely on a heavy TACFIRE computer for our ATI data storage. Message formats and some terminology with LTACFIRE was slightly different than heavy TACFIRE's, but posed little difficulty.

The training culminated in two rigorous command post exercises (CPXs) integrating LTACFIRE with BCS, multiple launch rocket system's (MLRS') fire direction system (FDS), Firefinder radar, meteorological data system (MDS) and heavy TACFIRE. With help from Fort Sill's III Corps Artillery, we digitally integrated all these systems into the CPXs. As the exercises progressed, we found more to do to increase our proficiency before deploying. The decision to transport LTACFIRE with our troops by air instead of shipping it with the other equipment gave us more time to solve problems.

The brigade soldiers' knowledge of manual gunnery helped them learn LTACFIRE. All they needed to learn was the technical aspects of the system. These dedicated soldiers spent long hours of their own time to hone their digital skills.

As the deployment deadline quickly approached, we made changes daily. When something didn't work, we changed it. When it worked, we added it to our newly developed standing operating procedure (SOP)—see Figure 1 for the LTACFIRE configuration we settled on.

142d Brigade TOC
- FDC: One Dual-Station BCT
- Counterfire: One Single-Station BCT
- Operations: One Single-Station BCT

Cannon Battalion TOC (Times Two)
- FDC: One Single-Station BCT
- Operations: One Single-Station BCT

Figure 1: This is the LTACFIRE configuration the 142d FA Brigade settled on for deployment after much training and trial and error.

The brigade FDC controlled all fire mission processing along with digital communications to higher, lower and supporting FDCs. The brigade operations cell processed all fire plans and command and control information to the battalions. The brigade counterfire cell handled the expected high volume of targets generated by Firefinder's Q-36 and Q37 radars.

All things worked well, resulting in a highly trained crew and a good TACFIRE SOP. Now, after shedding their regular professions as college students, farmers, accountants and lawyers to "Answer the Call," these digitally trained civilian soldiers were ready to help defeat Saddam Hussein's army.

On 8 January 1991, we packed the BCTs for shipment. Thanks to LTACFIRE's

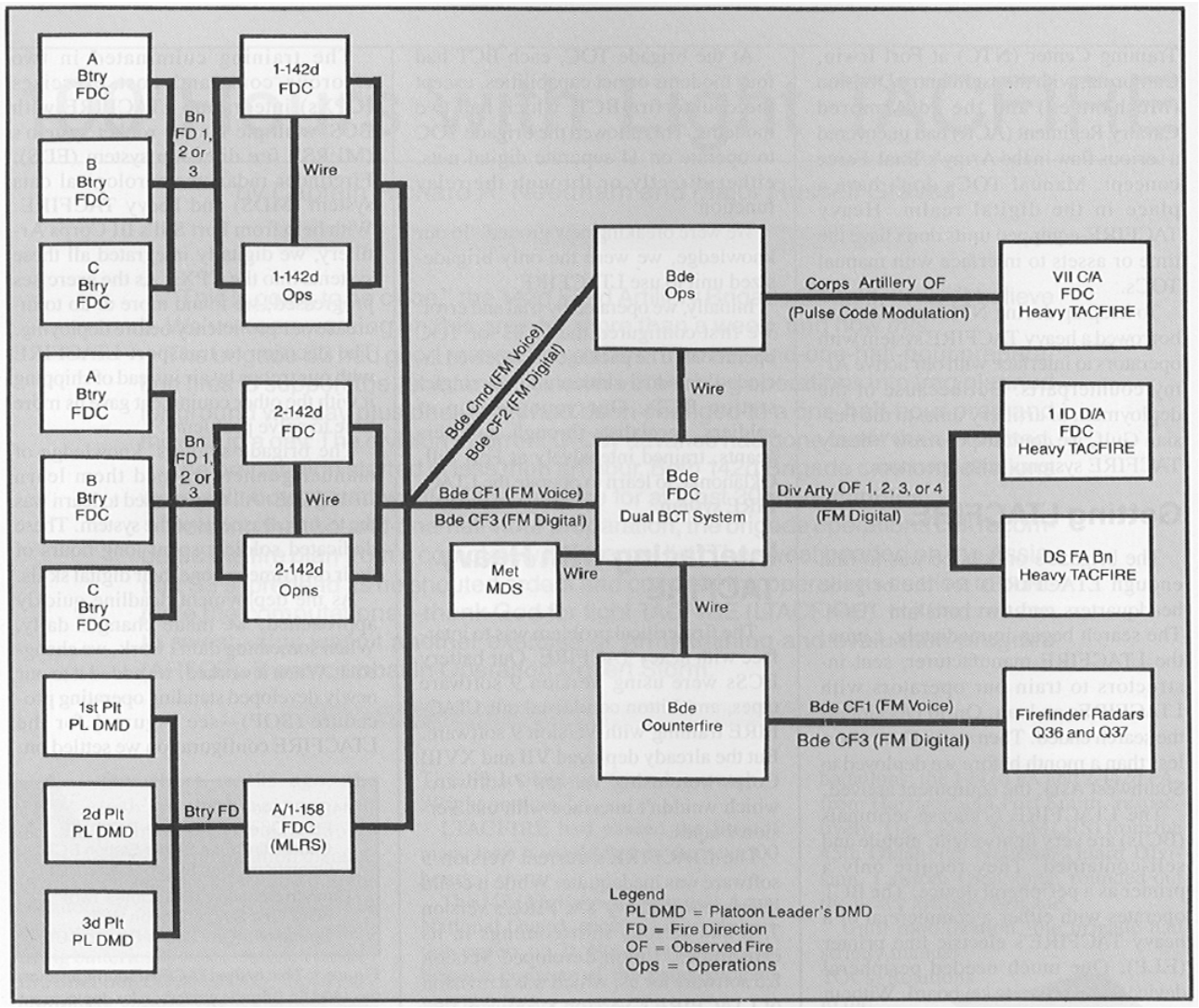


Figure 2: The 142d FA Brigade's Communications Net. At TAA Hawg, before linking up with the 1st Infantry Division, the brigade finalized its LTACFIRE-Heavy TACFIRE digital communications structure.

being "user-friendly," we completed the initial training in about a month, a feat that usually takes 13 weeks for heavy TACFIRE operator training. The credit goes to the quality of our soldiers and help from III Corps Artillery and Litton. They did everything in their power to help us acquire the equipment and provided training materials and technical expertise on short notice.

Deploying with TACFIRE

The brigade deployed to Saudi Arabia in mid-January 1991. Carefully, the soldiers loaded the LTACFIRE crates on 5-ton trucks and transported them more than 300 miles northwest to Tactical Assembly Area (TAA) Hawg. There we installed the BCTs in the vehicles that would carry them into battle. (We didn't install the BCTs at Fort Sill because we had to ship the vehicles before we received LTACFIRE.)

Never having LTACFIRE BCTs mounted in expandable vans, our soldiers installed them in one day, to include establishing the digital communications with the VII Corps Artillery heavy TACFIRE via pulse code modulation (PCM). Establishing PCM communication was a challenge. Our operators never had seen or used a PCM and never had learned four-wire communications. Through their persistence, the soldiers established and maintained this vital link.

Training with LTACFIRE continued at TAA Hawg with the brigade fine-tuning its digital skills. The training consisted of dry-fire missions, fire plans, command and control and FM and PCM communications troubleshooting.

Like heavy TACFIRE, FM digital communications with LTACFIRE proved to be a difficult task. Using multiplexers and the PRM-34 helped us establish and maintain FM communications. By using one four-pack and one five-pack multiplexer, the brigade TOC only needed to erect two OE-254 antennas to operate its nine FM radios. The PRM-34 device made radio troubleshooting quick and easy. At TAA Hawg, we finalized the digital communications net structure (see Figure 2). The FM nets were extracted from the brigade's wartime signal operating instructions (SOI).

On 17 February, the brigade moved forward and linked up with the 1st Infantry

Div Arty. Prior coordination for subscriber information and radio net assignments facilitated our establishing initial TACFIRE communications. When the brigade FDC went "on the air," it had instant digital communications with the Div Arty. Now the brigade could receive combat intelligence, battlefield geometry, fire plans and command and control information.

The 1st Infantry Div Arty delivered the original two-and-one-half-hour preparation fire plan to the brigade. The Div Arty had developed the fire plan by using heavy TACFIRE. But because of the fire plan's length and the number of fire units, the plan exceeded heavy TACFIRE's capabilities. Therefore, the Div Arty modified the fire plan and provided a draft copy to each supporting artillery brigade. The artillery brigades entered the fire plan into their TACFIRE computers and computed it for their units. Entering the two-and-one-half hour preparation "from scratch" into LTACFIRE, the brigade computed it in two hours. We produced a clean schedule of fires ready for digital transmission to our battalions.

The 1st Infantry Div Arty revised the fire plan several times. For each revision, the master digital fire planners took only about 30 minutes to recompute and produce another clean schedule of fires. The two-and-one-half-hour fire plan was actually two fire plans—one for 120 minutes and the other for 30 minutes. We had to plan the fires in segments because of the 120-minute limitation for a fire plan in the software.

On 19 February, the tracked vehicles of 1-142d, 2-142d and 1-158th arrived at the Damman port. Seventy-two hours later, they were all sitting in TAA Hawg, 314 miles away. Within 12 hours, the cannon battalions installed the BCTs in their command post carriers, making the total digital TACFIRE link complete. For the first time, the brigade practiced the fire plan digitally down to the guns. The speed with which LTACFIRE disseminated the fire plan digitally was *much* faster than manually.

On 22 February, less than 24 hours after the three battalions arrived at TAA Hawg, they journeyed another 70 kilometers to join the brigade TOC and fire in the artillery raids. For the 142d FA Brigade, it was the first rounds ever fired using LTACFIRE and the first fired in combat since the Korean War.

On 24 February 1991 at 0300, the 1st Infantry Div Arty finalized the preparation fire plan, and the brigade participated in the prep at 1430, a day earlier than originally planned. The much-trained-for 100 hours began.

Assuming the mission of general support reinforcing (GSR) to the 1st Infantry Div Arty, the 142d FA Brigade roared into combat. Digital music soared through the airwaves with command and control information, AFUs, fire missions, meteorological messages and more. When voice communications failed, the digital link prevailed, providing continuous communications for commanders and S3s.

The battalions received the fire plan digitally, then the guns and launchers fired. The accurate and deadly fire from our 8-inch howitzers and MLRS devastated the enemy's positions and their will to fight. The 1st Infantry Division, aided by the 142d's cannon and missile fires, rolled virtually unopposed through the breach area.

After passing through the breach, the VII Corps Artillery commander sent the brigade, with its two 8-inch howitzer battalions and one MLRS battery, to reinforce the British 1st Armored Div Arty. On 25 February, the brigade continued its offensive march to battle with the British 1st Division. The Div Arty didn't have TACFIRE; therefore, it positioned liaison officers (LNOs) inside the brigade FDC van.

The brigade FDC received the fire missions by voice from the British LNOs. As the target was being plotted manually, the fire control BCT operator furiously punched in the data. Upon receipt of the fire order from the fire direction officer (FDO), the BCT operator then transmitted the fire mission digitally. A clean battalion "Ack" brought a grin to the communications BCT operator's face. The distant thunder of the units firing brought smiles to all, for they knew the 142d's "Steel on Target" quickened the drive in smashing Saddam's army.

A few minutes of silence prevailed in the LTACFIRE FDC van, only to be broken again by the words "Fire Mission." Moving, shooting and communicating, 24 hours a day—such went the 100-Hour War.

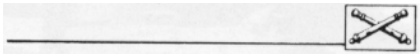
The timely, accurate fires from the brigade's long-range artillery brought high praises from the British. The 142d's support for their drive through Saddam's forces enhanced Anglo-American relations.

The British 1st Armored Division quickly routed the enemy with minimal friendly casualties.

Conclusion

On 28 February 1991 at 0700, the 100 hours ended with notification of the cease-fire. In those 100 hours, the brigade had fired more than 1,000 rounds of 8-inch and MLRS. It moved 12 times and fought in three countries, stopping in northwestern Kuwait. It provided artillery support to both the US TACFIRE-equipped and Allied non-TACFIRE-equipped divisions. It maintained a 100 percent operational readiness rate on all digital systems and a 100 percent interface and communications link between its LTACFIRE computers and heavy TACFIRE systems. Without the use of LTACFIRE, none of this could have been possible.

Though 100 hours is short as wars go, the fast pace of the mobile armored warfare in Desert Storm and the demands to constantly "Move, Shoot and Communicate" challenged the US Artillery. The perfection of the brigade's digital execution resulted from numerous hours of training and the determination of our soldiers to make the system work. The 142d FA Brigade, Army National Guard, proved we're ready to "Answer the Call."



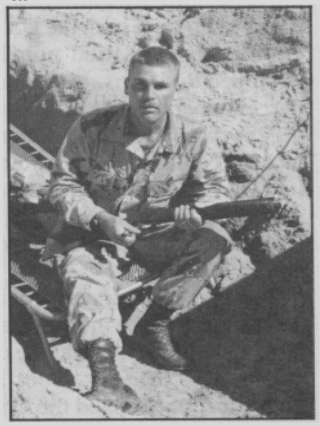
CPT Richard A. Needham is currently the G1 of III Corps Artillery; he volunteered in November of 1990 to join the 142d Field Artillery Brigade, Arkansas Army National Guard, as Fire Control Officer, deploying to Southwest Asia with that unit in January 1991. Prior to this deployment, he commanded Headquarters Battery, 1st Battalion, 12th Field Artillery (Lance) and A Battery, 2d Battalion, 34th Field Artillery (155-mm, Self-Propelled), 75th FA Brigade, Fort Sill.

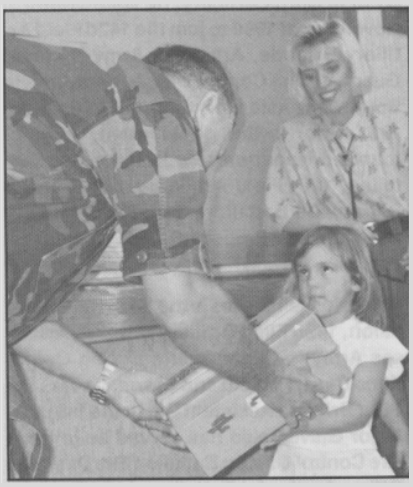
Major Russell Graves is the S3 of the 2d Battalion, 142d Field Artillery Brigade, Arkansas Army National Guard. During Operations Desert Shield and Storm, he was the 142d Brigade Assistant S3. In the brigade, Major Graves also has served as brigade Fire Control Officer; Battalion Fire Direction Officer for the 1st Battalion, 142d Field Artillery; and Commander of B Battery, also in the 1st Battalion, 142d Field Artillery.

On to War

by Command Sergeant Major Harold F. Shrewsberry

James E. Murati





Monica Wood

III Corps Arty

The soldiers' faces suddenly change to stone. Not a sound can one hear; eyes fix on the commander. A few heads drop; some sit at rigid attention. Words echo through the room, "You're going to Saudi Arabia and prepare for combat against the hostile forces of Iraq." Expecting this, some are eager to test themselves in combat. All are afraid but dedicated to serving their country.

Soldiers do things in hours that normally take days or weeks. Commanders constantly change orders. Supplies come faster than space will allow. Equipment that many have never seen suddenly appears. Rifle ranges are cracking and everywhere nuclear, biological and chemical (NBC) training is in progress.

Wives, young and with child, stand in the cold rain with tears in their eyes and fear on their faces. Their soldiers have just ridden on to war. Suddenly they are alone and scared. Where is finance, housing and personnel? The baby is sick. Where is the doctor? On his way to war! Fear can turn to panic. But overnight, a Family Service Support Center arises, and each wife is met with a smile, a hug and led to a chair and given a cup of coffee. Volunteers find answers for the wives' questions, and color returns to their faces as fear leaves and security enters.

Soldiers arrive to a desert—strange, very strange—among peoples of different life styles, odd animals and the wind. Tasks are performed with professional haste. Camps are born from nothing, among nothing, from nowhere—as if the wind has blown them in from the night.

In the middle of the night, a cracking sound and a roar of streaking light. A bang, a siren; SCUD is now reality and Patriot means security. Mission-oriented protective posture (MOPP) is the uniform for the desert fighter. Soldiers change from battle dress uniform (BDU) to MOPP in minutes.

Tanks are attacking, and down comes the order, "Move and fight." Vehicles are mounted and tanks are started. Scary fighter planes are overhead as soldiers continue to arrive on planes from a busy sky. The desert is dark, open, empty and large. Maps are hard to find; compass is the talk and direction is the language. Lost, disoriented and off-course seems normal throughout the night. Artillery in front, tanks in the rear, artillery in the middle, tanks in front with Bradleys in circle—they move to fight. The enemy is phantom, and the training lesson valuable.

Tapline, highway of death, lifeline for an army. A headless Saudi under a blanket. A soldier with half a face in a pool of blood that seeps into the sand. Another lifeless with a broken hand and a twisted leg. For one, cardiovascular pulmonary resuscitation (CPR) brings spurts of blood from lungs empty of air and a heart with no beat. His eyes turn gray as life fades away. The Bible from which I read speaks of words from God to a soldier in death. The war is here on the road of life for an army.

Soldiers train with zeal for real, and it shows as difficult training missions never experienced before are mastered at a touch. Faces are stone with lines of fear. "How is my buddy?" "How is my buddy?" echoes through the desert.

Columns upon columns of tanks, artillery, trucks and tankers, big and small, move as ants to a place to start the fight. Helicopters, slim, long, fat and thin, swim through the air over the columns as planes ring down their bombs far ahead. An Army tactical missile system (Army TACMS) flashes through the air to destroy an enemy launcher site for missiles that kill things in the air. The first round is fired at an enemy dug in to stay. We're at war, and diplomats talk and politicians sing in tune for the first time. This makes our war all right.

The columns move to the berm: air is dust, the sky is dust, everywhere is dust. Cannons bang, rockets roar and bombs explode. Buzzards fly north and return low to the ground, land and await their favorite sound. What is it that attacks, destroys, kills and disappears? Apaches attacking at night.

Diplomats have failed and politicians are strong. The soldiers have trained right and fear no fight. Attack, invade, kill, destroy and liberate are new in the quiet sandy desert where Bedouins roam and sheep wander and graze with camels. Cannons and rockets fire. Tanks and engineers burst the berm. On through the breach we march. Kuwait is for us to liberate.

Columns upon columns upon columns creep steadily through the land of sand and wind. Darkness is in the air with little separation from day and night. The smell of smoke and the taste of powder lingers in our mouths. Onward we march with cannons and rockets ablazing.

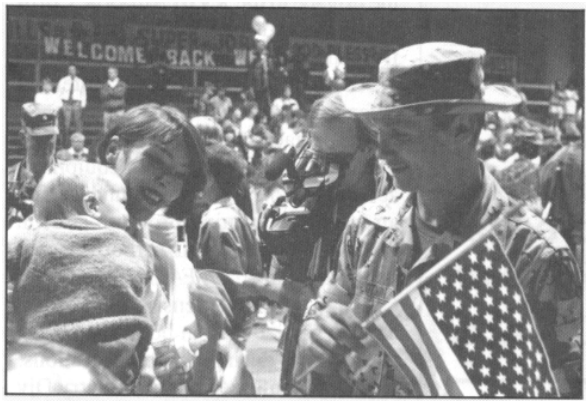
Explosions with flashes of flame in front of the columns, many columns of tanks and guns. Trucks, trucks and more trucks lag behind in steady pace. They carry the fuel, water, food, ammunition and supplies of death. Death to a crumbling enemy. Helicopters with crosses of red fly through the air. Ambulances carry pain and death.

The flag of white appears. Soldiers fight with guts of steel but answer the white with the compassion they feel. Prisoners are plenty and deaths of buddies are few. The war has ended and the day is bright. For days and days they talk of the fight.

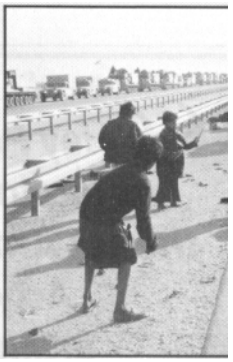
The American soldier has proved his might with compassion in his fight. Kuwait is free, the soldier is free, the wife is free and diplomats and politicians flee to justify the fight that made a country free.

75th FA Bde

2-18 FA, 212th FA Bde

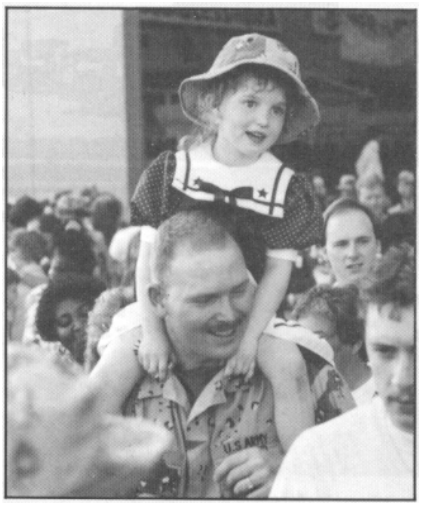


James E. Murati



2-18 FA, 212th FA Bde

Command Sergeant Major Harold F. Shrewberry was Command Sergeant Major (CSM) of VII Corps Artillery when it deployed to Southwest Asia and participated in Operation Desert Storm. Currently, he's the CSM of the NCO Academy, Fort Sill, Oklahoma. Recent assignments include Division Artillery CSM for the 7th Infantry Division (Light) and CSM for the 2d Battalion, 8th Field Artillery, both at Fort Ord, California. In addition to other assignments, Command Sergeant Major Shrewsberry served with the 1st Cavalry Division in Vietnam.



Logistical Support for the FA Brigade

by Lieutenant Colonel
Peter W. Gibbons

"Hey Pete, we're going to go catch the 1st Armored Div Arty [division artillery]."

As the 75th Field Artillery (FA) Brigade's Executive Officer (XO), I had just finished "wiring" our logistics to support the 1st Infantry Division's breach of the Saudi berm. The brigade S3's excitement at going after the Republican Guards some 150 miles away bitterly reminded me of how I'd most likely have to start all over again to arrange combat service support (CSS) for our battalions, stepchildren for other units. Even with pre-CSS coordination made a week ahead for the contingency mission, it would all fall through the cracks. Logistics preparations would have to happen "on the fly" into Iraq.

The doctrinally mandated corps CSS slice would not be in place at the beginning, end or along the route of our "Mother of All Road Marches." Getting coherent logistical support for my separate FA brigade was turning out to be the "Mother of All Nightmares."

Operational Overview

The 75th FA Brigade deployed to Saudi Arabia in September 1990. The Army Central Command (ARCENT) attached the brigade to the XVIII Airborne Corps Artillery, and logistical support came from the XVIII Airborne Corps. Initially, the brigade supported a potential defensive operation.

The brigade spent October to December 1990 getting people and equipment acclimated to the desert and undergoing an intensive training program. But in January 1991, the XVIII Airborne Corps "chopped" the 75th FA Brigade to VII Corps to support offensive operations, and we participated in both VII Corps' main efforts during ground operations. First, we reinforced the 1st Infantry Div Arty during breaching operations and then laterally crossed two divisional zones to support the 1st Armored Div Arty against the Republican Guards. During re-deployment operations, the brigade was re-attached to the XVIII Airborne Corps.

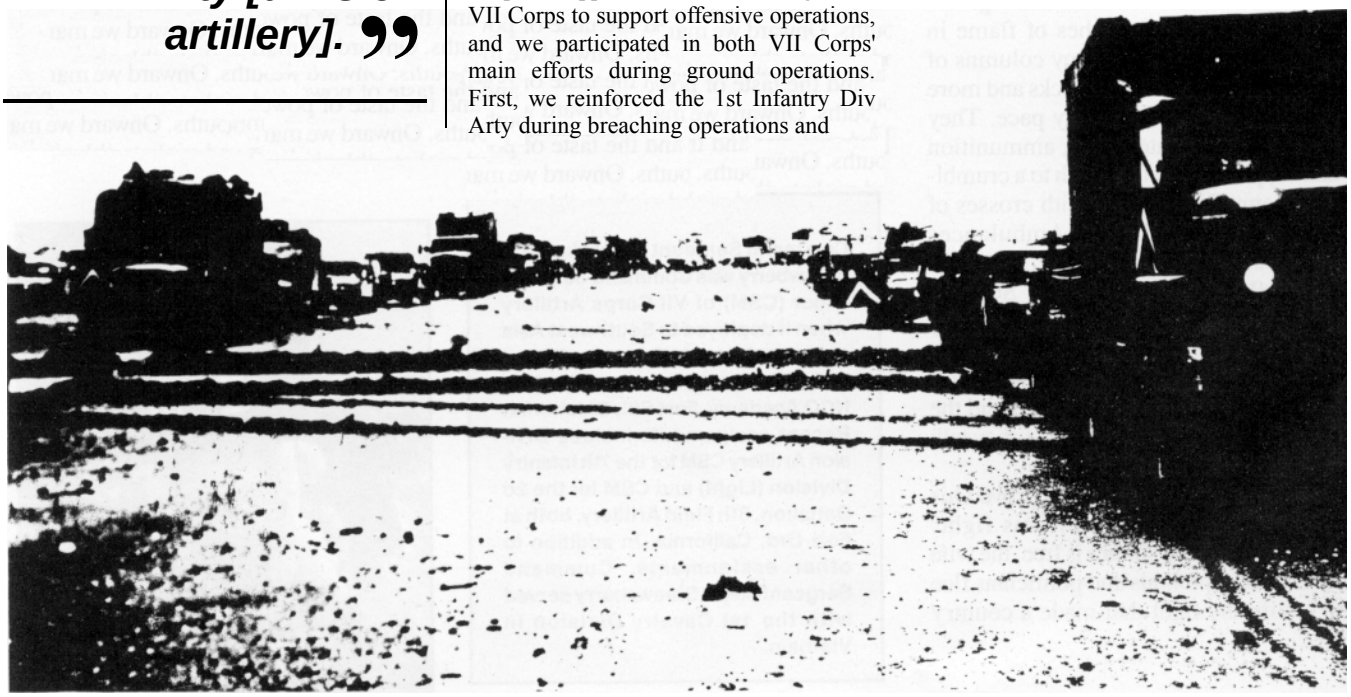
This operational overview shows how many different times the brigade had to plug-in and plug-out of different corps-level logistical support organizations. Complicating the situation somewhat was that the task organization in the brigade also was changing.

To keep from making this article too complicated, I'll hold the brigade task organization, logistical requirements and densities constant. (See Figures 1 and 2.)

Brigade Task Organization
- HHB 75th FA Bde
- 1-17 FA (155-mm) (3x6)
- 5-18 FA (203) (3x8)
- 6-27 FA (MLRS) (3x9)
- C-25 Btry (Target Acquisition) (Q36 and Q37 Radars)

Brigade Density
- More Than 2,000 Soldiers
- 154 Tracked Vehicles
- 480 Wheeled Vehicles
- 195 Trailers

Figure 1: The 75th FA Brigade Task Organization and Density. Although battery- and battalion-sized units changed, the brigade always had three battalions (plus) and four weapons systems, including Army TACMS.



Class of Supply	Item	Remarks
I	MRE Bulk Water Bottled Water	500 Cases Daily 10,000 Gallons Per Day (Haul Cap = 9,000) 500 Cases Daily
III	Bulk Fuel DF2 Only	30,000 Gallons Daily if Moving 5,000 Gallons Daily if Not Moving 27,300 DF2 Haul Capability
V	Ammo	Situation Dependent 8"/155-mm/MLRS/Army TACMS/Small Arms
IX	Repair Part	High priorities ASL and PLL

Figure 2: The 75th Brigade's Logistical Requirements During Operation Desert Storm.

Essential Tasks	Grade	Remarks
Manning	"C"	Health, Clothing, Rations, Individual Equipment, Chaplain, Finance, Legal, Water and Life Support
Arming	"D+"	Weapon Systems and Small Arms
Fueling	"D-"	Bulk Fuel
Fixing	"F"	Class IX and Major Assemblies (Cannibalization Point)
Moving	"D-"	People, Equipment and Life Support (MTOE and Other)

Figure 3: CSS Report Card. The grades given by the author for the support received by the 75th FA Brigade under the area support concept.

Although battery- and battalion-sized units changed with the changing task organization, two facts remained constent. The 75th Brigade stayed a three-battalion-plus unit and had four fire support weapon systems: 155-mm, self-propelled, and 8-inch howitzers, the multiple launch rocket system (MLRS) and the Army tactical missile system (Army TACMS).

The Problem

Corps area support groups and battalions, by doctrine, provide CSS to FA brigades under the "area support concept." The brigade's FA battalions deploy three to five kilometers from the forward line of own troops (FLOT) and, theoretically, receive support under this concept; corps logistical units are to support all non-divisional units in a given area.

During Desert Storm, this concept worked better on paper than in the field. If asked to fill out a report card on the five essential CSS tasks, the grades depicted in Figure 3 would characterize the adequacy of CSS for the 75th FA Brigade. In short, we continually struggled with a lack of CSS equipment and resources and poorly developed logistical plans to support non-divisional units.

VII Corps Rear
- Corps Support Command (COSCOM)
  - 800th MMC
    - 7th CSG (4 LTFs: 1st and 3d Armored Divisions)
    - 16th CSG (2 Logistics Bases)
    - 159th CSG (2 LTFs: 1st Infantry and 1st Cavalry Divisions)

Figure 4: VII Corps Logistical Support Structure During Desert Storm.

159th CSG
- 87th LTF
  - 147th Maintenance Company
  - 493d Supply and Service (S&S) Company
  - 557th Maintenance Company
  - 1229th Medium Truck Company (60 Tractors and 91 Trailers)
- 286th LTF
  - 504th Maintenance Company
  - 1052d Medium Truck Company (No Trucks until about 22 February)
  - 1158th Heavy Truck Company (Assets to 4th Transportation)
  - 1174th Petroleum, Oil and Lubricant (POL) Company

16th CSG: 2 Logistics Bases

Figure 5: 75th FA Brigade Support in the 1st Infantry Division Sector.

Getting Plugged In

Figure 4 depicts the VII Corps logistical support structure. The 159th Corps Support Group (CSG) had two logistics task forces (LTFs) supporting non-divisional and divisional units in the 1st Infantry and 1st Cavalry Divisions sectors. While in the tactical assembly area (TAA), initial fighting positions and through the breaching operations, the 159th CSG's 87th LTF and 286th LTF supported the 75th FA Brigade (Figure 5).

Transportation Support. Trucking assets were at a premium. The 1052d Medium Truck Company didn't receive its trucks until a few days before the ground war started. Hauling ammunition from port tied up most corps-level transportation assets. Divisional unit's needs and unsatisfied corps transport requirements dried up any possibility of the brigade's getting divisional trucking support. There were no trucking assets available to the brigade to move more than 100 miles from our TAA into initial fighting positions.

One might assume that an FA brigade wouldn't need help moving. Not so. When you factor in the requirement to move desert life support items, extra bulk water, refrigerator (Reefer) vans without tractors, a full unit basic load (UBL) of ammunition, four extra gun crew sections in each cannon battalion (about 44 soldiers per battalion) and the complete modification table of organization and equipment (MTOE), it's impossible for an FA brigade to move without external hauling support.

The "work-around" options were bleak. We could make multiple trips or leave some "non-essential" items back. We ended up doing both. As we approached G-Day (ground war), we stored and dropped enough equipment to carry our equipment in one move. That meant we went into the ground war with no life desert support items, Reefer vans or extra bulk water.

Point: FA brigades need dedicated hauling equipment over and above their current TOE or additional MTOE assets, for example, heavy expanded-mobility tactical trucks (HEMTTs).

The area support concept proved marginally adequate while the brigade was in the 1st Infantry Division's sector, and it wasn't any better in the 1st Armored Division. Figure 6 shows how the

1st Infantry Division and VII Corps logistical units dispersed over great distances after moving from their TAAs into initial pre-G-Day positions.

VII Corps gave the 75th FA Brigade movement orders from our TAA two days before the 159th CSGs moved out. Therefore, we had to "strike a deal" with the 16th CSG to support us until the 159th CSG positioned itself to provide support. Accordingly, the 16th CSG's TF Bennet at Log Base Echo provided the first three days of support to our battalions. That meant all supply, mess and motor sergeants and XOs made daily trips 60 to 70 kilometers back to the log base. Although TF Bennet could have "pushed" supplies forward to a logistical resupply point (LRP), it didn't have the transportation assets to do so. Its primary mission was supporting Log Base Echo.

Point: Planning needs to ensure logistics and supply points are established before customers move into the sector.

Supply Support. The 159th CSG (with both its LTFs) set up in the 1st Infantry Divison support area (DSA). That put the CSG 20 kilometers north of Log Base Echo but still some 45 kilometers from 75th Brigade units—still too far to make supply runs. Coordination with the 87th LTF commander produced a logistics resupply point (LRP) about 18 kilometers from the 75th tactical operations center (TOC). A closer LRP would have been preferable, but at the time locating it at the end of the main supply route (MSR) and next to a known ammunition supply point (ASP) seemed to be in our mutual interest.

The LRP provided limited CSS. It operated from 1000 to 1400 hours and only issued meals ready to (MREs), bulk water, bulk fuel and, sometimes, bottled water. The CSS was limited because the LTF had too few assets, navigational concerns and long round-trip supply runs to Log Base Echo, some 15 to 20 kilometers away.

Point: Supply points need to be established closer to customer units and issue the variety of supplies the customers need.

CSS Navigational Dependence. Navigating in the desert to the supply points severely constrained CSS operations from both the "provider" and customer perspectives. Operations personnel seized available global positioning system (GPS) devices. Commanders had justified concern over soldiers and convoys getting lost in the desert. They proscribed nighttime movement before G-Day and relented only if the lead vehicle had a navigational device. MSRs, well established in the VII Corps rear around Log Base Echo and through the division rear into the brigade sectors, proved to be tremendous navigational aids. Once off an MSR, however, navigation was very difficult both day and night.

Two points: Well-established and properly marked MSRs not only control traffic, but also serve as navigational aids. We need to add navigational devices to units MTOEs in enough quantities to satisfy navigationally dependent CSS functions.

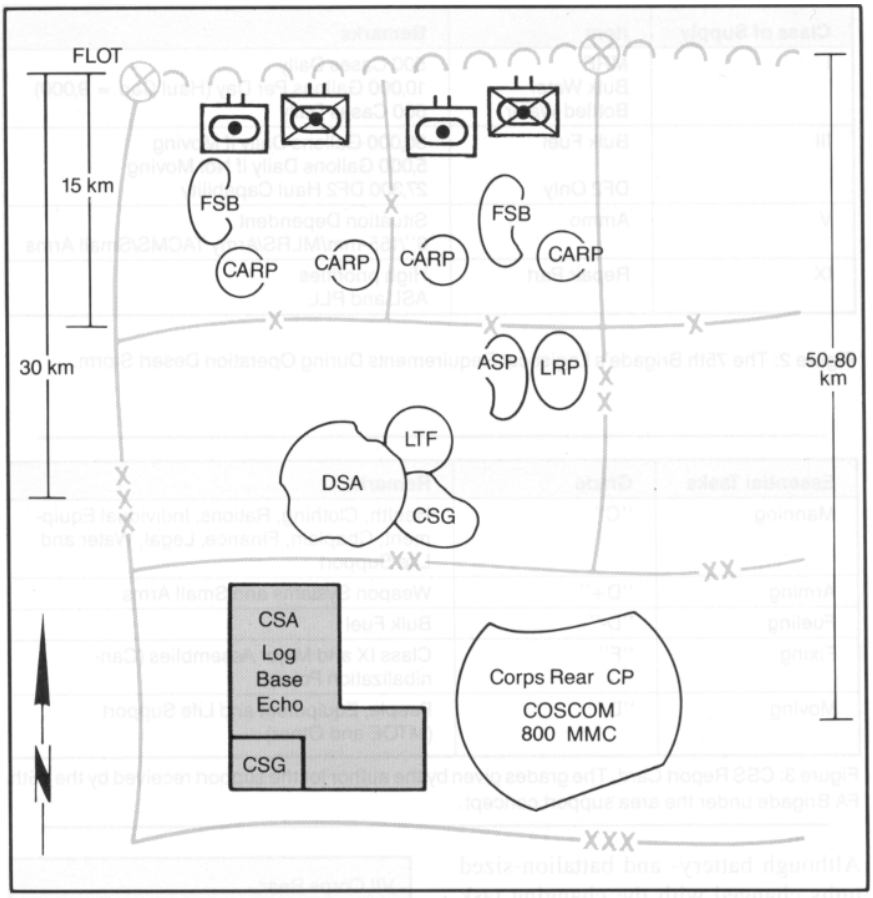


Figure 6: The 1st Infantry Division Sector. This figure shows how the 1st Infantry Division and VII Corps logistical units dispersed over great distances after moving from their TAAs into initial pre-G-Day positions. The corps ammunition resupply points (CARPs) were located forward in the maneuver brigade sector.

Pushed Supplies. Even after the logistical units were set up, an LRP was established and MSRs were well known, the supply system wasn't adequate. Supply vehicles had to travel back to the LTF area in the DSA—40 to 45 kilometers—for food other than MREs, all Class IX, major assemblies and other classes of supplies not issued at the LRPs. When the LTF or the CSG in the DSA couldn't help, those same supply vehicles went all the way back to Log Base Echo.

Two days before G-Day, the 87th LTF split some of its assets and moved closer to the 1st Infantry Division's brigade sectors and on the flanks of the division. This cut down some travel time but only provided the same limited service the LRPs provided.

Point: Supplies need to be pushed forward in enough types and quantities for non-divisional units.

Pulling the Plug Out—Trying to Plug Back In

One week before G-Day, the 75th FA Brigade prepared to execute numerous on-order missions after the 1st Infantry Division's breaching operation. The brigade commander told me to coordinate for all on-order missions but to focus on the option of supporting the 1st Armored Division. Most importantly, we had to ensure we had fuel and ammunition when we got where we were going.

I coordinated with the 1st Armored Division's 7th CSG as well as 71st LTF (see Figure 7). They didn't know the 75th FA Bde might be supporting the 1st Armored Division. I gave them our requirements, densities and best guess as to what we'd need when we were in their area, emphasizing fuel and ammunition. I had the 75th FA Brigade S3 remind the 1st Armored Div Arty of our 30,000-gallon fuel requirement going into the division sector. The fuel never showed up.

7th CSG
- 71st LTF: 1st Armored Division Sector
  - 156th Maintenance Company
    - 317th Maintenance Company (Direct Support to 2d Armored Cavalry Regiments and 1st Armored Division)
    - 240th S&S Company
    - 1742d Medium Truck Company
    - 1157th (Platoon of 5-Ton Trucks)
  - 1st LTF: 3d Armored Division Sector
  - 6th LTF: S&S Battalion Headquarters
  - 213th LTF: Transportation Headquarters
- 16th CSG: Log Base Echo

Figure 7: The 75th FA Brigade Support in the 1st Armored Division Sector.

As for the ammunition, there was no plan to have any 203-mm projectiles and extra 155-mm and MLRS ammunition in the 1st Armored Division area. The 7th CSG sent me back to the 800th Materiel Management Center (MMC) to coordinate for ammunition. The MMC's response was, "We're already positioning your brigade's ammunition in the 1st Infantry Division sector, and we can't do both. We just don't have the transportation assets." That was not what I wanted to hear. The MMC did say it might have the ammunition in the 1st Armored Division sector by G+3 days.

I informed the commander and let the problem run through command channels. It did, and we were told the ammunition would be there. But it never was. The closest the ammunition ever got was to an ammunition transfer point (ATP) more than 55 miles from our cease-fire position in the 1st Armored Division sector (see Figure 8). I don't think any 203-mm projectiles made it to the ATP. If the ground war had continued, the 75th FA Brigade guns would have run out of ammunition, and the supply chain would have taken days to fix the problem.

Point: We need to develop a detailed fuel and ammunition supply plan with enough assets to keep up with offensive operations. FA brigades need the assurance that what they need will materialize, and the CSS community needs the assets to provide that assurance.

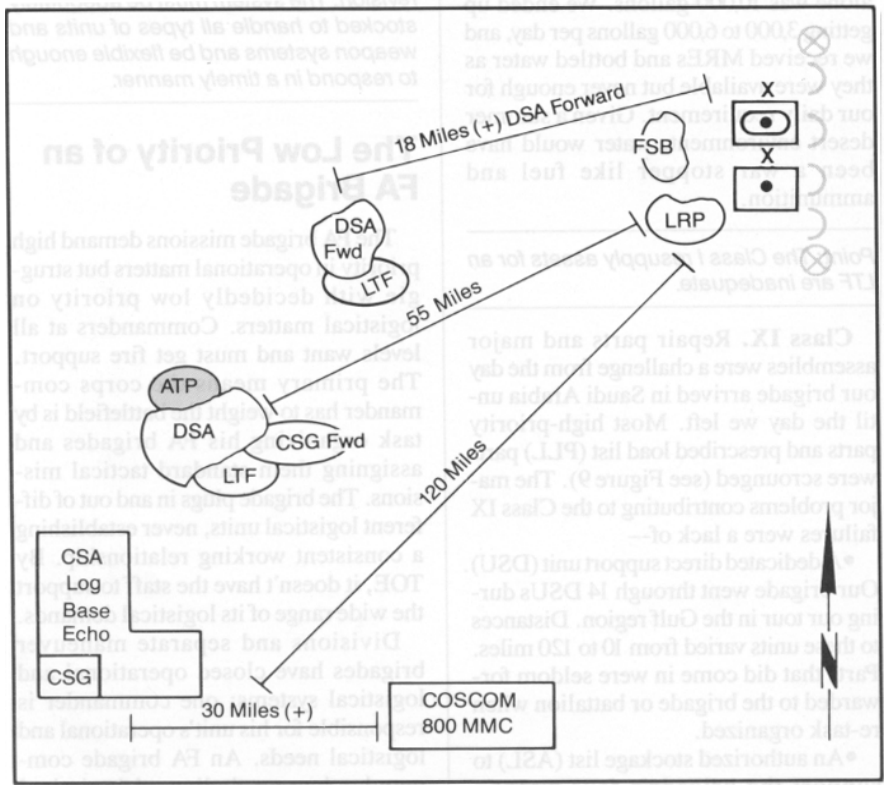


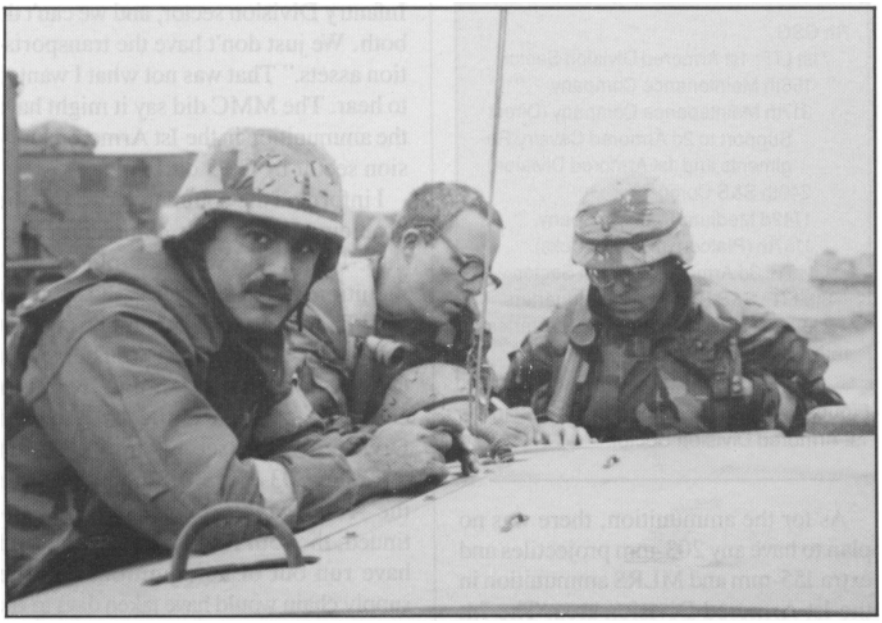
Figure 8: The ammunition resupply promised the 75th FA Brigade for G+3 never arrived. The brigade would have had to travel 55 miles from its cease-fire position to the nearest ATP. If the ground war had continued, the brigade would have run out of ammunition, and the supply chain would have taken days to fix it.

Weather. During the ground war and just after the cease-fire, there was another problem that completely stopped logistical operations: the weather. We had tremendous rains that stopped all 18 wheelers for about 30 hours. MSRs weren't well-established, and most wheeled vehicles had trouble.

Point: Logistical assets in the year 2000 need to be able to keep up and go where the fight goes.

As you can see in Figure 8, we had a difficult time keeping the brigade supplied with the bare necessities of Classes I and III (Fuel). Class IX and major assemblies were even more difficult to acquire.

More on Class III. We were two hours from being bone dry when the 1st Armored Division stopped forward movement; the division had the same fuel problems we had. I took most of the brigade's tankers 55 miles back to the DSA and loaded them with fuel. The 71st LTF commander was only going to give us 5,000 gallons—all he had. But after a few hours of waiting, we got about 20,000 gallons.



Log planning "on the fly" in Desert Storm—the author is flanked on the left by CW2 Gary Hilliard, Brigade Maintenance Technician, and on the right by Major Tom Eccleston, Brigade S4.

At the same time, the division had pushed about 30 fuel tankers forward, close to the forward support battalion (FSB). On our return trip from the DSA, we ran into this load of fuel. We still had one empty tanker and three that hadn't made the trip. The plan was to fill them with these divisional assets. After talking with the division G4, he said we were authorized 5,000 gallons. (He didn't know we had the fuel from the LTFs). As it was, he gave us 7,500 gallons. If we hadn't taken our fuel tankers on the 110-mile round-trip, the brigade would have run out of gas. The division's 7,500 gallons wouldn't have been enough to keep us rolling.

After a couple of days, the DSA and LTF moved some elements to a forward location and cut the distance down to about 18 miles; it took three days to get our vehicles and tankers topped off. If the division hadn't stopped, we all would have run out of fuel.

Point Again: We need a detailed fuel plan and assets to support it.

Class I. From this same location, we ran out of bulk and bottled water and were very low on MREs because of reoccurring problems: 18 wheelers getting stuck in the desert and inadequate trucking assets.

The bulk water situation was never resolved. The LTF had three 3,000-gallon water blivits. It had to supply a mobile Army surgical hospital (MASH) unit, non-divisional engineers and our brigade with its 9,000-gallon capacity. The daily requirement of the brigade alone was 10,000 gallons. We ended up getting 3,000 to 6,000 gallons per day, and we received MREs and bottled water as they were available but never enough for our daily requirement. Given a summer desert environment, water would have been a war stopper like fuel and ammunition.

Point: The Class I resupply assets for an LTF are inadequate.

Class IX. Repair parts and major assemblies were a challenge from the day our brigade arrived in Saudi Arabia until the day we left. Most high-priority parts and prescribed load list (PLL) parts were scrounged (see Figure 9). The major problems contributing to the Class IX failures were a lack of—

- A dedicated direct support unit (DSU). Our brigade went through 14 DSUs during our tour in the Gulf region. Distances to these units varied from 10 to 120 miles. Parts that did come in were seldom forwarded to the brigade or battalion when re-task organized.
- An authorized stockage list (ASL) to support the brigade's four weapon systems. Most of the DSUs supporting the brigade didn't have the required weapon system parts and major assemblies on hand to fill high-priority parts or PLL.
- An accurate stockage list. From the MMC down to the DSU levels, it appeared that there wasn't an accurate list of what parts were on hand or where they were located. Everyone knew there were parts available; they just didn't know where they were.
- Transportation assets to push major assemblies forward. This caused units to spend most of the day on the road scrounging parts to maintain operational readiness.

Source	% PLL	% High-Priority Parts
Technical Supply	40	20
Fill or Kill (Scrounge)	30	50
Local Purchase (Scrounge)	5	10
Good Ole Boy (Scrounge)	25	20

Figure 9: The 75th FA Brigade's procurement percentages of PLL and high-priority parts used during the ground war.

Point: The entire Class IX system needs revision. The system must be adequately stocked to handle all types of units and weapon systems and be flexible enough to respond in a timely manner.

The Low Priority of an FA Brigade

The FA brigade missions demand high priority in operational matters but struggle with decidedly low priority on logistical matters. Commanders at all levels want and must get fire support. The primary means the corps commander has to weight the battlefield is by task organizing his FA brigades and assigning them standard tactical missions. The brigade plugs in and out of different logistical units, never establishing a consistent working relationship. By TOE, it doesn't have the staff to support the wide range of its logistical demands.

Divisions and separate maneuver brigades have closed operational and logistical systems; one commander is responsible for his unit's operational and logistical needs. An FA brigade commander has no dedicated logistical assets. He must depend on corps logistical units to support him.

The chain of command for enforcing logistical priorities penalizes the FA brigade commander. He must present his

issue to the corps artillery commander (a brigadier general), who then may present the problem to his peer, the corps support command (COSCOM) commander or the deputy corps commanding general (a major general). The problem must work its way through these filters before it gets to the corps commanding general (a lieutenant general). On the other hand, if a division commander has a logistical problem, he goes directly to the COSCOM commander, who he outranks, or tells the corps commanding general, who fixes it quickly.

The bottom line is that the FA brigade has less clout than divisional units. The following are a few examples of how the logistical priority system affected our brigade.

●**Class II Desert Camouflage Uniform (DCU) Issue.** Our brigade deployed in September, and up until the final week in April, operated with only two sets of DCUs per soldier. There was an attempt to issue us a third set per soldier one month before redeployment. They issued us 1,500 sets of DCUs, all of which were either extra small or extra large.

●**Water Tankers.** When the brigade was task organized under VII Corps and left the XVIII Airborne Corps area, we had to give back our water tankers. The XVIII Airborne Corps said it was VII Corps' responsibility to provide us water tankers. VII Corps didn't have any to give us.

●**HEMTT Fuel Tankers.** One of our battalions was short two heavy expanded-mobility tactical trucks (HEMTT) tankers on its MTOE. We reported this shortage daily. When the flock of HEMTT tankers arrived in country, VII Corps prioritized the issue to swap out divisional 5,000-gallon tankers on a two-to-one ratio first; then, if there were any left over, the brigade would get two. On G-1, we had to travel more than 250 miles to port and pick them up.

Conclusion

Logistical support for the FA has some serious flaws, providing potential for innovative improvements. When you look at what the brigade accomplished, you'd have to say the system isn't entirely broken. That's true. But we made the system work because dedicated soldiers and NCOs kept vehicles running, scrounged parts and pulled proper preventive maintenance checks and services (PMCS); because service battery and headquarters and headquarters battery (HHB) commanders lead supply convoys over large distances with their navigational devices; and because logistics personnel supporting our brigade bent over backwards and took short cuts trying to support us.

One major reason we "survived" in the VII Corps area of operations was the efforts of the VII Corps Artillery G1 and G4. Collocated with the VII Corps rear, COSCOM and 800th MMC, they were outstanding spokesmen for all the FA brigades.

But the supply system for the FA brigade is seriously flawed. Here are several options we need to study in detail.

●Give the FA brigade its own forward support battalion (FSB). The FSB would coordinate for and provide all classes of supplies. It would provide a logistical planning staff, a constant DSU for all weapon systems and additional haul capabilities. Problems would still arise when battalions were individually re-task organized, but they would be minor compared with current ones. The FSB would have to be highly mobile to support the FA brigade moving quickly across divisional and corps boundaries in the maneuver main effort.

●Give the division support command (DISCOM) the mission of supporting one additional FA brigade and the TOE to do it. The DISCOM would need enough permanently assigned assets to accomplish all the requirements to support an FA brigade like a dedicated FSB would. This would allow the FA brigade to move across the battlefield and plug into the DISCOM. There still would be chain-of-command problems with this option, but it would move support and responsibility for that support closer to the FA brigade.

●Design a hybrid support structure for the mobile FA brigade, using an existing corps support battalion's assets. For example, we could mix heavy equipment transporters (HETs) with HEMTTs in a "type" transportation company, have a maintenance company with an ASL for three to four weapon systems and associated mobile support systems (MSTs) and create one platoon for missile maintenance with the brigade's MST coming from the platoon. A supply and service (S&S) platoon could carry Classes I, II, IV, limited VIII and plug into a S&S company at a nearby combat support battalion. In addition, the FA brigade would need an ATP under brigade control that draws from corps ASPs.

Whatever the ultimate solutions are, we must systematically correct the logistical support problems of the FA brigade. The Army needs the FA brigade to go where the action is and add its firepower to weight the battle for victory.

The Headquarters and Headquarters Battery, 75th FA Brigade, in position during Desert Storm.

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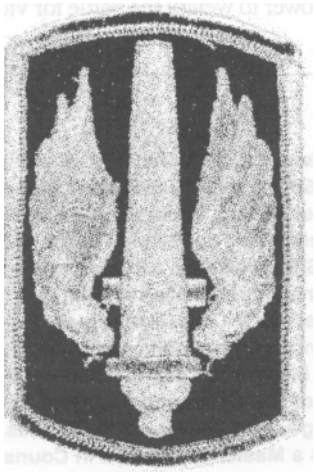
A Unique Challenge

for the 18th FA Brigade (Airborne)

by Colonel Freddy E. McFarren and Lieutenant Colonels Lonnie L. Johnson, Jr.; John R. Wood; and William H. Groening



As the only towed, 155-mm (M198) howitzer brigade in Army Central Command (ARCENT), the 18th Field Artillery (FA) Brigade provided the XVIII Airborne Corps a unique capability. Without heavy equipment transport (HET) support, the brigade can move 72 howitzers vast distances in a short time, thus adding agility to firepower.

The 18th FA Brigade (Airborne) was selected to reinforce the French 6th Light Armored Division on the extreme western flank in Central Command's (CENTCOM's) two-corps flanking move to envelope Saddam Hussein's army. The brigade moved 200+ miles to a final assembly area near Rahfa, Saudi Arabia—in one night, unassisted. Soldiers drove all night at speeds up to 50 miles per hour, in the rain and much of the way in mission-oriented protective posture, Level 4 (MOPP 4) gear. That move culminated five months of the brigade's training and waiting to perform its combat mission. Later, the brigade reinforced the fires of the 24th Infantry Division (Mechanized) Artillery (Div-Arty)

and attached battalions to the 82d Airborne Division and the 101st Airborne Division (Air Assault).

As the brigade moved into Iraq, it controlled five battalions, to include a 155-mm self-propelled National Guard battalion from West Virginia (1-201 FA), a multiple launch rocket system (MLRS) battalion (6-27) FA from III Corps Artillelry, Fort Sill, Oklahoma, more than 2,600 soldiers, 18 rocket launchers, 90 155-mm howitzers and more than 960 vehicles. Roughly 3,000 155-mm rounds, more than 350 rockets and seven Army tactical missile system (Army TACMS) missiles were fired under brigade control during Desert Storm. This article highlights some aspects of the 18th Brigade's experiences.

Brigade Command and Control

Our mission was to reinforce the fires of the French 6th Light Armored Division in its attack to As Salman, Iraq. We would provide fires to the 2d Brigade, 82d Airborne Division, attached to the French. The attack was to be fast-paced and focus on securing the only usable road north as a corps main supply route (MSR). The French identified an intermediate and final objective on which they wanted the entire brigade to fire. During movement, one cannon battalion and one MLRS battery were to be in position to fire at all times.

In analyzing the mission, we decided we couldn't operate the brigade tactical operations center (TOC) with its tactical fire direction system (TACFIRE) per standing operating procedure (SOP). By the time, it was set up, the battalions would be out of radio range, supporting the forward elements. The solution was to streamline the TOC, make it mobile and be prepared to conduct fire missions on the move.

We configured the back of a high-mobility multipurpose wheeled vehicle (HMMWV) with two large map boards on the walls, a small status chart and five secure VRC-46 radios. The radio mounts were already in place as this was the vehicle we drop during airborne operations for command and control.

We kept most information, such as ammunition and weapon status and unit locations, in a loose-leaf binder. The communications nets were brigade operations and intelligence (O&I), brigade command, brigade fire (voice), target acquisition (OH58D helicopters and Q37 Firefinder radar) and corps artillery command. One officer (a major) and two NCOs (the operations NCO and fire direction NCO) operated in the TOC vehicle. Other vehicles in this TOC complex included those of the brigade commander, S3, French liaison Party, meteorological, two radio teletypewriters (RATTs), retrans and the Air Defense Artillery (ADA) battery headquarters with three Vulcan guns. The TOC processed missions and issued movement orders on the move but made short roadside stops when things got too busy. The S3, French liaison officer (LNO) and TOC vehicles collocated to form the TOC complex. The brigade processed more than 70 fire missions in support of the French, to include seven counterfire targets provided by the Q-37 radar and eyes on the target.

The main reason for the success of this TOC concept was our three tactical exercise without troops (TEWT) rehearsals. Four battalion TOCs and the brigade TOC went to areas south of Rahfa and drove distances of up to 70 kilometers across the desert. Each TEWT consisted of preplanned battalion "goose egg" positions. The Brigade TOC "leapfrogged" units to meet the French criteria of one cannon battalion and one MLRS battery in position at all times and all elements available for assault on the primary and intermediate objectives. The French observer teams participated in the TEWTs and sent dry-fire missions to the French LNO, who, in turn, passed the missions to the brigade TOC.

The first rehearsal wasn't successful. Net discipline was poor, and the organization of the TOC needed many changes. The subsequent rehearsals included battery command and control elements, selected gun sections and even combat service support (CSS) vehicles to simulate actual emplacement, displacement and movement times. The final rehearsal was a success. These rehearsals were key to our accomplishing the mission during action in Iraq.

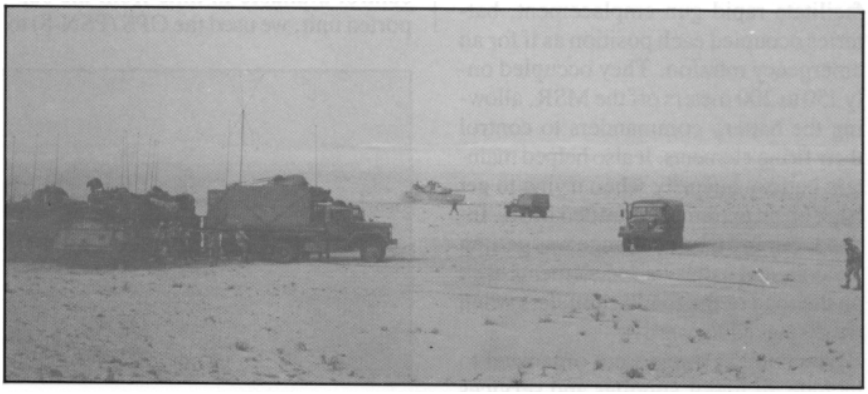
Battalion Movement

Operations in support of the 6th French Division and the other divisions of the XVIII Airborne Corps required revised battalion movement techniques to provide continuous fire support. Operations inside Iraq were characterized by very long distance movements, both between firing positions and across division boundaries when mission assignments changed. The average tactical movement was 30 kilometers between firing positions, and several battalions conducted a terrain march of more than 150 kilometers when missions changed.

The challenge was to achieve speed and distance while providing continuous, accurate fire support and maintaining security. Although trafficability in Iraq was generally suitable for the towed M198, training during Desert Shield had shown that sending any element down an unreconnoitered route could result in many stuck and broken vehicles. Each battalion decided to minimize the number of elements moving on the battlefield, move all elements on a single primary route to increase control, form a battalion advance party and travel as a battalion to increase speed. While two cannon battalions were moving, the third was prepared to accept fire missions.

March Column Organization

A typical battalion advance party was led by the reconnaissance and survey officer (RSO) and was formed from the battalion survey sections augmented by



A Heavy Battalion TOC in Desert Storm. The 18 FA Brigade controlled 5 battalions as it moved into Iraq, including two heavy battalions.

elements of the communications platoon, which provided security and road guards as required. The battery advance parties traveled with the battalion advance party until they reached their firing positions. The battalion advance party had bought signs locally and had a large quantity of chem lights to mark the route. Additionally, it carried mine detectors, nine global positioning system (GPS) devices and several Trimpacks and long-range aid to navigation (LORAN) devices for navigational assistance. The GPS established a survey control point (SCP) if the position and azimuth determining system (PADS) couldn't carry survey data far enough forward.

When movement was planned or anticipated, the RSO was briefed on the axis of advance and desired position areas along the axis. The mission of the battalion advance party was first to identify and mark a single trafficable route that led to the position area and then to prepare positions for occupation by firing battery elements. A simple route-marking SOP was used to identify turns and key points along the route for both day and night operations. The ADA attachments moved either with the advance party or to the flanks of the lead firing battery. Command and control was organized into a light TOC using only HMMWVs, including the light TAC-FIRE (LTACFIRE) vehicle for an automated interface to both the brigade and the platoon fire direction centers (FDCs). By establishing a standard battalion order of march, the TOC traveled habitually with a firing battery for security.

Command and control was maintained as far forward as possible. The wheeled capability of the M198 howitzer allowed the battalions to move quickly with the supported maneuver elements. To facilitate rapid gun emplacement, batteries occupied each position as if for an emergency mission. They occupied only 150 to 200 meters off the MSR, allowing the battery commanders to control their firing elements. It also helped maintain battery integrity when trying to get back on an extremely crowded MSR. Indeed, our greatest challenge was getting platoon- and battery-sized elements back on the road or the road's shoulders when we displaced forward.

The combat trains were organized to include all major supplies and services required on less than 24-hours' notice, such as additional ammunition, water, fuel and critical repair parts. Recovery vehicles; nuclear, biological and chemical (NBC) decontamination vehicles; and the battalion aid station usually traveled with this element under the control of the headquarters and headquarters battery (HHB) commander. (During some very long moves, the wreckers and fuel tankers moved with the firing batteries for immediate availability.) All remaining vehicles, as well as most trailers and support attachments, moved as part of the consolidated brigade field trains with the service battery commander.

Battalion Assembly Areas

Several times, the battalions moved into areas where the tactical situation was unclear, and security coordination hadn't been completed before occupation. We developed and rehearsed SOPs for occupation of battalion assembly areas from the march during Desert Shield. These battle drills greatly enhanced security, ensured accountability and minimized confusion when we occupied during Desert Storm.

Survey Operations

The division and corps artillery survey elements moved at our rear and couldn't provide data to use for firing in the fast-paced attack. Survey data was carried forward using PADS, which had been initialized at the French divisional control SCP. Each battery established SCPs in its position with its two PADS when we had enough time for updates. When all units were moving in formation, the distances traveled precluded the accurate use of the PADS.

After arriving in the new battalion position area and with no existing survey control available in time from the supported unit, we used the GPS (PSN-8) to establish the battalion SCP, and PADS carried survey data to the batteries. We used our trimpacks to double-check the surveyed locations. Directional control was established with PADS, once the SCP was emplaced. We used simultaneous observation and magnetic methods with a correction factor based on marginal map information as backups and to check our survey data.

TACFIRE/LTACFIRE Operations

The French fire control and direction system didn't interface with TACFIRE. The missions went from French observers to the French LNO in the brigade TOC. He had a battalion automated system identical to that used by the French battalion FDC. The French LNO passed missions to our brigade TOC, which used voice commands to convey the missions to our battalions.

LTACFIRE was the primary digital interface between the brigade's battalions and their platoon FDCs. While LTACFIRE provided the functional equivalent to TACFIRE, the limited number of modems available on our older configuration prevented us from using it as a complete substitute for TACFIRE. Had four or more modems been available, as will be the case in all light divisions, we could have used LTACFIRE as the full equivalent of TACFIRE.

With both LTACFIRE and TACFIRE on hand, a number of operational enhancements were available. Since both systems maintained identical data bases, an automated backup was always available without a mutual support unit (MSU). LTACFIRE was employed as both a "jump FDC" and as a peripheral device in the TOC, using the graphic display function. During fast-moving operations, the LTACFIRE HMMWV

An M198 gun section moves out during Desert Shield. Batteries occupied positions within 150 to 200 meters of the MSR.

with a tent extension and the operations HMMWV (for additional radios) formed the primary TOC for the battalion. LTACFIRE demonstrated full interoperability with existing systems and is more mobile and easier to setup than TACFIRE.

Fire Support for French LNO Operations

Without organic observers, the brigade established liaison with the French Division, the 2d Brigade, 82d Airborne Division and two of the forward French maneuver regiments (battalions). While most missions were passed and cleared through the division LNO, the LNOs operating with the leading regimental TOCs provided the best picture of the battlefield. The LNOs passed vital and immediate information on the front line trace (FLT) and changes to maneuver plans well before this information was available through the division. On several occasions, the LNO with the leading regiment stopped brigade elements from moving beyond forward of the forward line of own troops (FLOT) into active engagement areas.

The LNOs' information cued movements, based on progress of the FLT. They coordinated positions directly with the regiment that owned the ground and ensured integration of operational plans. All LNOs worked alongside a French artillery officer in the maneuver headquarters to form a regimental fire support section for each front-line regiment. Language problems were overcome by using bilingual officers in these key positions. We added resources (radios, vehicles and personnel) to give our LNO teams the means to provide this useful information. The LNOs' information was a major contributor to our overall effort.

Meteorological Support

The meteorological (Met) section was an integral part of all operations. First-round accuracy had to be achieved without the benefit of registrations.

Before Desert Storm, the Met section used the AN/GMD-1 meteorological system and the Marwin-12 Rawinsonde system, which is the heart of the proposed meteorological measuring system (MMS) for airborne and light units. The older system has been in the Army inventory for more than 37 years. The technology lacks repair parts, resulting in a low operational rate. We got the Marwin system during Operation Just Cause in Panama. Fortunately, the brigade had the new meteorological data system, (MDS) AN/TMQ 31, which was fielded in Saudi Arabia.

A howitzer section in B Battery, 5th Battalion, 8th FA fires a mission in Desert Storm. Batteries fired missions originating from US and French forces.

After the Iraqi invasion of Kuwait on 2 August, 1991, part of the Met section deployed with 82d Div Arty, with what we like to call "Met Light." This consists of the Marwin-12 Rawinsonde system mounted in a HMMWV, a PU620 5-kilowatt generator set and a 2 1/2-ton cargo truck to carry expendables. The Marwin-12 Rawinsonde system is a highly-mobile, one-man portable unit. It can operate in a 120V AC mode or 24V DC mode and produce all standard artillery weather messages with the exception of target acquisition Met and fallout messages (although the software is available). It also can produce an air weather service message that we used to create an atmospheric profile for the desert environment.

The MDS has many advantages over the prototype Marwin-12 Rawinsonde system. It has a TACFIRE interface, allows for mobile operations and includes a sophisticated radio direction-finder antenna. This system performed very well throughout Desert Shield and Storm.

During Desert Storm, the Marwin-12 was the primary means of gathering atmospheric data on the battlefield. It was very reliable, accurate, easy to use and greatly improved our artillery first-round fire-for-effect capabilities. The light system, used in conjunction with the MDS helped solve our altitude problem. By using the large balloon that carries the larger radiosonde for the MDS and the small Marwin-12 Radiosonde, we collected data to a much greater altitude for the Army TACMS unit.

Although it was an unique experience to deploy and operate with three Met systems, we look forward to fielding the lightweight MMS, which incorporates the features of the Marwin-12 and the MDS.

Logistical Support

Logistical support for non-divisional FA units was a tough challenge for combat units as well as the corps support units. The most significant problems were having enough haul capability and the availability of Class IX (Repair Parts). We used the vehicle of choice—the heavy expanded-mobility tactical truck (HEMTT)—to increase our haul capability. The HEMTT carried not only all types of munitions, but also water blivets, rations and supplies required for sustainment in a desert environment.

As the Southwest Asia Theater matured, the Class IX dilemma improved. But the audit trail of repair parts was sometimes

unresponsive. As a non-divisional FA unit, we changed direct support (DS) units five times based on the area support concept. The willingness of the DS units to try and keep up with the demands of the extreme environment on their vehicles and equipment was admirable. We should consider having a habitually associated DS unit with the authorized supply list (ASL) and proper maintenance MOS in the Active or Reserve Components.

Maintenance support was likewise frustrating due to the changes in DS units. It was very difficult to find the expertise and equipment for our "one-of-a-kind" weapon throughout the theater. We had to tow unrepaired equipment to our new DS unit each time we changed.

The fact that we were able to accomplish our mission can be attributed to our soldiers and the resourcefulness of our supporting units.

OH58D Helicopters

In the desert, accurate target location is a tough problem. The OH58D proved to be the best system for providing targets, but flying conditions in the desert dictate two pilots instead of a pilot and observer. Pilots can easily learn to do what's necessary to support the FA. The OH58D is the best lasing system for Copperhead rounds. It's also very easy to establish common survey with the OH58D.

Rehearsals with OH58Ds proved invaluable to successful execution in combat. Call-for-fire procedures, both voice and digital, were reviewed with the aviation units. These basic techniques yielded timely, accurate fires and target hits.

Throughout our Gulf War experience, the OH58D-FA team proved itself a significant modern FA tool and combat multiplier available to provide commanders fast, accurate target location.

Navigation

In a land where severe weather conditions change geographic formations at nature's whim, a controlled military movement overland becomes a challenge. In much of northern Saudi Arabia and southern Iraq, frequent wind storms move land masses, cover paved roads and erase recent trails. This land erosion process often makes map spotting and terrain association a futile method of getting from Point A to Point B.

We overcame this navigational obstacle by using satellite, radio and rotating gyro technology. The battalions used HMMWVs equipped with the GPS, LORAN, and the PADS to ensure accurate locations for firing elements.

These systems were not only practical for navigating, but also establishing rapid common survey for an artillery battalion, easily out-pacing the slower methods of conventional survey. One of the major lessons of Desert Shield and Storm operations was that these modern methods of navigation and survey were much more valuable on the offensive, where the battlefield is a highly technical and dynamic environment, than on the defensive, a less dynamic environment.

To minimize errors, system redundancy entails using PADS and GPS simultaneously to cross check each other. Significant differences between the two systems in survey or navigation data alert the operator to a possible problem with one of the systems. The cross check called for two PADS and one GPS used simultaneously to minimize errors during movements.

Platoon versus Battery Operations

The attack was fast-paced and called for quick, responsive fire support. Due to limited trafficability for towed artillery, the battalions had to move on, or in the vicinity of, improved roads. To increase command and control, we moved and employed firing units as eight-gun batteries instead of split platoons on most occasions. The decision to use the "battery" concept was based on a minimal counterfire threat from the Iraqi 45th Infantry Division and the requirement for fast battalion-sized moves and highly accurate massed fires.

As offensive operations began, each battalion received its proposed goose-egg position to occupy. These positions went through both the intermediate and final objectives. Our tactical maneuver plan was to move to one of the goose eggs and get off the MSR into position ready to fire as fast as possible. As each battalion moved along the MSR, it occupied as a battalion in a hasty occupation similar to a battery eight-gun hip shoot.

As stated earlier, the battalion convoy was led by the RSO. With GPS, he led the battalion rapidly to a release point along the MSR, and the firing batteries and TOC immediately dispersed. The mission called for rapid movement of "battalions" of artillery along the axis of advance of an Allied armored division; moving by platoons was too slow. By combining the command and control of both platoons, we enhanced operational control over the batteries and reduced the span of control by one layer, increasing our ability to keep up with armor and mechanized infantry.

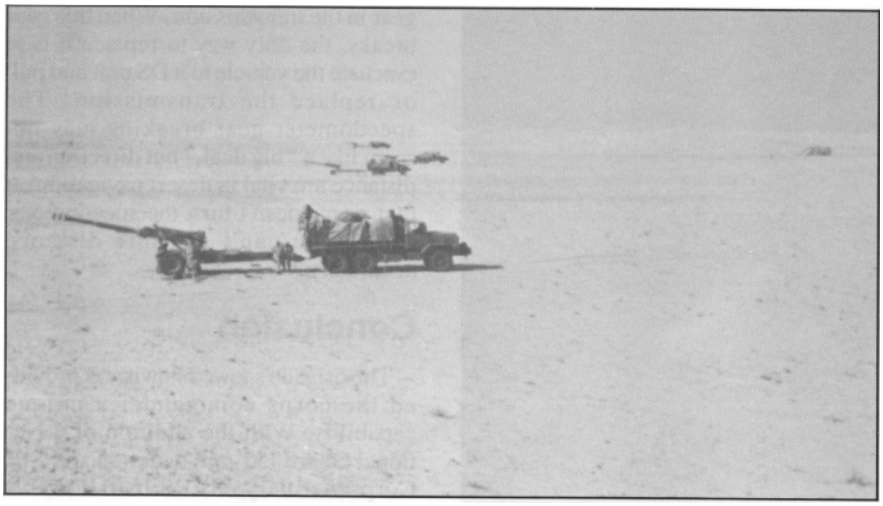
Towed Howitzer Mobility

Off-road M198 howitzer mobility was tricky. Only the C5A Galaxy aircraft can transport M198 howitzers with wide tires; therefore, the 18th FA Brigade usually deploys with narrow, 10-inch wide tires. The narrow tires can handle short moves around Fort Bragg, North Carolina. But during the first convoy in Saudi Arabia, one battalion had blowouts in about 25 percent of its howitzers. The tires are the shock absorbers for the M198. This stress and the intense heat built up on the move caused our 10-inch tires to fail very quickly. We tried changing the tire pressure to the different recommended levels for on- and off-road driving with limited success. We spent 30 to 45 minutes changing our tires' pressure each time we switched road surfaces.

But regulating our tire pressure wasn't the answer. When off road, the narrow tires proved less than adequate as they followed in the tracks of the M925A1 5-ton truck. Often the tires wouldn't even roll, causing the howitzer to act like a 15,000-pound anchor.

The wide balloon tire was the answer. When the balloon tire and rims arrived, we saw a significant increase in the off-road mobility of our howitzers. The off-road skills of our drivers increased, and their confidence in themselves and their trucks grew. Section members learned to recognize terrain that gun trucks could and couldn't traverse. They also recognized when their gun trucks were beginning to bog down and what actions to take to keep the trucks from burying themselves in sand. But the M925A1 towing a howitzer with wide tires was nearly impossible to get stuck and balloon tires didn't blow out as often as the narrow ones.

Once a howitzer became stuck, rapid self-recovery was difficult, at best. Until sand ladders were built by unit maintenance sections, the howitzer was unhitched and rotated 90 degrees. This allowed the prime mover to approach for hookup through undisturbed sand. If the



The M925A1 5-ton truck with balloon tires is nearly impossible to get stuck towing a howitzer in the desert, and the wide tires don't blow out as often.

howitzer remained stuck, a wrecker or HEMTT extracted the vehicle and howitzer. Attempts to "rock" or snatch a howitzer and prime mover from deep sand generally resulted in broken equipment.

The HEMTT is useful in extracting stuck howitzers but isn't an effective prime mover. It wasn't designed to tow a howitzer, and the howitzer isn't designed to be pulled safely behind it. The height of the towing pintle pushes the center of balance past the axle and places unneeded strain on the inside of the howitzer's lowering carriage. This stress is compounded by the howitzer's bouncing like an M102 howitzer when it's towed over rough terrain.

Met, Calibration and MVV

Desert Shield and Storm presented some unique challenges in the areas of calibration', Met and muzzle velocity variation (MVV) management. We identified those areas as possible problems even before deploying to Southwest Asia. Staff studies were conducted and guidance sought from the FA School at Fort Sill, Oklahoma. Our primary concern was for Met.

Meteorological Data. Extreme weather conditions in the theater of operations caused non-standard effects on the ballistic trajectory of the round. Our major concern was the possibility that the meteorological section, for short periods, would be unable to provide current Met.

Anticipating this possibility, the brigade TACFIRE sections compiled meteorological data during the months before Desert Storm. We then categorized this data and compiled a "standard Met" for different weather conditions and times. This information was passed down to the platoon level for use in case we couldn't get or disseminate the current meteorological information. Fortunately, the meteorological sections did an outstanding job of providing our units with current Met on an hourly basis during combat operations.

Calibration and MVV. A second concern was for calibration and MVV management. Our basic load consisted of many munitions and propellants, but because of peacetime safety restrictions on firing ranges, we couldn't determine the calibration data for all of them.

Calibration was the brigade's top shooting priority once the unit deployed to the desert. In October 1990, the brigade had the opportunity to calibrate our largest lot of propellant. Our M90 chronographs were difficult devices to use because of their high failure rate. The M90 is a dated piece of equipment that we ought to replace with the velocimeter. As programmed, every howitzer should have a velocimeter as part of its section equipment.

One week before the Ground War started, while firing on Iraqi observation posts, all three battalions were able to calibrate with M203 Red Bag propellants for rocket assisted projectiles (RAP). We calibrated with other smaller lots of M119A2 and M203 propellants in ground combat operations during the Ground War.

Unlike peacetime exercises, we found ourselves with a large number of different lots for each type of propellant. For the M119A2 propellant, we had 23

An 18th FA Brigade gun crew fires its M198 howitzer in Desert Storm. In the desert, the M198's mobility off road was tricky.

The 18th FA Brigade's battalions gave the corps commander unique capabilities, including the devastating fires of 6-27 FA's MLRS.

different lots. This was a challenge in that the battalion TACFIRE system and battery computer system (BCS) only allow 16 different lots for each propellant type.

Our solution for this lot management problem was a manual tracking system, but it was time-consuming and cumbersome during the heat of battle. To ensure that mission processing and firing didn't slow down, the battalions directed that all lots be distributed equally down to platoon levels using internal lot designators for each. Fire direction personnel were briefed and trained on proper lot management. Large calibrated lots were used for battalion fire-for-effect (FFE) missions while the smaller lots were set aside for adjust fire missions. As MVVs became available for these odd lots, battalions compiled and disseminated the information down to the battery or platoon level.

Equipment Upgrades

The overall quality of our equipment was very high. The Army certainly has gotten its money's worth.

M925A1 Drop-Side, 5-Ton Truck. Our experience in Saudi proved that the M925A1 isn't good enough as a prime mover for an M198 howitzer. It works fine on hard-packed or paved roads, but its cross-country capability is limited. The howitzer, loaded only with section equipment, exceeds the truck's maximum pintle towing weight by at least 600 pounds. When you add ammunition, food and water and a crew of 10, you quickly exceed the vehicle's ability to travel cross country.

To try to make it more mobile, we deflated the tires. We made sand ladders. We lightened the load by leaving behind section equipment that wasn't absolutely mission-essential, and we reduced the ammunition basic load on the truck. The bottom line: the M925A1 isn't up to the task of pulling a 15,750-pound howitzer.

The transfer cracks if you put the transmission in reverse when a howitzer is attached and the transfer is in low. Of course, the -10 operators manuals say not to use reverse in low transfer, but a driver only has to get it wrong *once* to deadline the howitzer system. Our experience shows the M925A2 5-ton drop-side truck with the improved transfer and more torque and air pressure should replace the M925A1.

HEMTT. This vehicle was an outstanding asset. It could travel through all types of terrain—deep sand, mud and rocks—with a full load. We loaded HEMTTs to their maximum gross weight capability. They never got stuck and didn't break down. They were worth their weight in gold.

HMMWV. This is another great vehicle, but not without some faults. First, the HMMWV has a plastic speedometer gear in the transmission. When this gear breaks, the only way to replace it is to evacuate the vehicle to a DS unit and pull or replace the transmission. The speedometer gear breaking may not seem like a "big deal," but direction and distance are vital in desert navigation. If that gear doesn't turn the speedometer cable, you can't measure distance accurately.

Conclusion

The brigade's towed howitzers provided the corps commander a unique capability. With the addition of a National Guard 155-mm battalion and a III Corps Artillery MLRS battalion, we wielded a devastating firing capability.

We used new techniques and tactics to meet the challenges of combat in the desert, but our focus on gunnery basics proved to be the key to our success.

Colonel Freddy E. McFarren commanded the 18th Field Artillery Brigade (Airborne). Fort Bragg, North Carolina, until recently and deployed the brigade to Southwest Asia for Operations Desert Shield and Storm. He's currently the G3 of the XVIII Airborn Corps at Fort Bragg. Previous Field Artillery assignments include a battery command in the XVIII Airborne Corps Artillery and one in the 82d Airborne Division, both at Fort Bragg; and Battalion Commander of 1-319th Airborne Field Artillery Regiment, also in the 82d Division.

Lieutenant Colonel Lonnie L. Johnson, Jr., has commanded the 5th Battalion, 8th Field Artillery, 18th Field Artillery Brigade, from 17 June 90 to the present, during its deployment to Desert Shield and Storm. He also has commanded B Battery, 1st Battalion (Airborne), 319th Field Artillery, 82d Airborne Division and was the battalion's Executive Officer and, later, the Plans Officer, G3 Plans for the 82d Division.

Lieutenant Colonel John R. Wood commands the 3d Battalion, 8th Field Artillery, 18th Field Artillery Brigade, deploying the battalion to Desert Shield and Storm. He previously served as the Division Artillery S3 and Battalion Executive Officer with the 1st Armored Division Artillery in Germany.

Lieutenant Colonel (P) William H. Groening commanded the 1st Battalion, 39th Field Artillery (Airborne), 18th Field Artillery Brigade, until recently and deployed the battalion to Desert Shield and Storm. He's currently the Assistant G3 of the XVIII Airborne Corps. He also commanded two batteries in the 82d Airborne Division Artillery and served as the S2, 82d Division Artillery and Executive Officer of the 18th FA Brigade.

Steel Rain—

XVIII Airborne Corps Artillery in Desert Storm

by Major Kenneth P. Graves

103d Public Affairs Office

Elements of the XVIII Airborne Corps Artillery were among the first forces deployed to Saudi Arabia in August 1990. The Contingency Corps Artillery force soon increased to three Field Artillery (FA) brigades and four division artilleries. This force spanned the spectrum from light artillery in airborne and air assault units to heavy artillery from armored and mechanized units. By mid-October, this formidable artillery organization was fully prepared to destroy any Iraqi attack into the Kingdom of Saudi Arabia.

In early November, the XVIII Airborne Corps began preparing for offensive actions to liberate Kuwait. The corps began adjusting its task organization to accommodate the arrival of VII Corps into the theater, and compartmented planning continued as the Central Command (CENTCOM) plan began to solidify. The plan underwent many changes before the ground forces crossed the line of departure some three months later. But the XVIII Airborne Corps mission remained clear:

On order, XVIII Airborne Corps attacks to penetrate Iraqi forward defenses and interdict Iraqi LOCs (lines of communication)

along the Euphrates River in order to prevent reinforcement of and escape from the Kuwaiti Theater of Operations (KTO) by Iraqi forces; on order, continues the attack east to assist in the destruction of the RGFC (Republican Guards Forces Command).

The success of Operation Desert Storm is now well-documented. This was the first time in many decades that our armed forces have gathered such a large force for a conventional battle. This also was our first opportunity to apply Airland Battle doctrine in war. And for the artillery, this was the first opportunity to employ several new fire support systems and apply doctrine from the tactical to operational levels.

Did it all work perfectly? Is our direction in the fire support community sound? Could things have gone better?

Many of the answers to these questions could be lost in the euphoria of our great victory.

This article won't presume to provide "the answers" but will provide an insight into what worked, what didn't work and what we Redlegs need to do to improve our fire support and fire support coordination.

Transition to Desert Storm

In the first week of November 1990, the corps artillery received mission guidance for Desert Storm. Detailed planning to support the corps mission began immediately throughout the corps artillery. The change from a defensive to an offensive mission required a new organization for combat (see Figure 1) and detailed planning for logistics, movement and command, control and communications (C^3). Offensive planning continued from early November until "G-Day" (ground war day) with constant refinements to the corps artillery support plan as the enemy and friendly situation changed.

The corps artillery moved from its Desert Shield locations to Desert Storm attack positions during the first two weeks of the air campaign. By 1 February, all corps artillery units, less the 196th FA Brigade that was still deploying to the theater, were in their attack positions and preparing for action. Air defense artillery (ADA) batteries, chemical decontamination platoons, target acquisition assets and maintenance contact teams accompanied each of our three FA brigades.

In terms of numbers of vehicles and distances traveled, this movement dwarfed General Patton's movement of the Third Army in 1944 during the Battle of the Bulge. Figure 2 illustrates the magnitude of the XVIII Airborne Corps movement. It was the equivalent of moving the entire population of Fayetteville, North Carolina, to Philadelphia, Pennsylvania, over a single two lane-road in 14 days. Corps artillery units moved on the two routes shown by the arrows in

XVIII Airborne Corps Artillery

6-27 FA (MLRS/Army TACMS) (-) (General Support Reinforcing) 6th Light Armored Division Artillery (French), 2/101 Chemical Company (Decontamination) (Attached)
5-62 Air Defense Artillery (-) (DS)
101 Chemical Company (-)
18th FA Brigade (Force Artillery Headquarters) (Reinforcing or R) 6th Light Armored Division Artillery (French), On Call (General Support or GS)
- 1-39 FA (155-mm, Towed)
- 3-8 FA (155-mm, Towed)
- 5-8 FA (155-mm, Towed)
- 1-201 FA (155-mm, Self-Propelled)
- 1st FA Detachment (2 Q37 Radars)
- A/5-62 Air Defense Artillery (DS)
- 3/101 Chemical Company (Decontamination) (Attached)

196th FA Brigade (-) En Route to Tactical Assembly Area
- 1-181 FA (203-mm)
- 1-623 FA (203-mm)

212th FA Brigade (-) (R) 24th Infantry Division Artillery (Mechanized)
- 2-17 FA (155-mm, Self-Propelled)
- 2-18 FA (203-mm)
- 3-27 FA (MLRS)
- C/25 FA Detachment (2 Q36 Radars and a Q37) (-)
- C/5-62 Air Defence Artillery (DS)
- 1/101 Chemical Company (Decontamination) (Attached)

Attachments
- C/5-8 FA (155-mm, Towed) Attached to 101st Airborne Division (Air Assault).
- 3-18 FA (155-mm, Self-Propelled) Attached to 3d Armored Cavalry Regiment (ACR) with FA Detachment (Q36 Radar and Q37 Radar) (Attached)

Figure 1: The initial organization of the XVIII Airborne Corps Artillery for combat in the offensive mission.

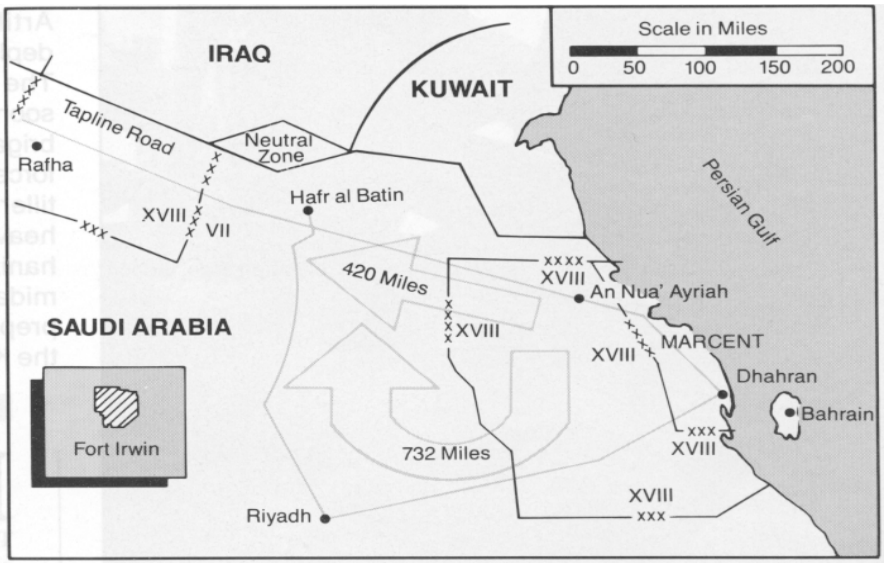


Figure 2: The XVIII Corps Artillery's Movement from Defensive Positions to Desert Storm Offensive Positions. The large area the corps artillery units operated in is clear in comparison to the area of the National Training Center (NTC) at Fort Irwin, California, inserted on the map to scale.

Figure 2, with all tracked vehicles moving on heavy equipment transporters (HETs) or "lowboys." Incredibly detailed movement planning and decentralized execution at all levels made the move a success.

Desert Storm

After deploying to attack positions, the units continued the detailed preparation for the eventual ground attack. Some long awaited personnel and equipment shortages were filled during this period.

Deep operations were limited in scope in the XVIII Airborne Corps sector, which supported the CENTCOM's plan to deceive the enemy about the location of the XVIII Airborne Corps. Based on enemy prisoner of war interrogations after the war, the deception plan was successful, despite the size of the corps move.

On G-7, Army deep operations began in the XVIII Airborne Corps zone. Both the 212th and 18th FA Brigades fired missions in support of deep battle operations by the 24th Infantry (Mechanized) and 82d Airborne Divisions, respectively. The 6-27th FA Bn (-) assisted the 18th FA Brigade in this role with multiple launch rocket system (MLRS) fires. These missions took place from 13 to 23 February and were important in suppressing suspected enemy air defenses, destroying enemy reconnaissance and surveillance assets and deceiving the enemy about the attack helicopter flight routes.

Concurrently, the corps artillery established liaison at all levels, built hardened artillery positions, configured and attached Classes III (Fuel) and V (Ammunition) logistical slices to the FA brigades and fine-tuned plans through rehearsals. Intense preventive maintenance by all units paid off during the ground war; all artillery weapons systems maintained more than 90 percent readiness throughout the campaign.

The XVIII Airborne Corps Artillery was positioned as shown in Figure 3 at the beginning of G-Day. All artillery was well forward with maneuver units and would maintain the rapid pace of the maneuver forces until the cease fire on 28 February. From G-Day to the cease-fire on G+4 (Figures 4 and 5), the corps artillery units stayed on the move, stopping only to refuel, rearm or fire. In approximately 90 hours, the FA brigades and corps artillery command and control elements moved over distances varying between 370 and 435 kilometers.

SGT P. Fohl

On G-Day, gunners from B Battery, 5th Battalion, 8th FA send Iraqi forces a deadly message.

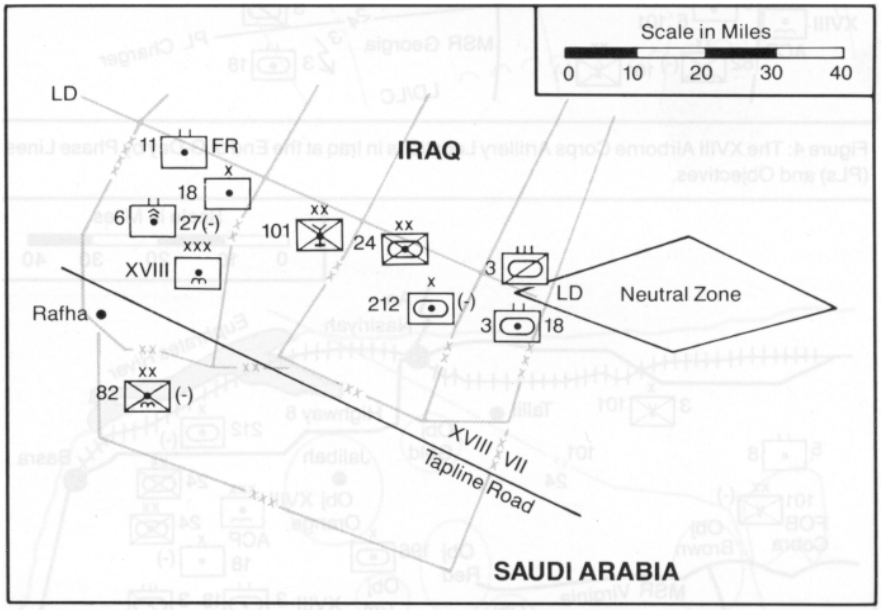
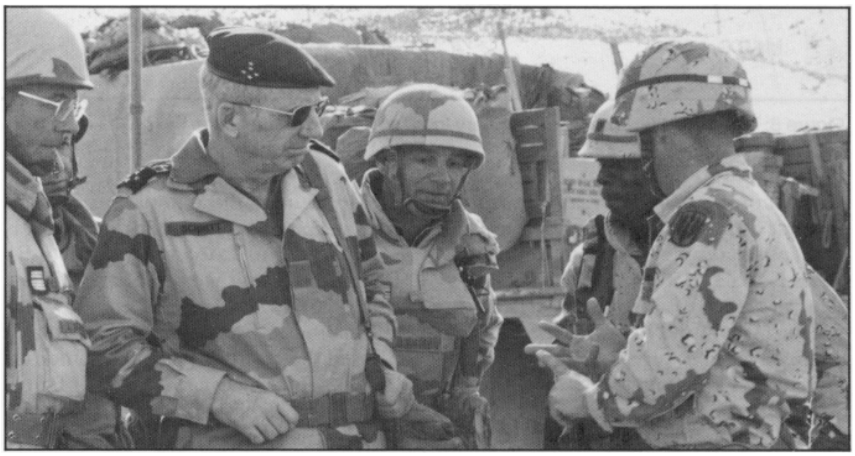


Figure 3: Artillery Deployment in XVII Airborne Corps Sector on G-Day. Corps artillery units worked with French (FR) units.



SGT P. Fohl

General Schmitt, Chief of Staff of the French Army, talks to soldiers of the 18th FA Brigade just before G-Day.

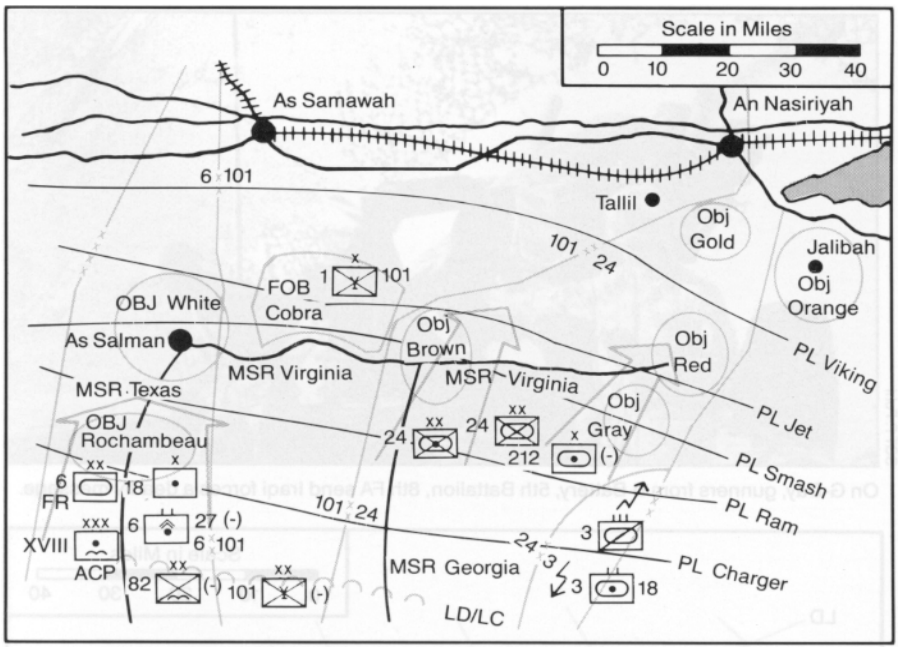


Figure 4: The XVIII Airborne Corps Artillery Locations in Iraq at the End of G-Day by Phase Lines (PLs) and Objectives.

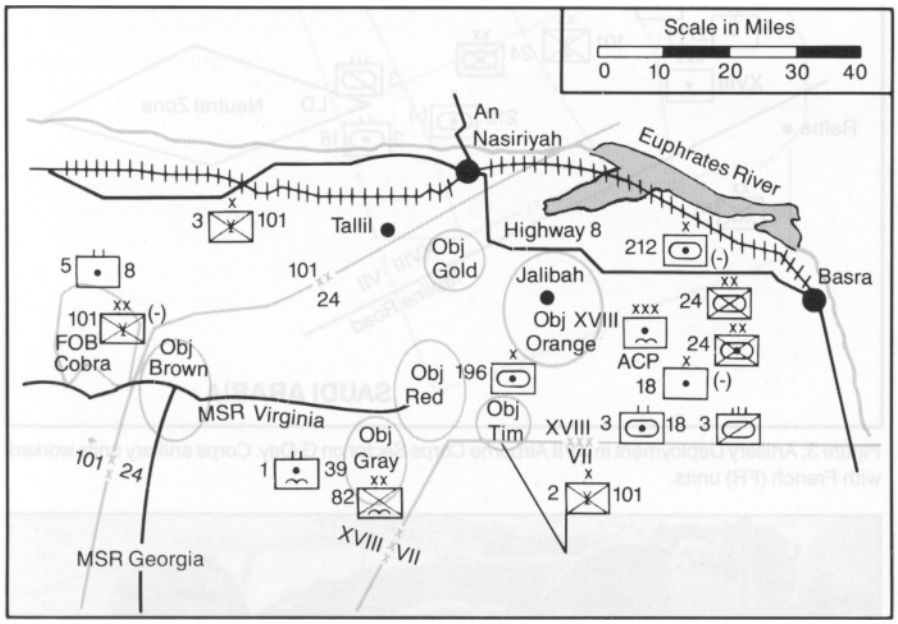


Figure 5: The XVIII Airborne Corps Artillery locations in Iraq at the cease fire on G+4.

XVIII Airborne Corps Artillery
- 18 FA Brigade (GS)
  - 3-8 FA (155-mm, Towed)
  - 1-201 FA (155-mm, Self-Propelled)
  - 6-27 FA (MLRS/Army TACMS) (-)
    - 2/101st Chemical Company (Decontamination) (Attached)
  - 1 FA Detachment (2 Q37 Radars)
  - A/5-62 ADA (DS)
  - 3/101st Chemical Company (Decontamination) (Attached)
- 5-62 ADA (-) (DS)
- 101st Chemical Company (-)
- 196th FA Brigade (-) En Route to Objective Tim
  - 1-181 FA (203-mm)
  - 1-623 FA (203-mm)
- 212th FA Brigade (-) (R) 24th Infantry Division Artillery
  - 2-17 FA (155-mm, Self-Propelled)
  - 2-18 FA (203-mm)
  - 3-27 FA (MLRS)
  - C/25th TA (2 Q36 Radars and 1 Q37 Radar) (-)
  - C/5-62 ADA Battery (DS)
    - 1/101st Chemical Company (Decontamination) (Attached)

Attachments
- 5-8 FA (155-mm, Towed) Attached to 101st Airborne Division
- 1-39 FA (Airborne) (155-mm, Towed) Attached to 82d Airborne Division
- 3-18 FA (155-mm, Self-Propelled) Attached to 3d ACR, FA Detachment (1 Q36 Radar and 1 Q37 Radar) (Attached)

Figure 6: Corp Artillery Organization for Combat after Operations in the 6th French Sector.

The corps artillery organization for combat went through one major adjustment after completing operations in the French 6th Light Armored Division's sector (Figure 6). The 18th FA Brigade fought in both the western and eastern portions of the corps sector, moving more than 150 kilometers east to join the 24th Infantry Division. The first Army tactical missile system (Army TACMS) mission fired in the corps was fired during this move by the 6-27 FA (-), attached to the 18th FA Brigade.

Throughout the campaign, massed fires at the battalion and brigade levels were the norm. In the west, the 18th FA Brigade, acting as the force artillery headquarters for five US artillery battalions in the French sector, habitually massed the entire brigade on numerous targets. In the east, the 24th Infantry Division Artillery and 212th FA Brigade usually massed at least three battalions on each target. The 212th FA Brigade played a crucial role in the east, acting as force artillery headquarters initially for the 1st Brigade of the 24th Division and later for the entire division. On the final day, the 18th and 212th FA Brigades and 24th Infantry Division Artillery massed nine battalions in a devastating early morning preparation that destroyed the Hammurabi RGFC Armored Division.

The campaign was a great success. Corps artillery casualties were light, and soldiers and equipment performed magnificently as artillery fires swept enemy positions with extreme devastation. The effectiveness of these fires, in particular dual-purpose improved conventional munitions (DPICM), led to a term coined by Iraqi soldiers—"Steel Rain."

Observations from a Corps Perspective

The XVIII Airborne Corps Artillery perspective of this operation provides some unique insights and lessons for the FA community. You should keep in mind that many of the lessons are based on the

fast-moving nature of XVIII Airborne Corps operations. The operations are best characterized as exploitive rather than the deliberate attack accomplished by VII Corps.

Operations and Intelligence

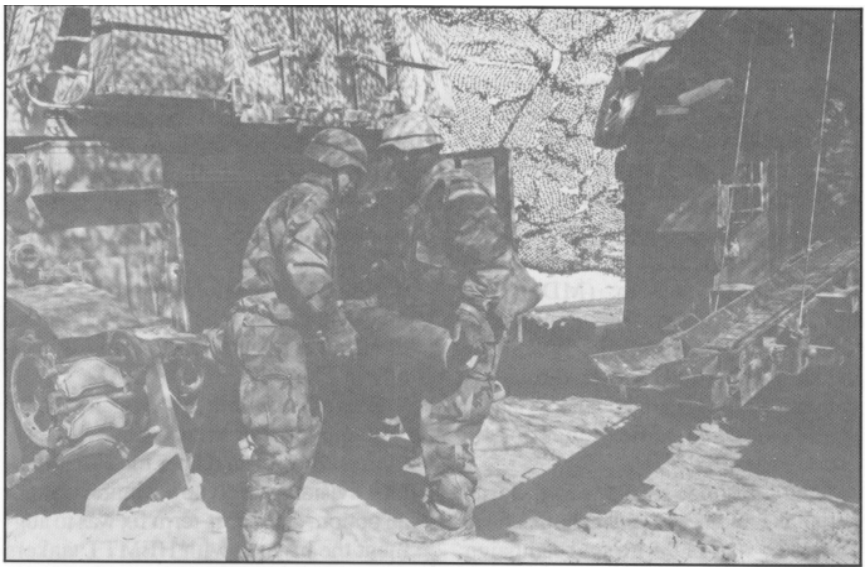
Targeting Process. The targeting process at the corps level is highly dependent upon both echelons above corps (EAC) and corps intelligence assets. In Desert Storm, the corps used the doctrinal decide, detect, deliver process. High-payoff target (HPT) lists and attack guidance matrices were part of the process. The decide and deliver portions of the process worked well. The detect portion of the process needs improvement.

MAJ T. Taylor

The XVIII Airborne Corps Artillery tactical command post crosses into Iraq with the 2d Brigade, 82d Airborne Division.

1LT Gregory Gadson

An 8-inch howitzer prepares to fire with a backdrop of MLRS rocket fires.



Gunners from the 2-17 FA, 212th Brigade, load ammo for fires in support of the 24th Infantry Division (Mechanized).

Within the corps tactical operations center support element (CTOCSE), it's critical that intelligence analysts quickly recognize and pass HPTs to the fire support cell, especially deep targets. Many of the HPTs in Desert Storm were fleeting targets. With only a small number of Army TACMS available as the main artillery system for deep attack, timeliness in reporting was essential. An Army TACMS missile couldn't be risked on an HPT more than one hour old. The joint surveillance and target attack radar system (JSTARS) provided target information fairly quickly and should be of great value in the targeting process once ground station modules are fielded in the corps and corps artillery.

Keeping Pace with Maneuver. With minor exceptions, all FA units kept up with the maneuver forces they supported. But we still need a tracked howitzer system with the mobility equivalent to the M1A1 tank. The FA's M548 ammunition carriers fell far behind. The one battalion in the corps artillery with FA ammunition supply vehicles (FAASVs) had no such problems.

Units innovatively countered mobility problems. For example, they mounted tactical fire direction system (TACFIRE) shelters on heavy expanded-mobility tactical trucks (HEMTTs) to overcome some TACFIRE mobility problems. Five-ton expandable vans in the FA brigades had limited mobility and wouldn't allow artillery tactical operations center (TOCs) to keep up. So the brigades created "jump TOCs" in high-mobility multipurpose wheeled vehicles (HMMWVs) that kept pace with the battle. In one case, a unit replaced its 5-ton expandable vans with M577 command post (CP) carriers.

Command, Control and Communications. In the corps sector, 200 miles wide and 120 miles deep, command and control was highly dependent on reliable long-range communications. Tactical satellite (TACSAT) radios proved to be the only reliable link between the corps and corps artillery headquarters. There was no reliable long-range communications means among the corps artillery headquarters, its liaison officers (LNOs) and the FA brigades, although radio teletypewriter (RATT) worked intermittently.

AM secure voice communications failed entirely in the corps artillery, Mobile subscriber equipment (MSE), which

worked well in Desert Shield rehearsals, was unable to keep up with the rapid advances in Desert Storm. Had the enemy presented any great surprises, this lack of communications could have had serious consequences.

Using a tactical CP (TACCP) and an assault CP (ACP) was critical to the corps artillery commander's ability to control his brigades. The ACP jumped ahead to maintain FM radio contact with the FA brigades (at first only one brigade) and was joined by the TACCP after the jump.

Both CPs maintained a single-channel TACSAT radio on the corps command nets, providing a minimal link to the corps. Additionally, the corps artillery commander was issued a MARCONI TACSAT telephone which, at times, provided the only link to the corps headquarters.

TACFIRE at the Corps Level. TACFIRE worked fairly well in Desert Shield rehearsals, even over distances of 40 kilometers. But the fast pace of operations and extensive distances between TACFIRE subscribers precluded its use in Desert Storm at the corps artillery level. Tactical fire control at the corps level was done exclusively with voice radio communications.

0H58D Artillery Team. Close work between the corps artillery units and 0H58D helicopters from various aviation units was a major success. Though the 0H58Ds laser designated for Copperhead missions, their greatest value was in targeting. The helicopters were particularly useful in locating enemy artillery units for attack. For the initial phase of the attack, the 12th Combat Aviation Brigade (CAB) with six OH58Ds was under the operational control of (OPCON) the corp artillery—a fruitful relationship. The FA needs to continue to work closely with OH58Ds.

Survey. During Desert Shield, survey control was established across the corps sector using the corps topographical engineer section attached to the corps artillery. This was easily accomplished in a static defensive situation.

But in Desert Storm, survey control was more difficult to establish. The Arabian-American Oil Company (ARAMCO) survey data was inaccurate by almost 200 meters. We couldn't calculate conventional survey using the position and azimuth determining system (PADS) because there were no absolute survey points to update PADS, and the pace of the advance prevented the topographical engineers from emplacing absolute survey points.

Some 18th FA Brigade Redlegs shoot one of thousands of rounds the brigade fired at Iraqi forces in Desert Storm.

By placing a global positioning system (GPS) device (PSN-8 or PSN-9) in each PADS survey vehicle, units had a self-location capability that provided data good enough to shoot with. When an arbitrary survey point was emplaced using GPS data, other PADS survey vehicles could initialize on that point and then provide common survey to all artillery units in the immediate area, which allowed the units to mass fires more accurately. The lesson here is that each PADS vehicle should have GPS to provide "good enough" survey during fast-moving situations.

Dissemination of survey data across the corps proved difficult, mainly due to the long-range communications problems we experienced throughout Desert Storm. This could have had a serious impact on other survey-dependent systems in the corps, such as the Patriot and Hawk missiles and electronic warfare systems.

Meteorological Data. The meteorological data system (MDS) and lightweight Met systems deployed to Saudi Arabia performed fairly well during Desert Storm. However, throughout the war there was a critical shortage of spare parts and radiosondes for the systems.

The radiosonde shortage forced us to curtail the number of Met balloons flown before the start of the ground campaign. The calcium hydride generator for Met balloons uses too much water for desert operations (approximately 16 gallons per balloon). The preferred method for inflating the balloons was to use commercial helium bottles. This was faster than calcium hydrides although some problems were encountered in refilling the bottles.

Logistics

Log planning accounted for much of the corps artillery staff effort. Log was one important element of our operations that could prevent our success. As should be expected, Class III and Class V were our greatest concerns. The large quantities of both classes of supplies required for a single day greatly exceeded our haul capacities. This necessitated a close relationship with the corps support command (COSCOM) to work out a satisfactory support relationship.

A "quick fix" plan evolved for corps artillery units. The 212th FA Brigade rolled up its support requirements with the 24th Infantry Division because it initially was intended to remain in a reinforcing role to that division throughout the war. The 24th Infantry Division, in turn, received the added logistic support of the 101st Corps Support Group (CSG). This non-standard relationship provided adequate support for the 212th FA Brigade, though it experienced shortfalls, especially in Class III.

Because the 18th FA Brigade would first support the French 6th Light Armored Division and later the 24th Infantry Division, a "roll up" solution was not an option. The short-term fix was to augment the brigade with HEMTT tankers and have a one-day's supply of Class V (uploaded on COSCOM assets) accompany the brigade trains. After the brigade

arrived in the 101st CSG area (24th Infantry Division sector), the normal area support would occur. The 18th FA Brigade also experienced Class III shortfalls, and the 101st CSG eventually became overwhelmed.

A fundamental observation is that logistical support doctrine for non-divisional units is not consistent with AirLand Battle doctrine. Had the war continued for a few more days or had the Class V usage increased, the situation would have been critical.

During the entire Southwest Asian conflict, the XVIII Airborne Corps Artillery units drew all logistical and maintenance support from CSGs on an area basis, in accordance with current logistical doctrine. This arrangement presented significant problems. Direct support (DS) maintenance units changed frequently, causing difficulty in tracking requisitions. Many times, DS units didn't have proper equipment or maintenance personnel to work on the supported units' equipment.

On the supply side, the corps artillery G4 and brigade S4 sections had to function as fully operational support platoons, a mission for which they aren't configured. Area support for non-divisional artillery was cumbersome and slow. To expedite supply actions, the G4 and S4 sections frequently had to travel hundreds of miles to draw supplies directly from general support (GS) supply companies rather than through DS support.

Non-divisional logistics support needs a thorough review, especially as more combat support units move from division to corps control in the future force restructuring. FA brigades must have either organic or dedicated logistical units—especially in the maintenance area.

Fire Support Coordination

Joint Fire Support Doctrine. As the XVIII Airborne Corps began deep-battle operations, it became apparent there's a great disconnect between the Air Force and Army concerning the use of battlefield air interdiction (BAI) and the application of fire support coordination lines (FSCL). The Army doctrinally uses BAI to allow the corps commander to shape the battlefield. During Desert Storm, the Air Force didn't allow the corps commander to determine the BAI targets. This conflict in doctrine led to highly centralized control of Air Force assets during the war, with the corps receiving less tactical air (TACAIR) support than expected.

The terms BAI and air interdiction (AI) need clarification. The Air Force prefers AI because it allows them greater flexibility. The Army wants BAI, which provides dedicated air packages with munitions for each target and a specific block of time for use. During Desert Storm, AI was used exclusively.

The targeting cycle at EAC embraced this centralized approach. Corps targets were submitted through the Army Central Command (ARCENT) to the joint and combined targeting board at Central Command (CENTCOM). If the targets fit the CENTCOM targeting priorities, the Air Force attacked them. The corps submitted hundreds of targets; however, less than 15 percent were approved by CENTCOM. Obviously, this makes it very difficult for the corps commander to shape the deep battle using air assets.

Although the Air Force and Army have long agreed on a joint definition of the FSCL, interpretations of the definition differed during Desert Storm. The Army viewed the FSCL as a permissive fire control measure that allows us to fire beyond it without coordination. The Air Force viewed the FSCL as a restrictive fire control measure that required the Army to coordinate all surface-to-surface fires beyond the FSCL with the Air Force.

The same problem held true for airspace coordination. Instead of establishing airspace coordination areas (ACAs) or flight corridors, Central Air Force (CENTAF) required clearance of fires above 32,000 feet throughout the battlefield. This caused lengthy delays with all Army TACMS missions and some MLRS missions.

During Desert Storm, some non-doctrinal, improvised fire support coordination measures were used. The Air Force used "kill boxes" to provide both AI and close air support (CAS). Often, targets weren't at the reported locations, resulting in the targets not being attacked. To use the sortie, the Air Force would let the sortie attack any positively identified enemy target within a certain kill box. Often these targets were the original targets, which had moved.

Joint Attack of Artillery (JAART). The basis of JAART is the use of all assets (USAF, FA, attack helicopters, etc.) to destroy enemy artillery before it can engage friendly forces. We used this concept in combat for the first time in Desert Storm with significant success. Air Force assets attacked many enemy artillery positions before the ground campaign. Attack helicopters and aerial scouts frequently found and destroyed enemy artillery; the 30-mm gun on the Apache helicopter is excellent against all artillery pieces. The OH58D helicopters OPCON to the corps artillery provided accurate locations for enemy artillery units, which corps artillery elements then fired upon. By using all available fire support to proactively locate and destroy enemy artillery, the corps effectively negated one of the Iraqi Army's greatest strengths.

Liaison

Communications. During Desert Shield and Storm, the XVIII Airborne Corps Artillery deployed several liaison teams to various units. The primary means of communication with these teams was AM secure voice, which was the only system that could range the distances involved. This system worked

Howitzers of the 2-18 FA, 212th Brigade cross the berm, returning to Saudi Arabia.

intermittently during Desert Shield and failed completely during Desert Storm. At the corps level, liaison teams have to communicate over long distances.

We need a reliable long-range communications system for liaison teams if they're to be useful. TACSAT appears to be one potential solution.

EAC Liaison Positions. The corps artillery normally doesn't provide extensive liaison to EAC. However in Southwest Asia, the corps artillery found this to be essential.

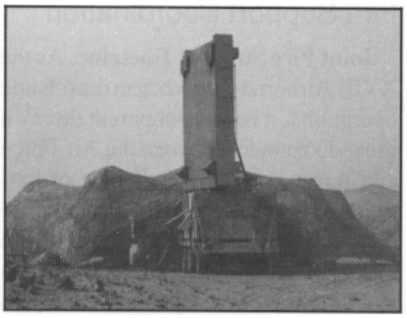
Corps artillery was represented at the ARCENT battlefield coordination element (BCE), on the airborne battlefield C^3 aircraft and in the deep targeting cell. Liaison at this level became essential when ARCENT began controlling two corps.

Field Artillery Systems Employment

Heavy versus Towed FA Brigade. The corps artillery initially employed a heavy brigade behind the 24th Infantry Division and a predominantly towed, 155-mm brigade behind the French 6th Light Armored Division. This decision was based on the need for each brigade to have mobility similar to its supported maneuver unit. The artillery brigades also had protection requirements and logistical needs similar to their respective supported units.

In the later stages of the battle, elements of the towed FA brigade were sent across the corps sector to support the 24th Infantry Division. These elements demonstrated more mobility than expected, traveling more than 150 miles in 36 hours with much of this movement cross country through the desert at night.

The towed elements were able to effectively support the heavy division. However, it's wise to match the mobility protection levels and logistical requirements of an artillery brigade with those characteristic of the supported maneuver division.



103d Public Affairs Office

The XVIII Airborne Corps Q37 Firefinder radars couldn't complete the cross-country trek because of mobility problems with the trailers.

MLRS and Army TACMS. MLRS quickly proved itself the weapon of choice for counterfire missions and was particularly devastating against towed artillery units. MLRS units were frequently employed by battery rather than by the platoon-based concept. This was possible because of the lack of a credible air or counterfire threat and allowed easier command and control.

Army TACMS fires were controlled at the corps level throughout the operation. This system was excellent for deep attack once suitable targets were obtained. Of the seven targets fired upon by the XVIII Airborne Corps Artillery, all were destroyed or rendered combat ineffective.

Generally, one platoon of the Army TACMS battery was configured for Army TACMS at any time. While this was usually enough, we learned it's prudent to provide the battery as much warning as possible when a surge of Army TACMS missions is expected. The package requests may exceed the battery's capability if a launcher is down or a missile malfunctions. Prior warning will give the battery time to reconfigure other launchers from MLRS to Army TACMS, as required.

Counterfire Radars. Our counterfire radars were expected to provide us a distinct advantage over the Iraqis. For the most part they did, though there were some problems.

The Q37 radar experienced severe mobility problems in cross-country movement. No Q37 radar played a significant role in the XVIII Airborne Corps' eastern sector. All six radars were unable to complete the crosscountry trek—the trailer must be replaced.

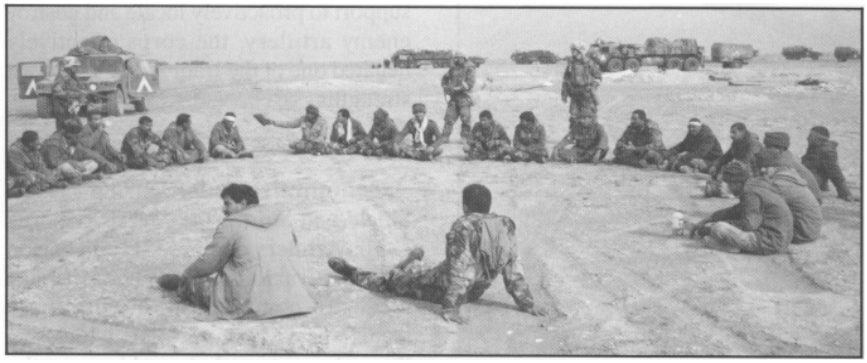
The Q36 radar became the mainstay for counterfire; however, it detected many spurious targets that required careful screening by operators.

Conclusion

Great soldiers, great training and great equipment made the Desert Storm victory possible. Clearly, fire support and fire support coordination for Desert Storm was outstanding.

But as artillery operations in the Kuwaiti Theater of Operations are analyzed, we must recognize our success was due, in part, to an enemy unable to inflict heavy casualties on our forces or cause us to deviate from our plans. This presented a very "forgiving" battlefield. We must ensure we don't place undue emphasis on lessons learned from a war fought under very unique circumstances.

But one lesson from Desert Storm is clear. Accurately delivered, massed artillery fire continues to be the critical ingredient for success on the modern battlefield. As has been proven in previous wars, the FA is truly the "King of Battle."



Soldiers of the 2-18 FA, 212th Brigade, guard enemy prisoners of war in southeastern Iraq.

Major Kenneth P. Graves was assigned to the XVIII Airborne Corps Artillery Headquarters in Saudi Arabia in September 1990. He deployed in Operation Desert Shield as the Corps Artillery Liaison Officer (LNO) to the Marine Central Command (MARCENT) and the 1st Marine Division. During planning for Operation Desert Storm, he was the Corps Artillery G3 Planner and then served as the LNO to the 24th Infantry Division (Mechanized). Major Graves is currently the Force Modernization Officer and LNO of the XVIII Airborne Corps Artillery. He has commanded two batteries, one in the 2d Battalion, 35th Field Artillery, 24th Infantry Division, Fort Stewart, Georgia, and the Howitzer Battery of the 3d Squadron, 11th Armored Cavalry Regiment, Germany.

The Lightning of Desert Storm

by Colonel Randall J. Anderson and Major Charles B. Allen

This article is a combination of two by the same authors. The first part covers the 101st Airborne Division (Air Assault) four-phase operations plan (OPLAN) as it attacked into Kuwait in Operation Desert Storm. The second part discusses the 101st's light-heavy organization and operations for its covering force defensive mission in Desert Shield to respond to an anticipated Iraqi attack from Kuwait south into Saudi Arabia.

DTG 170001C Jan 91

Soldiers, Sailors, Airmen and Marines of United States Central Command, this morning at 0300C we launched Operation Desert Storm, an offensive campaign that will enforce United Nations Resolutions that Iraq must cease its rape and pillage of its weaker neighbor and withdraw its forces from Kuwait. . . . My confidence in you is total. Our cause is just! Now you must be the thunder and lightning of Desert Storm. May God be with you, your loved ones at home and our country.

General H. Norman Schwarzkopf
Commander in Chief, Central Command

DTG 220700C Feb 91

Division OPORD 91-1 is effective for execution upon receipt of this message. G-Day H-Hour is 240600C Feb 91.

The Division's next Rendezvous with Destiny is north to the Euphrates River. Godspeed and good luck! Air Assault.

Major General J.H. Binford Peay III
Commanding General
101st Airborne Division (Air Assault)

On 17 January at approximately 0300 hours, the coalition forces unleashed the fury of Operation Desert Storm on the infrastructure and military forces of Iraq. The 101st Division OPLAN 91-1, code-named Operation Desert Rendezvous, laid out a four-phased operation to take the division from force repositioning (concurrent with the air campaign) to consolidation after offensive operations. Phase I (logistical buildup) moved engineer equipment, quartering parties, the division assault command post (ACP) and logistical resources to positions forward at Tactical Assembly Area (TAA) Campbell. The TAA was on the Saudi Arabian-Iraqi border, approximately 50 kilometers east of Rafha, Saudi Arabia. (See Figure 1.) Phase II repositioned the division from its base camp, Camp Eagle II (near Dhahran, Saudi Arabia), to the TAA.

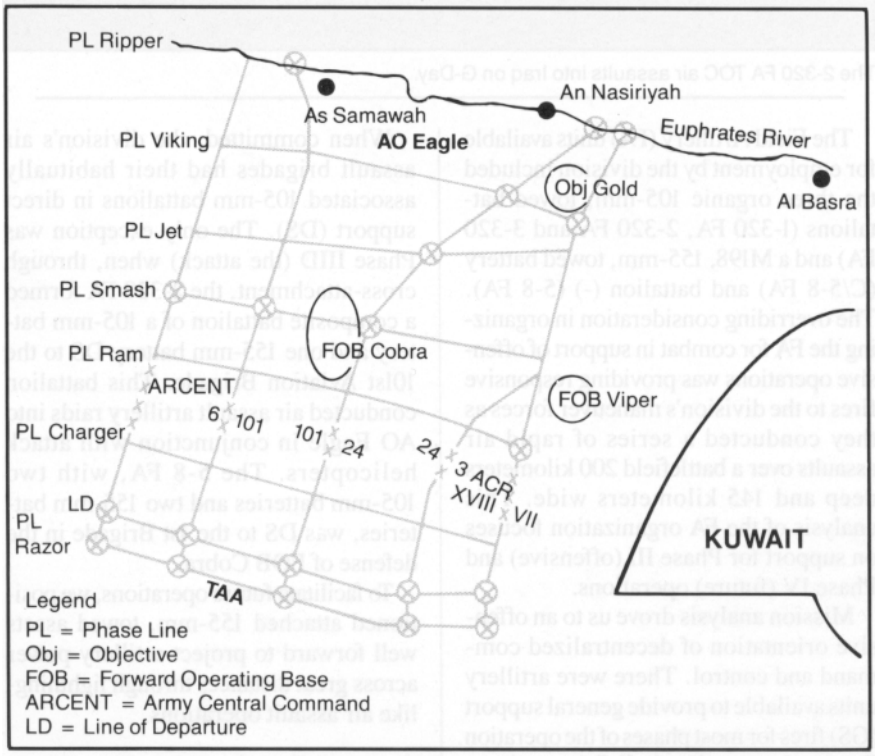


Figure 1: The 101st Airborne Division's OPLAN 91-1, from repositioning in the TAA (concurrent with the air campaign) to consolidation after offensive operations in Area of Operations Eagle along the Euphrates River.

Phase III, offensive operations against Iraqi forces, included four subphases: Phase IIIA—the seizure and establishment of a forward operating base (FOB Cobra) approximately 75 miles inside Iraq; Phase IIIB—the buildup of the FOB; Phase IIIC—an armed reconnaissance of the Euphrates River valley area of operations (AO Eagle) to interdict enemy forces and identify suitable landing zones (LZs) and blocking positions; and Phase IIID—the attack into the Euphrates River valley to interdict and block enemy forces. Phase IV (future operations) consisted of three subphases: Phase IVA—force repositioning and logistics buildup of a deeper FOB (Objective Gold); Phase IVB—aviation reconnaissance of the 101st Division AO in the vicinity of Basra, Iraq; and Phase IVC—offensive operations to destroy the Republican Guards Forces Command (RGFC) and isolate Basra.

This article documents the 101st Airborne Division Artillery's implementation of Division OPLAN/OPORD 91-1. This OPLAN provided the direction to move the division artillery (Div Arty) to the TAA and then conduct combat operations against Iraqi forces.

Operation Desert Storm

The 2-320 FA TOC air assaults into Iraq on G-Day.

The Field Artillery (FA) units available for employment by the division included the three organic 105-mm, towed battalions (1-320 FA, 2-320 FA and 3-320 FA) and a M198, 155-mm, towed battery (C/5-8 FA) and battalion (-) (5-8 FA). The overriding consideration in organizing the FA for combat in support of offensive operations was providing responsive fires to the division's maneuver forces as they conducted a series of rapid air assaults over a battlefield 200 kilometers deep and 145 kilometers wide. This analysis of the FA organization focuses on support for Phase III (offensive) and Phase IV (future) operations.

Mission analysis drove us to an offensive orientation of decentralized command and control. There were artillery units available to provide general support (GS) fires for most phases of the operation. But we decentralized all firing units to support offensive operations as far north as the Euphrates River, as far south as FOB Cobra and as far east as FOB Viper.

When committed, the division's air assault brigades had their habitually associated 105-mm battalions in direct support (DS). The only exception was Phase IIID (the attack) when, through cross-attachment, the 2-320 FA formed a composite battalion of a 105-mm battery and one 155-mm battery DS to the 101st Aviation Brigade. This battalion conducted air assault artillery raids into AO Eagle in conjunction with attack helicopters. The 5-8 FA, with two 105-mm batteries and two 155-mm batteries, was DS to the 1st Brigade in the defense of FOB Cobra.

To facilitate future operations, we positioned attached 155-mm, towed assets well forward to project artillery power across great distances through lightning-like air assault operations.

Camp Eagle II to the TAA

At start of the air campaign, the 101st deployed by air and ground from Camp Eagle II to the TAA by task-organized brigades in seven days. The division's entire high-mobility multipurpose wheeled vehicle (HMMWV) fleet and the majority of its personnel moved from King Fahd International Airport (vicinity of Camp Eagle II) to the Rafha airfield by C-130 aircraft. All 2-1/2 ton and larger vehicles moved from Camp Eagle II to the TAA by a 723-mile ground convoy through the Saudi capital of Riyadh.

Operations. Once Div Arty units and C/5-8 FA arrived in the TAA, the first priority was to provide fire support across the divisional front. Two air assault brigades along the Saudi-Iraqi border began aggressive patrolling and counter-patrolling operations. Their DS battalions provided fires in support of these operations. Additionally, C/5-8 FA and C/6-27 FA multiple launch rocket systems (MLRS) were positioned to provide fires GS to the division.

From G-7 to G-Day, the division planned armed aerial reconnaissance operations to identify and attack enemy forces that threatened operations beyond the border. We planned both ground and air assault artillery raids, supported by attack helicopters, to neutralize or destroy lucrative targets.

Although positioned and prepared to support a variety of missions, the Div Arty organic and attached elements didn't fire while the division occupied the TAA. It was decided that sporadic enemy activity didn't justify possibly disclosing the presence of the division to the Iraqi forces in our AO.

Training. The Div Arty firing units conducted final precombat training after their arrival in TAA Campbell. Clearly, air assault operations were the linchpin of preparation for combat. Two components

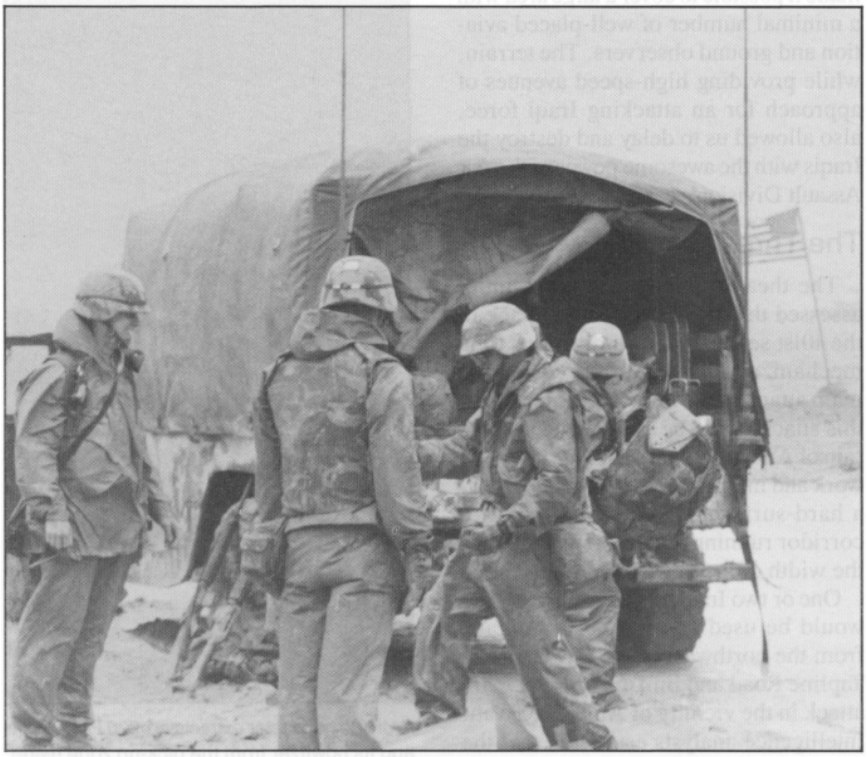
of this training deserve special attention: day and night air assault artillery raid training and training to employ CH-47 helicopters as "prime movers" during air assault operations.

The Div Arty firing units spent several days conducting progressive training with the division's medium- and heavy-lift battalions. This day and night training consisted of dry drills, tactical exercises without troops (TEWTs) with the firing battery leadership and the aircraft crews, static training with the aircraft and battery collective training.

We developed an air assault procedure for 105-mm units that would allow them to conduct extended air assault artillery raids. A firing battery loaded inside CH-47s, air assaulted to a firing position. Upon arrival, the aircraft shut down to the rear of each howitzer and remained in the firing position through extraction.

This concept provided several advantages. It increased the survivability of the aircraft, affording them the security of the artillery battery instead of having to proceed to an unsecured laager site. The aircraft were available for immediate extraction, decreasing fuel consumption and, therefore, making it possible to conduct deeper artillery raids. Using these procedures, we could carry up to 900 rounds per battery (150 with each howitzer), allowing us to engage multiple targets in a target-rich environment.

Using CH-47 helicopters as the 105-mm howitzers' prime movers, the 101st Airborne Div Arty trained for extended air assault artillery raids.



The 3-320 FA tactical operations center emplaces in the Euphrates River valley in Iraq.

Combat Operations Against Iraqi Forces

The tremendous successes achieved during the G-7 to G-Day armed aerial recons minimized the enemy threat from the line of departure (LD) all the way to the proposed FOB. We had captured 462 enemy prisoners of war (EPWs) and captured or destroyed extensive equipment. Although 105-mm and 155-mm firing units were positioned for on-call SEAD fires for the air assault penetration at the LD, they didn't receive a call for fire.

The 2-320 FA, DS to the 1st Air Assault Brigade, air assaulted with two firing batteries loaded inside CH-47s to FOB Cobra. The third battery, with C/5-8 FA, moved by ground convoy to the FOB. C/2-320 FA fired the first rounds of the war from a 101st Div Arty unit when it engaged an Iraqi infantry battalion dug in three to five kilometers north of the FOB. Shortly after the fire mission, an enemy battalion of more than 400 soldiers surrendered to 1st Brigade soldiers.

The 5-8 FA (-) had been with its parent 18th FA Brigade, reinforcing the French

6th Light Armored Division as they attacked and seized objectives to the 101st's west on G-Day and G+1. Early on G+2, the 5-8 FA (-) was released from its reinforcing mission to the 6th Division, rearmed, refueled and joined the Div Arty in FOB Cobra. The battalion provided GS fires for the security of the FOB and prepared for future operations to the east.

Within 12 hours of FOB Cobra's becoming operational, the 3d Air Assault Brigade conducted an air assault into AO Eagle and began to establish blocking positions and interdict enemy lines of communication (LOCs) along the Euphrates River valley. The 3-320 FA air assaulted two batteries into AO Eagle (a distance of 128 kilometers) to provide DS fires for the 3d Brigade. The third firing battery from 3-320 FA moved by ground convoy through FOB Cobra and joined the rest of the battalion in AO Eagle. The 3-320 FA fired several combat missions in DS of the 3d Brigade and was credited with destroying vehicles and equipment along this critical enemy LOC.

The 1-320 FA, DS to the 2d Brigade, had moved from TAA Campbell to FOB Cobra by ground convoy on G-Day and G+1. It was occupying an assembly area in FOB Cobra, preparing for an air assault attack to the north, when it was diverted to the east. The ground campaign had been so successful that Central Command (CENTCOM) accelerated operations to destroy the retreating, disorganized RGFC forces.

The 2d Brigade established a FOB (FOB Viper) 145 kilometers to the east of FOB Cobra. From Viper, our attack helicopters launched east to help destroy the RGFC. The 1-320 FA air assaulted its three firing batteries to FOB Viper in support of 2d Brigade's operation. The C/5-8 FA was attached to 1-320 FA and moved by ground convoy to FOB Viper. FOB Viper was being built up logistically when the cease-fire was announced.

The Lightning of Desert Storm

The 101st Airborne Division and the coalition forces experienced unprecedented success in combat operations against Iraqi forces. The 101st effectively projected power across an operational area the size of the northeastern United States. This was classic application of AirLand Battle doctrine, and air assault artillery played a critical role as it moved quickly over long distances in support of infantry and aviation task forces.

At the conclusion of the war, General Schwarzkopf visited the division and said, "While the armor and air forces were the thunder, the 101st Airborne Division (Air Assault) was truly the lightning of Desert Storm."

Operation Desert Shield

The Covering Force Mission

By mid-October 1990, the 101st Division was performing the covering force mission for the XVIII Airborne Corps in Saudi Arabia. The 101st Div Arty faced several challenges as we prepared to respond to an anticipated attack by Iraqi forces south from Kuwait.

A Vast Desert Wasteland

The covering force area (CFA) assigned to the 101st was a vast desert wasteland, 100 kilometers wide and 55 kilometers deep, which was 100 kilometers south of the Saudi Arabian-Kuwaiti border. Throughout the CFA, there were very few terrain features that would limit mechanized forces' mobility or canalize attacking forces in any significant way. The entire CFA could be used by the enemy in a combination of division-sized avenues of approach.

On the positive side, the terrain also facilitated our employing close air support (CAS), attack helicopters, tube-launched, optically tracked, wire-guided missiles (TOWs) and FA as an integrated team. Line of sight that stretched from a few kilometers out to 30 to 40 kilometers made it possible to cover a large area with a minimal number of well-placed aviation and ground observers. The terrain, while providing high-speed avenues of approach for an attacking Iraqi force, also allowed us to delay and destroy the Iraqis with the awesome power of the Air Assault Division's combined-arms team.

The Threat

The theater intelligence community assessed that the Iraqis would attack in the 101st sector with two divisions (one mechanized and one armored) as the main attack in the east. The objective of this attack would be to seize the key terrain of An Nu Ayriyah, a major road network and intersection, and Tapline Road, a hard-surfaced, high-speed mobility corridor running northwest to southeast the width of the CFA.

One or two Iraqi mechanized divisions would be used as a supporting attack from the northwest of the CFA to seize Tapline Road and link up with the main attack in the vicinity of An Nu Ayriyah. Intelligence analysts estimated that the supporting attack would follow the main attack by 12 to 24 hours.

A UH-60 helicopter extracts a 1-320 FA section and its howitzer from the pick-up zone using an extended sling.

A 101st Div Arty 105-mm howitzer gun crew prepares to fire. For the covering force mission, the Div Arty was reinforced with the heavy artillery of the 75th and 212th FA Brigades.

Facing this threat, the covering force mission called for an integrated light-heavy force operating over an extended battlefield in accordance with AirLand Battle doctrine. The organic maneuver forces available to the division commander included the three air assault brigades (1st, 2d and 3d), the 101st Aviation Brigade with its two attack helicopter battalions (1-101 AAtk-Apache and 3-101 AAtk Cobra) and the 2-17 Air Cavalry Squadron.

The commander positioned his three air assault brigades in the western portion of the CFA. Their concepts of operations called for a series of engagement areas that would delay, deceive and attrit attacking Iraqi forces as they moved from north to south through the CFA. Employing classic combined-arms doctrine while taking advantage of their superior knowledge of the open terrain in their sectors, the brigade commanders were confident of their ability to accomplish their light-heavy mission.

To "thicken" the battlefield and adequately address the threat to the key terrain of An Nu Ayriyah, the XVIII Airborne Corps Commander attached additional maneuver forces to the 101st. The 3d Armored Cavalry Regiment (ACR) positioned its three heavy, highly mobile, armored cavalry squadrons, one air cavalry squadron and three howitzer batteries to counter the threat to An Nu Ayriyah. The 12th Combat Aviation Brigade (CAB), with its two attack helicopter battalions (3-227 AAtk-Apache and 5-6 Air Cavalry), also was attached. The 2-229th AAtk Battalion (Apache) from Fort Rucker, Alabama, also joined the 101st Aviation Brigade team. The addition of these assets to the division, coupled with the vastness of the division AO, presented some new and unique fire support challenges.

Artillery Organization for Combat

To address the formidable Iraqi threat facing the 101st in the CFA mission, the XVIII Airborne Corps Artillery Commander reinforced the 101st Div Arty with the 75th and 212th FA Brigades from III Corps Artillery, Fort Sill, Oklahoma. (See Figure 2.) Including the organic 105-mm and 155-mm howitzer batteries, the 101st Div Arty fought the fire support battle with the equivalent of 11 artillery battalions. This proved to be a welcome challenge for a light Div Arty headquarters.

The 101st three organic FA battalions were DS to their habitually associated maneuver brigades. Because the 3d ACR was the division's main defensive effort, a significant artillery force was required to support them. The 101st Div Arty designated the 212th FA Brigade as the Force FA Headquarters for the 3d ACR and attached the three howitzer batteries to the brigade's 3-18 FA (155-mm, self propelled). The 3-18 FA, thus, became a six-battery DS battalion for the 3d ACR.

Setting the Stage

The division's concept of operations was to engage and attrit attacking Iraqi forces with its attack aviation assets well forward in the sector. The aviation would then hand over the battle to the air assault brigades and the 3d ACR, who would continue the fight in their respective sectors. If the threat persisted, the division would then conduct passage of lines with and hand the battle over to the 24th Infantry Division (Mechanized) and assume a screening mission on the 24th's west flank.

Positioning FA assets was critical to provide continuous fires for the depth of the CFA. The nature of the covering force mission favored centralized control, but the size and expanse of the AO offered a strong argument for decentralization. Unless firing units were judiciously positioned, significant gaps would result and responsive fires wouldn't be available.

To support the aviation brigades, the 75th FA Brigade positioned two 155-mm battalions well forward in the CFA to provide priority fires and quick-fire channels. The battalions were to provide fires from at least 10 kilometers north of Phase Line (PL) Shovel back to their battle hand-over line with the air assault brigades.

The 212th FA Brigade also positioned two MLRS batteries far enough forward in the 3d ACR sector to range 10 kilometers beyond PL Shovel. This provided additional fire support to the aviation

75th FA Brigade	**212th FA Brigade**
1-17 FA (155-mm, Self-Propelled)	1-18 FA (203-mm)
2-17 FA (155-mm, Self-Propelled)	3-18 FA (+) (155-mm, Self-Propelled)
5-18 FA (203-mm)	3-27 FA (MLRS) (Attached)
6-27 FA (-) (Army TACMS/MLRS)	

Figure 2: Preparing to face potential Iraqi attacks in the covering force area, the XVIII Airborne Corps Artillery Commander reinforced the 101st Div Arty with the 75th and 212th FA Brigades from III Corps Artillery.

brigade operating forward of the 212th's sector.

An interbrigade reinforcing fire net was established from the 155-mm battalion of the 75th FA Brigade to the MLRS battalion of the 212th FA Brigade to enhance the responsiveness of fire support to the forward aviation brigade. The great distances of the CFA, coupled with the limited range of FM digital and voice communications, necessitated this unusual link up.

Train as You'll Fight—Fight as You've Trained

The 101st developed a contingency plan that had two air assault brigades and their DS artillery battalions forward in their CFA positions at all times. The third brigade was positioned at Camp Eagle II to provide rear area security.

Brigade task forces (TFs) deployed to the CFA for 30 out of every 45 days. While there, they focused on their mission essential task lists (METLs) to prepare for combat operations. During these rotations, DS battalions conducted detailed briefbacks of their plans to support the maneuver brigade's concept of operations, as well as the Div Arty FA support plan. Comprehensive fire support rehearsals soon followed.

During these rehearsals, movement matrices were validated, voice and digital fire nets were exercised and fire support plans were integrated to support the maneuver brigades. Battalion survey teams emplaced primary, supplemental and alternate firing positions, as well as observer target reference points and brigade obstacles.

A Div Arty-wide covering force exercise integrated all fire support elements from the 0H58D observation helicopters to the firing batteries of all DS battalions and FA brigades. A thorough after-action review was conducted to capture the multitude of lessons learned.

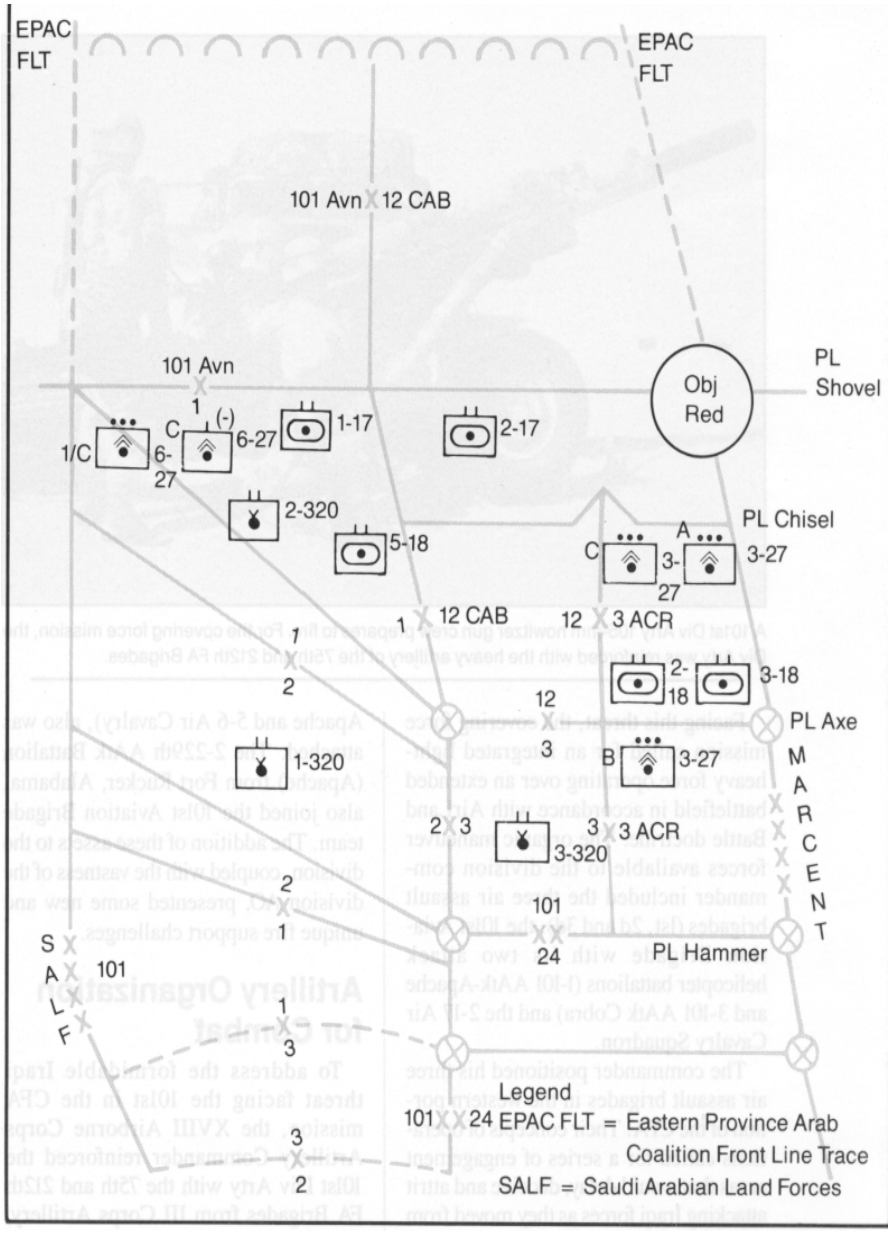
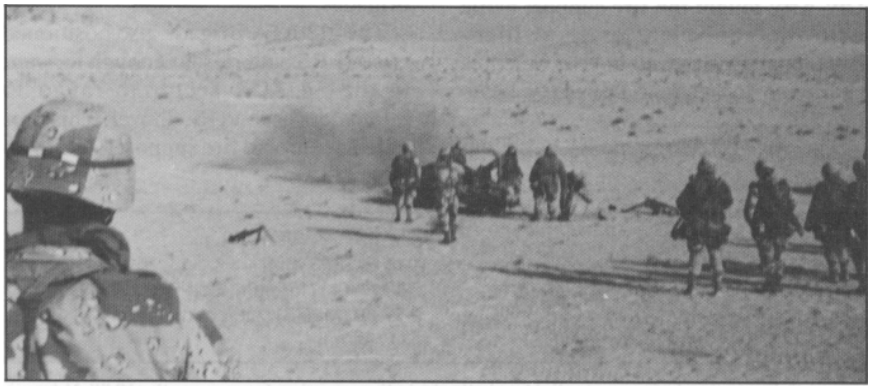


Figure 3: The 101st Division's position during its covering force mission in Operation Desert Shield.

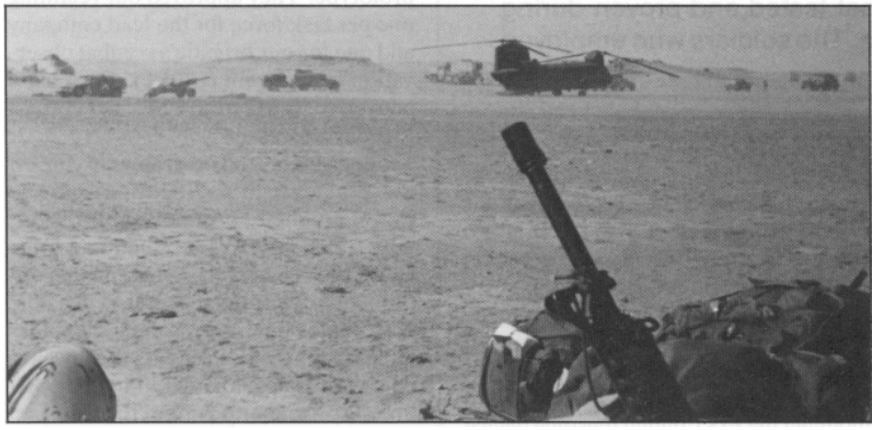


A howitzer section of 2-320 FA direct fires at Faisal Training Area, Saudi Arabia, in November 1990.

With the reinforcement of the 75th and 212th FA Brigades came the responsibility for 101st fire support coordinators to gain and maintain proficiency employing the varied munitions offered by the additional weapons systems. This included combat observation lasing teams (COLTs) and ground/vehicular laser locator designator (G/VLLD) teams lasing for Copperhead round live shoots.

The 101st Div Arty and reinforcing artillery units conducted rigorous, realistic training in the local training areas and "up country" in the CFA positions. We

A gunner in the 101st Airborne Div Arty sets off deflection to hit the target during Desert Shield.



A howitzer section of C Battery, 2-320 FA is ready for pick up on the Saudi-Iraqi border on G-Day.

eventually built an artillery live-fire range in the CFA, which enabled all firing elements to practice and refine their skills. This provided outstanding opportunities for our units to train precisely as we intended to fight.

TACFIRE Interface

The absence of a tactical fire direction system (TACFIRE) capability in the 101st Div Arty challenged our command and control network as we synchronized and coordinated the fires of our 11 artillery battalions. All 75th and 212th FA Brigade battalions, as well as the brigade headquarters, had TACFIRE. Using liaison officers (LNOs) from the two reinforcing brigades proved to be critical to our ability to control reinforcing fires, reposition 75th FA Brigade elements and remain abreast of the fire support battle in the 212th FA Brigade sector. The LNOs relayed and received secure messages to and from their brigade tactical operations centers (TOCs) using mobile subscriber equipment (MSE). Because the two reinforcing FA brigades had MSE, this superb, state-of-the-art communications system was provided to the Div Arty TOC to interface with them.

Some TACFIRE/Non-TACFIRE interface challenges were solved by the fact that OH-58Ds, the division's primary target acquisition asset north of the CFA, could down-link digitally into the brigades' TACFIRE systems. This feature, which was exercised on numerous occasions during rehearsals, proved to be a most responsive method for placing timely and accurate fires on the enemy.

Another system found in the reinforcing FA brigades that interfaced effectively with TACFIRE was the Q-36 and Q-37 Firefinder radars. The radars' TACFIRE compatibility drove us to attach the two Q-37 radars from the 101st 2d FA Detachment (FAD) to the 75th FA Brigade. Each FA brigade was responsible for the counterfire mission in its respective area.

North to the Euphrates

On 17 January at approximately 0300 hours, the fury of Operation Desert Storm replaced the deterrent posture of Operation Desert Shield with a massive air offensive on the infrastructure and military forces of Iraq. Marine Central Command (MARCENT) forces relieved 101st Division units in place in the CFA. This freed the 101st to prepare for its next "Rendezvous with Destiny" north to the Euphrates River during offensive operations of Desert Storm. Without question, Operation Desert Shield proved to be the finest training experience in many years and paved the way for the unprecedented successes of Desert Storm.

In the 101st Div Arty, our success and the short duration of this conflict are a tribute to our air assault doctrine, our planning, equipment and, most importantly, to the skill, will and courage of our soldiers. There were no casualties in the Div Arty during Operation Desert Storm. In the 101st Division, we refer to the conflict as "The 101-Hour War."

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Major Charles B. (Ben) Allen is the Fire Support Officer for the 3d Air Assault Brigade, 101st Airborne Division (Air Assault). He was the 101st Division Artillery Assistant S3 during Operations Desert Shield and Storm. He's a graduate of the Command and General Staff College, Fort Leaven-worth, Kansas, and commanded A Battery, 4th Battalion, 9th Field Artillery (Pershing), Germany, and A Battery, 2d Battalion, 8th Field Artillery, 7th Infantry Division (Light), Fort Ord, California.

How to Cure the FIST-V Blues

by First Lieutenants Aaron L. Geduldig, Mark S. Kremer, James A. Skelton and Willie R. Witherspoon

Do you have the M981 fire support team vehicle (FIST-V) blues? Bring in that old M981 and drive away in a new Bradley fire support vehicle or FM2. The new FM2 has greater mobility, speed and armament and allows quicker fire mission time. This isn't the fire support vehicle of the future. The FM2 is available now and is the most advanced fire support vehicle on the modern battlefield. This concept is combat tested and proven during Operation Desert Storm—it works. The soldiers who employed it in battle designed this vehicle.

While deployed as part of Operation Desert Shield, FISTs in M981s conducted numerous training exercises with their maneuver units. The current FIST vehicle wasn't doing the job in offensive operations. It had problems with mobility, speed and fire mission times. The smaller engine and track caused the M981 to bog down in the soft sand, and initializing the north-seeking gyro (NSG) increased the time required to process the fire missions.

As the training for war continued, the need for fire support increased. The conventional FIST-V provided a means of fire support, but an improved system was available. With the "rollover" of all M2 Bradley fighting vehicles in the 1st Cavalry Division in December, we had the opportunity to try a FIST-Bradley concept.

M2 Conversion to FM2

The battalion command sergeant major, a group of fire support soldiers, the direct support (DS) contact team and communications specialists went to work. They drafted a plan to allow some of the old Bradleys to stay in the hands of the artillery for testing purposes.

With one Bradley as a prototype, the group transferred the communications system from the FIST-V to the Bradley. But the Bradley only had a two-radio capability for the infantry, and four are required for a FIST. The two radios in the turret of the vehicle remained in place, and the communications team mounted two more in the hull. The team also mounted the FIST digital message device (DMD) in the hull (see Figure 1). This configuration allowed the DMD operator easy access to the two radios in the hull and the DMD. The two men in the turret had easy access to the radios they needed to monitor.

The next step was to mount the ground/vehicular laser locator designator (G/VLLD) on the M2. With the help of the maintenance team, a bracket was designed that would easily mount it on the right front of the turret (see Figure 2). The only temporary glitch in mounting the G/VLLD was running the DMD interface cable to the DMD in the hull. The slip ring in the bottom of the turret was the first option. This didn't work because of the turret's 360-degree traverse capabilities. The communications team reviewed the Bradley schematics and devised a way to run the cable through the communications system by using deadpins in the communications boxes. This option successfully interfaced the DMD and G/VLLD and worked flawlessly.

Our battalion commander, (3d Battalion, 82d Field Artillery), the 1st Cavalry Division Artillery commander, 2d Brigade commander and, eventually, the division commander reviewed the prototype. They approved our retaining one per task force for the lead company and one for our brigade's combat observation lasing team (COLT). Each team converted its M2 to an FM2, generally a two-day process.

There are several other ways to convert the Bradley into a FIST Bradley. The tube-launched, optically-controlled, wire-guided (TOW) rack can house the G/VLLD. The teams discussed this option, but determined it wasn't feasible with limited time and resources. Another location for the G/VLLD is in the coaxial machinegun slot; it'll fit in this position. From either position, the team can boresight the G/VLLD with the main gun sight. Also, the team can use the Bradley thermal night sight, a better system than the G/VLLD night sight (TAS-4B). Our putting the G/VLLD in front of the Bradley commander's hatch is a method that works effectively but isn't the only solution.

Operational Questions

The FIST Bradley raised many questions. Where was maintenance support going to come from? Would the FIST Bradley change FIST tactics? What about self defense? Do we need the 25-mm gun? How were the FIST teams going to determine accurate target locations without the NSG?

Maintenance. The maintenance support had an easy solution. Each maneuver company had hull and turret mechanics that knew the system—as opposed to

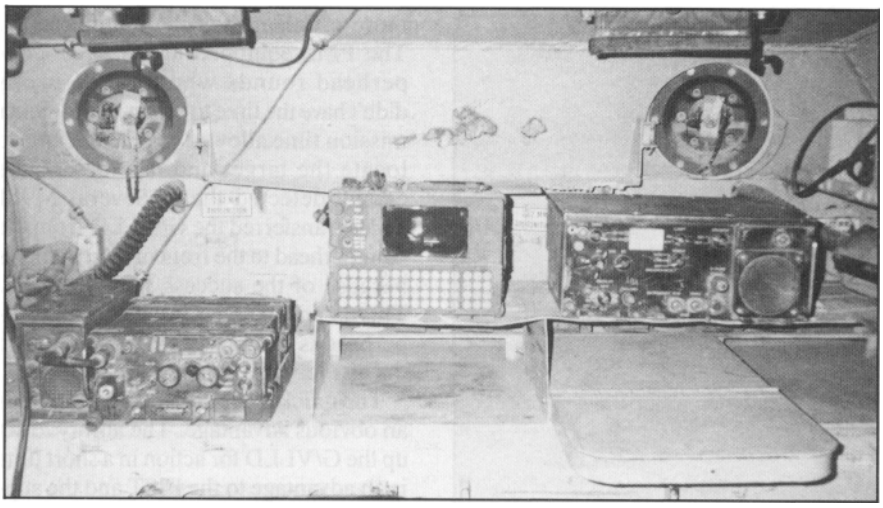

Figure 1: The team mounted the FIST DMD and two radios in the Bradley's hull.

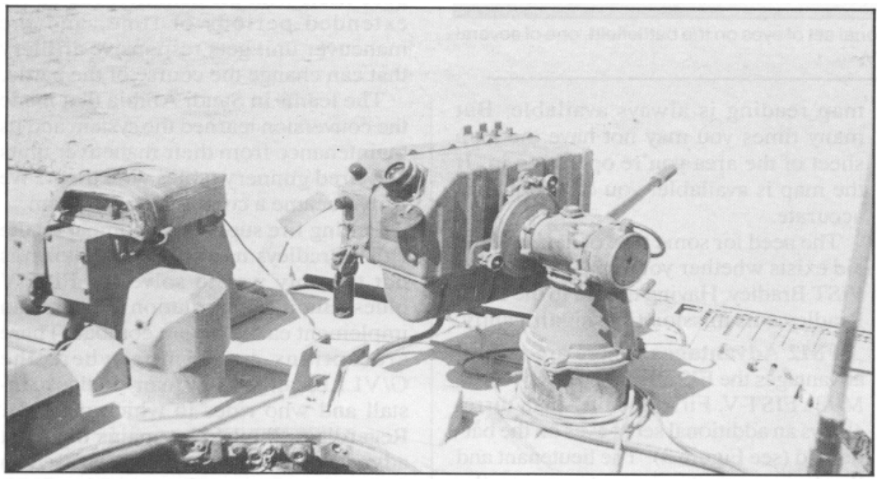

Figure 2: Using a specially designed bracket, the team mounted the G/VLLD on the right front of the M2's turret.

having the FIST-V in a Bradley or tank company without knowledgeable mechanics. The maneuver company mechanics fixed most problems on the spot. Our team drivers studied the operators manual and learned the system quickly. The Bradley needs preventive maintenance each day; done correctly, it performs exceptionally well.

FIST Tactics. The question of employing the FIST Bradley was a little harder. Teams have always moved about the battlefield and gotten into the best position to call for and observe rounds. Each team realized the importance of fire support and chose not to change its employment strategy because of its different vehicle. The ability to move about the battlefield increased, and teams found they could gain better vantage points from which to do their jobs.

The greatest advantage of the FIST Bradley's staying in the maneuver perimeter is its ability to blend in with the other Bradleys. The FIST no longer had a G/VLLD hammerhead and four antennas telling the enemy who and where it was; the FIST Bradley looks like any other Bradley. The teams devised a way to hide the two extra antennas by using the Bradley's gun portholes. Antenna tie-downs ran inside of the vehicle where the DMD operator could raise or lower them. When the particular radio (for example, the digital net) wasn't in use, the operator pulled the antenna down. This method, along with the likeness of vehicles, provided additional "camouflage" not possible with the M981.

Self Defense. The M60 machinegun on the M981 is a good weapon for self defense. Many argue that this is all the FIST needs while in the company perimeter. Although this is true, the 25-mm gun, with a 7.62 coaxial machinegun, provides the same defense with added bonuses. FISTs now can shoot direct and indirect fires simultaneously. When the need for fire support becomes greater, the team must maneuver into the best position to call for fire, possibly exposing itself. With the FIST Bradley, we can better defend ourselves while doing that.

One of the most debated issues has to do with the 25-mm main gun. Some artillerymen felt the FIST would lose perspective by having this weapon system and "fight" instead of call for fires. This wasn't the case. Only the brigade COLT used its main gun as a means of suppressing the enemy while continuing its mission. The ranging data from the G/VLLD determines distance for the 25-mm gun, providing an accurate means of direct fire while also calling for artillery.

As our brigade COLT discovered in combat, the maneuver unit may not always be able to support you while you're supporting them with artillery. The COLT needed to return direct fire while trying to withdraw to another observation location. The FIST Bradley allowed the COLT to return fire at a greater range and with more killing power, thus facilitating its withdrawal and subsequent observation of its fire missions. The M981 doesn't have the firepower we need.

Self-Location for Targeting. The M981 FIST-V has the NSG, which helps locate targets. It takes from eight to 10 minutes to initialize and align it. In addition, the FIST must get into a position on the battlefield where it can raise the hammerhead. As all teams discovered, there isn't time to stop, raise the hammerhead, initialize and align in an offensive battle. By the time these tasks are complete, the enemy has located your position. Also, the maneuver unit doesn't have time to stop and wait for this process.

The FIST Bradley doesn't have an NSG. But, the FM2 is more effective than the FIST-V and warrants some type of self-locating device. Throughout Operation Desert Storm, each team used either the long-range aid to navigation (LORAN) device or the global positioning system (GPS). The LORAN works off radio towers, the GPS works satellites.

Figure 3: The M2's two-man turret allows an additional set of eyes on the battlefield, one of several advantages the FIST Bradley has over the FIST-V.

There are two methods for locating targets that work best when using the FIST Bradley. One is to set the GPS to the azimuth tracking mode in mils. The GPS will continually update your azimuth and location as you maneuver. When the observer discovers the enemy, the G/VLLD operator uses the azimuth adjust knob to set the proper mil reading from the GPS. The other man in the turret tells the DMD operator the GPS grid location (observer), using the DMD's observer-location (OBCO) file. When this is complete, the G/VLLD operator lases the target, directly sending it to the DMD operator. This method is quick, easy and provides accurate target location.

The second method is a little slower but also very accurate. The G/VLLD operator locates a distant aiming point, and the other man shoots an azimuth with a compass. The azimuth is shot from in the turret or from directly in front of the vehicle. From inside the vehicle, you use either a non-magnetic compass or compensate for the magnetic attraction by using the adjusting screw on the M-2 compass. This method works effectively. Both methods provide a much quicker mission response time than using the NSG on the current FIST-V and provide extremely accurate fires.

Even without a navigational device, the Bradley is still a better FIST vehicle. You still have the G/VLLD, and you can shoot an azimuth in the same manner as mentioned. The difference is your ability to determine your own location, a key to accurate, predicted fires. Of course, map reading is always available. But many times you may not have the map sheet of the area you're operating in. If the map is available, you can be just as accurate.

The need for some type of navigational aid exists whether you're in a FIST-V or FIST Bradley. Having the aid in the FIST Bradley cuts mission time significantly.

FM2 Advantages. There are several advantages the FIST Bradley has over the M981 FIST-V. First, the two-man turret allows an additional set of eyes on the battlefield (see Figure 3). The lieutenant and the fire support sergeant can see the whole battlefield. The driver provides an additional set of eyes, giving the team three observers. This allows one man to track the movement on the map, follow the execution matrix and monitor the task force radio. The second man operates the G/VLLD, monitors the company command net and navigates the vehicle. The DMD operator can monitor another net in the hull of the vehicle while maintaining digital communications. This keeps one man from trying to do too many things simultaneously. Each man on the team works together to achieve accurate, predicted fires.

Secondly, the FIST Bradley can easily maneuver with the supported company. The common complaint among FIST-V-equipped teams is the maneuver unit outruns them. This is no longer a concern, and as mentioned, the Bradley also blends in with the rest of the company.

During Operation Desert Storm, the externally mounted G/VLLD proved more efficient than the hammerhead. The FM2-equipped teams fired Copperhead rounds where M981 teams didn't have the time to set up. The quicker mission time allowed the FM2 teams to locate the target and lase before the enemy detected them. Several M981 teams transferred the G/VLLD from the hammerhead to the front of their vehicles because of the success with the FM2. This is an obvious advantage as Copperhead is the most lethal tank killer in the artillery inventory.

The quicker mission response time is an obvious advantage. The ability to set up the G/VLLD for action in a short time is an advantage to the FIST and the supported unit. The FIST doesn't have to expose itself with the hammerhead up for extended periods of time, and the maneuver unit gets responsive artillery that can change the course of the battle.

The teams in Saudi Arabia that made the conversion learned the system and its maintenance from their maneuver units and fired gunnery tables with them. We truly became a combined-arms team.

Putting fire support equipment on the FIST Bradleys used in Desert Storm is not the only way to solve the FIST-V blues. But it's one solution soldiers can implement easily before combat. There are options concerning where the G/VLLD can go, how many radios to install and who rides in which position. Regardless, the FM2 remains the most advanced fire support vehicle used in Operation Desert Storm. The FIST Bradley proved its worth in combat.

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First Lieutenant Mark S. Kremer was a Company FSO for 3-82 FA in Desert Storm. He's currently a Battery Fire Direction Officer (FDO) in the same battalion.

First Lieutenant James A. Skelton was a Combat Observation Lasing Team (COLT) Leader for 3-82 FA in Desert Storm. Lieutenant Skelton is currently the battalion's Service Battery Executive Officer.

First Lieutenant Willie R. Witherspoon was a Battery FDO and Company FSO for 3-82 FA in Desert Storm. He's now a Platoon Leader for the battalion at Fort Hood.

Muzzle Velocity Management During Operation Desert Storm

by Captain B. L. Peyton, USMC

Many field manuals and *Field Artillery* Bulletin articles have discussed the advantages of having an effective muzzle velocity (MV) management system. This includes both managing the spread of propellant lots throughout the battery and battalion and maintaining an accurate data base of individual weapon muzzle velocity variances (MVVs). The management system proved far easier to discuss than to implement during Operation Desert Storm. The difficulties encountered when attempting to manage accurate weapon and ammunition information were overwhelming and were the result of three circumstances beyond the control of an artillery battalion.

The Problems

The first impediment to managing MVs stemmed from a large number of propellant lots being issued for each propellant model (M3A1, M4A2, M119A1/A2 and M203). Firing batteries routinely drew two and sometimes three lots for each propellant model in position. None of these lots were common among the firing batteries. The battalion fire direction officer (FDQ) was faced with six to eight propellant lots on hand for any propellant model; the small size of each lot prevented spreading one or two across the entire battalion. Unfortunately, the ammunition supply point (ASP) personnel proved insensitive to the requirement for issuing homogeneous lots to individual artillery battalions.

The second stumbling block encountered in MV management was the lack of any data base for the M119A1/A2 and M203 propellant models. This was primarily due to the safety restrictions on firing the higher charges at training ranges. Further, we didn't have enough ammunition earmarked for training to give us an MVV data base for the higher charges. But because of the pace of the maneuver advance during combat, we used M119A1/A2 and M203 propellants for more than 90 percent of the rounds we fired. Trying to establish a data base during fast-paced combat proved impractical.

The third obstacle to MV management was created by the combination of the number of small lots issued, a lack of a data base for the higher charge propellants and another problem: the nature of the M90 velocimeter. The unit of issue of one velocimeter per firing battery was inadequate. The tempo of this battlefield included short periods of intense firing followed by absolute calm. Adjust fire missions were aberrations, as most fires requested were planned. Trying to move the M90 velocimeter from one weapon to another while measuring velocities during intense firing was impractical. One firing battery tried to do this during an Iraqi counterattack but had to quit as the tempo of firing increased.

The cumulative effect of these problems completely stopped any attempt to manage MVs. Had a data base for M119A1/A2 and M203 MVVs existed and more homogeneous lots of propellants been issued, we could have used the M90 to infer second-lot calibrations, thus meeting the requirement for accurate weapon and ammunition information. But as was the case, the battalion could meet only three of the four requirements for accurate, predicted fire, regardless of our training and knowledge.

The Solution

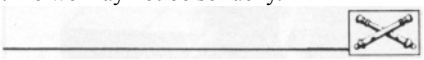
The solution to this problem is undoubtedly just as easy to discuss as MV management and, most likely, just as difficult to implement. To prevent these problems from repeating themselves, I recommend the following actions.

- The artillery community must communicate the need for ammunition lot management to the combat service support (CSS) elements who control the ASP. This may require an artillery officer with the CSS element and other artillery personnel at the ASP to ensure the need is recognized and acted upon. Given the size of Marine forces in Desert Storm, this would have to occur at the Marine expeditionary force (MEF) level to ensure across-the-board success.
- We must give firing elements opportunities to establish MVV data bases for the high charges during routine training exercises. This will require close scrutiny of range restrictions to ensure our desire for safe training doesn't handicap preparations needed for combat.
- We need a replacement for the M90 velocimeter. The new device should be easier to move from weapon to weapon, be powered by an internal source and have fewer components than the M90. This would reduce the physical difficulties of obtaining measured MVs for a firing battery.

Conclusion

The need for accurate weapon and ammunition information is valid—the increased accuracy gained from an effective MV management is indisputable. The challenge lies in removing the obstacles that prevent implementation of the theories.

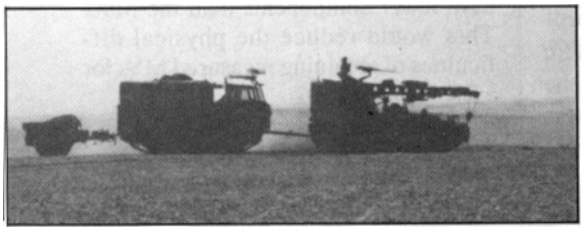
Fortunately, the Iraqis' overall lack of resolve to seriously resist diluted the impact of our having reduced accuracy stemming from ineffective MV management. The potentially disastrous effects this could have had on effective counter-battery and close supporting fires warrants our fixing the problems now. Next time we may not be so lucky.



Captain B. L. Peyton commands H Battery, 12th Marines, Camp Lejeune, North Carolina. Before his current assignment, he served as the Assistant S3 and Fire Direction Officer for the 3d Battalion, 10th Marines during Operations Desert Shield and Storm. He also served as a Gunnery Instructor for the Officer Basic Branch, Field Artillery School, Fort Sill, Oklahoma; Naval Gunfire Control Officer and Assistant Supporting Arms Coordinator for Commander Amphibious Forces, US 7th Fleet at Okinawa, Japan; and Executive Officer for E Battery, 2d Battalion, 11th Marines, at Camp Pendleton, California.

. . . *to Redlegs Everywhere*

101st Div Arty



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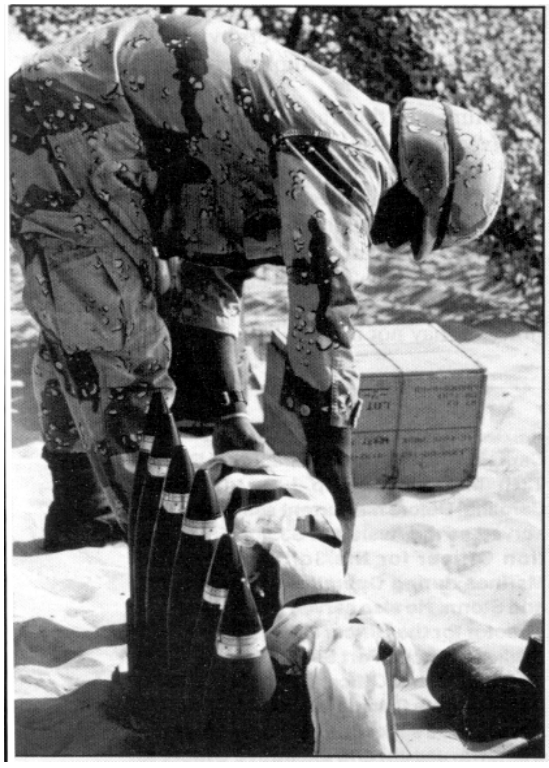

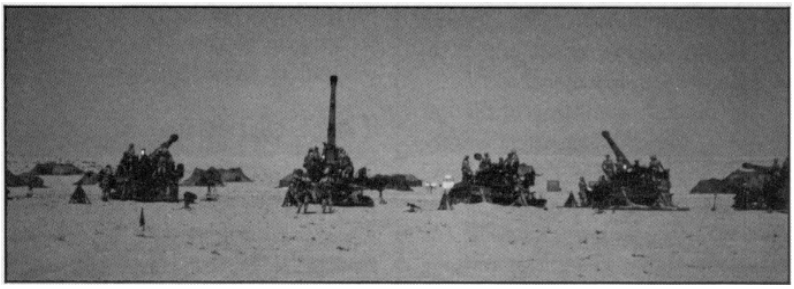

212th FA Bde

*Army Times/*Steve Elfers

1st Cav Div Arty

4-3 FA, 2d AR Div Arty (Fwd)

. . . A Job Well Done!