Field Artillery

A Professional Bulletin for Redlegs

October 1990

Massing Fires

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Articles

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PURPOSE (as slated 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 inter-dependence among the different arms and of hearty cooperation by all; and to promote understanding between the regular and militia forces by a closer bond; all of which objects are worthy and contribute to the good of our country.*

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Important Principles—Lost in the Political Shuffle?

We can't risk cutting our force structure . . . without a substantial investment in long-range capabilities.

Some pretty important principles could get lost in the post-Berlin Wall reassessment and the emphasis on more balanced forces in today's Army. There's only a short step from assuming that our bi-polar world has crumbled to rationalizing away the need for a substantial heavy force. That would be a serious political mistake—a mistake recently brought into sharp focus by the Persian Gulf Crisis.

Most agree on the need to maintain a mix of ready forces to meet worldwide contingencies. We must have a healthy number of light rapid-deployment and special operations forces for short-notice, low-intensity crises. But what will deter our potential enemies from "upping the ante" if we have few heavy units left after the budget cutters' ax has fallen?

Army Minus 50%

Suppose, for the sake of argument, the Army's active divisions are cut by 50 percent to about 373,000 soldiers by 1995—a real possibility, given the current political climate and gnawing economic realities that have been exacerbated by the Middle East crisis. That'll leave us with an active Army ground force of less than half the size of the North Korean People's Army (NKPA). I use this comparison not because the NKPA, which is opposed by an impressive Republic of Korea Army, is an immediate threat to us, but rather to bring into sharp focus how small in comparison to the worldwide threat our immediately deployable Army would be. Looking again to the Persian Gulf Crisis, Iraq can field a million-man force with 5,500 modern tanks. This hypothetical 50 percent-strength US Army would face a serious challenge, to say the least, if it had to fight Iraq's strong modernized forces or those in other parts of the world. This Army would be smaller than our own post-World War II Army.

History Repeating?

If all this sounds as though history could repeat itself—it could. In Korea, we paid dearly for the demobilization after World War II. We simply didn't have the ready forces necessary to implement national policy. Then we went ahead and cut our forces to the bone after Korea again.

Mathematically, it's impossible to have enough heavy divisions to win in several *likely* mid-intensity conflict scenarios—in the Middle East for example—with half our active Army gone. To paraphrase Colonel (Retired) Harry Summers' recent column in *Army Times*, once our heavy units are gone, they and the trained soldiers who man them can't be replicated quickly enough to do any good. Our ability to deter or fight a war at the mid-intensity level will have been undermined.

Army Minus 25%

Once again for the sake of argument, let's suppose our active Army is cut by 25 percent to about 560,000 soldiers—and this appears to be a certainty rather than a supposition. Given the declining threat in Europe, today's combined-arms force should be able to deter war or to fight and win in any conceivable scenario if enough critical new fire support, command, control, communications and intelligence systems come into the inventory systematically and *rapidly* as we approach the 21st century. Without them, nonlinear AirLand Battle-Future doctrine simply won't work. The problem may be that these systems will cost, in the coming years, as much as we'll save by cutting force structure.

As the articles in this edition clearly show, the need for both heavy and light forces with the ability to mass large quantities of fires at ever-greater depths is still pivotal to success on the battlefield. It's a capability we simply can't afford to lose.

Human Nature

Conflict has been a historical constant too—from the earliest recorded tribal battles to our own Civil War to the post-World War II US-Soviet dichotomy right down to disputes among family members. That is to say, conflict is a constant of the human condition. It's going to occur whenever interests clash.

The only question that remains to be answered today is how varied worldwide interests ultimately will line up either for or against us. Regardless, our mission remains the same, and the ability to mass devastating fires for *any* contingency, including mid-intensity conflicts, must be supported with dollars, not rhetoric.

Budget Cutters Beware

Our policymakers must make these hard choices—choices of "guns versus butter." Because the principal role of our central government is to protect our democratic way of life and our national interests, a modern, ready Army capable of executing AirLand Battle-Future is a must.

For the Field Artillery, that means the Congress must pay a big bill for the systems that allow us to maneuver with fires at great depths. We can't risk cutting our force structure by as much as 25 percent without a substantial investment in long-range capabilities.

The much-touted "peace dividend" ***must*** take into account the cost of making sure our Army stays modern and ready into the 21st century. Only then will the dividend be peace. Strength and readiness to fight in any arena remain our best defense against the uncertainties of the future.

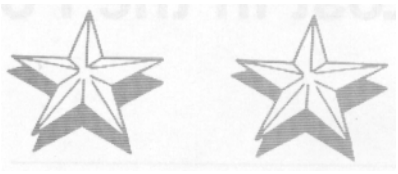
Editor

On the Move

MAJOR GENERAL RAPHAEL J. HALLADA

Massing and Integrating Fires

Today's FSO is the focal point for massing fires . . . the maneuver commander's expert for the integration and synchronization of all fire support.



A major Field Artillery strength is its ability to rapidly integrate, mass and shift fires. Weapons, doctrine, technology and training methods may change, but the inevitable tenet of Field Artillery is that the destructiveness of fire support comes from the collective application of all firepower in concert with the maneuver operation.

The old saying that "Figures will lie, and liars will figure" may be true for most things. But one figure we can't argue with is the increasing number of maneuver commanders who use fire support effectively. Combat Training Center (CTC) statistics prove that the integration of these assets is the essential ingredient for victory on the modern battlefield, and a new generation of fire support officers (FSOs) has taught our maneuver commanders the devastating effectiveness of the fire support assets at their command.

Recent History

At the onset of World War I, the concepts of integrating and massing fires were not new, but neither were they perfected. The American Army learned in a few short years the value of close fire support and the benefits of integrating artillery with maneuver operations.

A key strength of our Artillery was the bright young officers who weren't tied to the stagnant, trench-warfare doctrine established by our Allies. These men were devoted to their profession and used innovative techniques to provide responsive and accurate fires.

During World War II, the US Artillery gained the respect of both our Allies and our adversaries who noted our devastating ability to rapidly acquire and engage targets and mass fires for maneuver operations.

We learned quickly that the successful integration of fires required both detailed planning and centralized execution. And in Korea and Vietnam, we further learned the importance of a dedicated fire support coordinator (FSCOORD) at every level. From these lessons came our greatest advance in integration—the fire support team (FIST).

The Focal Point

Today's FSO is the focal point for massing fires. He's the maneuver commander's expert for the integration and synchronization of fire support. His knowledge of both fire support assets and maneuver capabilities is essential. The FSO must *know* the commander and his tactics—his tricks of the trade. He also must know and understand maneuver weapons, ammunition, organizational capabilities and a host of other things to support the maneuver force effectively.

He must be a master magician—educated in the basics of all branches and able to apply innovative solutions quickly. He also must be able to integrate joint air attack team (JAAT) operations and naval gunfire as well as closely coordinate Field Artillery fires for the maneuver commander.

Today's FSO directs more firepower than ever before. Unfortunately, there are still a few maneuver commanders out there who aren't convinced the FSO's role is pivotal to maneuver success.

Guidance for Tomorrow

Our greatest challenge is the need to stay current. With the rapid changes in the Soviet Bloc, it's clear we have to develop our equipment and doctrine to face threats, not only in the European theater, but also worldwide. This is clearly stated in Chief of Staff of the Army General Carl E. Vuono's *A Strategic Force* and his article in this edition that deployability, versatility and lethality are the guiding characteristics of our Army.

In October 1989, Training and Doctrine Command (TRADOC) Commander General John W. Foss called a meeting to discuss the latest threat changes worldwide. He established the need to review and update AirLand Battle Doctrine, which has emphasized the European scenario. The intent is to develop doctrine and equipment for *worldwide* contingencies.

When you consider recent changes, it's clear integrated fire support will play an important role in projecting military power in *any* of these contingencies. In turn, this will advance our deterrent and defensive capabilities, thereby supporting our national goals worldwide.

Efforts to modernize doctrine, equipment and training have never had such emphasis or importance as they do today. We once again must integrate our support on new battlefields. In the words of the late University of Alabama Football Coach Bear Bryant, we must be "mobile, agile and hostile" to succeed on the battlefield.

What's in Store

The Field Artillery is dedicated to remaining abreast of these rapidly changing times. Tomorrow's battlefield will be a faster paced and more lethal environment than we've ever known. Integrating and massing fires must be the cornerstone of our performance or we won't succeed.

Demand to "have your say" when the maneuver commander plans his operations. Be ***sure*** he understands what his fire support assets can do for him and that you understand his intent. Only then will you have done your duty. And remember, the future belongs to the Field Artillery.

Incoming

LETTERS TO THE EDITOR

How Soon We Forget

As increasing numbers of accounts of Operation Just Cause Panama, December 1989, appeared in the media, I felt a sense of failure, both personal and for the Army where I've spent my last 13 years. These feelings stemmed from an attempt to help my new commanding officer in the 2d Air and Naval Gunfire Liaison Company (ANGLICO) learn more about the unique organization with which he had been entrusted.

Digging through my professional reading files looking for reading material for the Boss, I came upon Major Scott McMichael's outstanding article "Urgent Fury: Looking Back and Looking Forward," published in the *Field Artillery Journal* in the March-April 1985 edition. Sadly, one of the lessons learned during Urgent Fury was that the US Army was severely lacking in its ability, at all levels, to plan for naval gunfire and Navy or Marine Corps close air support (CAS).

It appears our efforts to correct the problems identified during Urgent Fury were largely in vain. Thankfully, the introduction of the inter-theater COMSEC [communications security] package (ICP) eliminated virtually all of the COMSEC compatibility problems encountered when the 2d ANGLICO, an east-coast unit, could not communicate with naval gunfire ships of the west-coast Navy because the Pacific Fleet used different codes than the Atlantic Fleet. However, most of the other problems Major McMichael outlined in his article still exist.

Lack of Naval Gunfire Expertise

We of the Field Artillery community have failed to heed the painful lessons of Urgent Fury. In spite of our lack of expertise in naval gunfire, the Field Artillery School [Fort Sill, Oklahoma] continues to give only cursory attention to the subject. Just look for a section on naval gunfire in the new *Fire Support Handbook (ST 6-20-20*, Nov 89). The US Air Force prevents us from controlling CAS, while the Air Force, Navy and Marine Corps competition for domination of the CAS community (i.e., sparring for Congressional dollars) in joint operations continues to degrade support for Army ground forces.

A 105-mm howitzer fires in Grenada—Urgent Fury. The hydrography and tactical situation of Panama [Operation Just Cause] favored the use of naval gunfire.

Solutions

As a participant in an Army-Marine Corps fire support exchange, part of my charter is to help solve interoperability problems. With this in mind, I would like to make several suggestions.

Though I was not privy to the Operation Just Cause planning, I can see no reason for not including naval gunfire and naval air support in planning for the operation. The hydrography and tactical situation of Panama certainly favored the use of naval gunfire. Furthermore, with no credible naval threat from Panamanian forces, carrier-based air support could have been integrated into the operation easily.

Plan for All Fire Support. A principle is violated when one fails to plan for every means of fire support available, whether or not it is actually used. I realize that the extremely restrictive rules of engagement weighed heavily in the decision to exclude these fire support assets. However, over dependence on AC-130 and O/A-37 aircraft could have left units without backup fire support, had these systems been degraded or eliminated by weather or, God forbid, combat attrition.

Add ANGLICOs and Training. The Army needs to revive its ability to plan for and control naval gunfire. This is dictated by our move toward light forces and the emerging narco-terrorism threat in Central and South America. Secondly, the Marine Corps does not have enough ANGLICOs to support a multiple-division US Army operation adequately.

The Field Artillery School is the logical place to begin the repairs. It needs to include naval gunfire as a major subject in the FAOBC, FAOAC [Field Artillery Officer Basic and Advanced Courses] and MOS 13F courses.

In addition to naval gunfire planning, it should include naval gunfire "shoots" in the program of instruction for these courses. This can easily be done using howitzers firing high charges (i.e., flat trajectories) with FDCs [fire direction centers] receiving and responding to naval gunfire calls for fire. Speaking from ANGLICO experience, I can assure you this works.

We must teach our new Field Artillery lieutenants and 13Fs to control CAS routinely, not just control it in emergency situations (the artillery equivalent of an untrained observer mission).

Qualify for Air Force CAS. Our only obstacle is the Air Force's approval for soldiers to control airplanes in training; with the proper schooling, there's nothing magical about putting a pilot onto a target—the Marine Corps has been an advocate of this for years. You can be sure that in a large-scale conflict, there will not be enough Air Force TACP

[tactical air control party] personnel to go around, so let us qualify Army personnel.

Expand the Scope of Joint Exercises. We must use creativity in planning exercises and include naval gunfire and Navy and Marine Corps CAS in every possible situation. This is particularly important in large joint exercises, JRTC [Joint Readiness Training Center, Fort Chaffee, Arkansas] and BCTP [Battle Command Training Program] planning. Too often, major training opportunities fail to provide realistic challenges to fire supporters below the division level.

If questions arise during your planning, contact an ANGLICO, and you'll get the answers you need. Also, remember that your Air Force ALO [air liaison officer] can plan for Navy and Marine Corps CAS as well as Air Force CAS. CAS aircraft know no service boundaries.

Add a Naval Gunfire Officer. We should enhance the Army's ability to plan for and train in naval gunfire by the addition of a US Navy officer qualified in surface warfare to the staff of the XVIII Airborne Corps, 82d Airborne Division [both at Fort Bragg, North Carolina], 101st Airborne (Air Assault) Division [Fort Campbell, Kentucky], 10th Mountain Division (Light Infantry) [Fort Drum, New York], 7th Infantry Division (Light) [Fort Ord, California], the 75th Ranger Regiment, [Fort Bragg, North Carolina] and other units likely to see expeditionary service within the range of naval gunfire or naval CAS.

This could be accomplished by the addition of a Navy commander or lieutenant commander at the division (or Ranger Regiment) FSE [fire support element]. This division Naval Gunfire Officer also would coordinate naval gunfire training in the division.

Attend Navy and Marine Schools. We must take advantage of formal and informal schools available through the Navy and Marine Corps. The Navy Amphibious Schools at Little Creek, Virginia, and Coronado, California, offer outstanding naval gunfire courses.

The Landing Force Training Commands at the same locations offer equally valuable resident instruction in tactical air control and fire support coordination. They will occasionally provide mobile training teams as well. With plenty of lead time, ANGLICOs can provide training in CAS and naval gunfire at their home stations of Camp Lejeune, North Carolina, and Camp Pendleton, California.

Make Joint Air Support *Joint.* Finally, we need to give more than "lip service" to the concept of joint air support. The Joint Force Air Component Commanders (JFACCs) must be more than figureheads. Whenever possible, we need to combine airspace coordination, air tasking orders and command and control elements for air components in joint operations. We also must allow Marines to control Air Force CAS and airmen to control Navy and Marine Corps CAS and give soldiers the radios and training to control both.

Conclusion

Panama was a unique situation where we enjoyed a strong combat presence and a large logistical base in place before the commencement of hostilities. If future combat operations are necessary in Central or South America, we may not have this advantage.

The Army must plan for and be prepared to control all forms of joint firepower. The ultimate responsibility for CAS and naval gunfire rests with the Field Artillery community. Let's hope we can overcome the barrier of interservice rivalry and get on with our jobs.

Major Zachary P. Hubbard, FA
S3, 2d ANGLICO
Camp Lejeune, North Carolina

The Achilles' Heel of AirLand Battle-Future

As the armies of both alliances are reduced in strength and divested of their budgets, they must struggle with the problem of how to do more with less. Our Army is adjusting the current AirLand Battle doctrine to carry it into the 21st century with smaller forces that are, we hope, more flexible and technologically advanced.

One of the key requirements for the successful execution of the new AirLand Battle-Future doctrine is the early acquisition of the majority of the advancing enemy force. If this fails to take place, disaster could easily overtake the entire defending force. A vigorous Soviet (or Soviet-like) counter-reconnaissance program could easily blind enough of our intelligence-gathering assets to make this outcome a real possibility.

AirLand Battle-Future

The doctrine that is being prepared to take the US Army to the year 2004 and beyond is called AirLand Battle-Future. Many of its components are dictated by a shrinking budget, smaller forces and high-tech solutions to today's battlefield problems. [See the Interview with General John W. Foss, Commanding General of the Training and Doctrine Command, "The Challenges of Our Changing Times," and "The Evolving AirLand Battle-Future Concept," both in August 1990; and "Fire Support on the Non-Linear Battlefield: The Shape of Things to Come," this edition.]

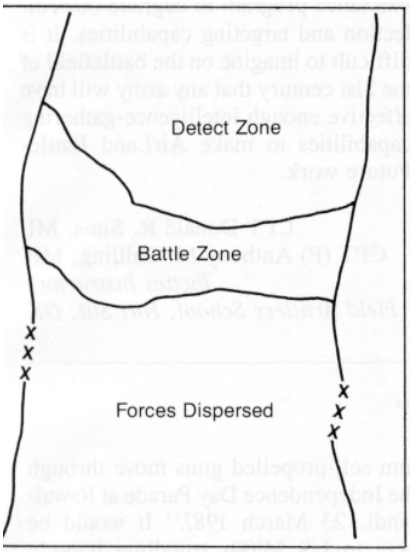
It's a doctrine designed to maximize the future Army's flexibility, firepower and advanced technology. It presupposes that warfare in the late 20th and early 21st century will be non-linear with opposing forces mingled throughout the depth of the battlefield.

AirLand Battle-Future divides tomorrow's battlefield into three general areas. The most forward and in many ways the most critical is the detection zone where advancing enemy units are found and targeted by intelligence and target acquisition systems.

Behind the detection zone is the battle zone. Armored cavalry units, corps artillery brigades, various military intelligence collectors, air defense assets, command and control facilities and logistical support units occupy this area.

The "reserve" or "dispersal" zone contains the preponderance of maneuver forces in "laagers" prepared to move forward and engage the enemy once the forces in the battle zone have located and engaged them and inflicted heavy enemy casualties.

The entire scheme of the deep attack by fires rests upon the intelligence analysts'



AirLand Battle-Future divides tomorrow's battlefield into three general areas.

ability to correctly determine the enemy's intent and location and, together with the target acquisition assets, provide targets for the forward artillery brigades. Not only must they do this, but they also must do it in the most timely of manners. Otherwise, AirLand Battle-Future will fail.

How would this failure be different than an intelligence failure with today's doctrine? AirLand Battle-Future positions much of its combat support and service support and some of the corps' C^3I [command, control, communications and intelligence] well forward with only an armored cavalry screen to protect them.

The price for an intelligence failure in the forward area of the defense in the future is far higher than it is today. The assets in the battle zone will be far more vulnerable to direct fire with Soviet-like maneuver units than are the forward units of today. Should intelligence fail to locate a single forward detachment, a tank battalion or regiment, the heart of the indirect-fire assets and support units of the corps could be quickly destroyed or neutralized as they struggle to defend against an armor-heavy enemy.

Soviet-Style Counter-Reconnaissance Measures

The Soviet Army understands the importance of preventing the enemy from determining what they intend to do. The measures they take in regard to this fall into two general categories: deception and the destruction or neutralization of enemy reconnaissance assets. Both would work against our forces using AirLand Battle-Future as doctrine.

Deception. The Soviets have a good track record in the arena of military deception. They were skillful in using it against the Wehrmacht during the Great Patriotic War at the operational and tactical levels. Their students, the Egyptians and Syrians, achieved operational surprise against the Israeli Army at the opening of the Yom Kippur War. And, while it can be argued that collection means have advanced considerably even since 1973, it can be argued equally well that deception and "anti-reconnaissance" measures have improved as rapidly.

A good counter-reconnaissance program includes measures to blind or deceive the enemy at the strategic, operational and tactical levels of war. The effects of the deception plan do not have to last long to be successful.

The amount of forces and their flexibility and mobility provide much battlefield "noise" that will cause our intelligence analysts great difficulty in deciding which of the enemy's forces has the main attack mission. With the Soviet's emphasis on dispersion on the battlefield, the analyst also may be hard pressed to derive accurate locations for all enemy forces.

The Soviets regularly practice deception at all levels, having units at the army and front levels whose total mission is to add more confusion to the chaotic battlefield. The Soviet Army also has a fondness for phony command posts and radio stations, dummy vehicles and positions, demonstrations and feints and using terrain to mask movements. The sophistication of these measures enable the Soviets to emanate heat, light and electromagnetic energy to deceive reconnaissance systems.

Destruction or Neutralization. In the area of "blinding" measures, the Soviet military has several options that run the gamut from the national to tactical levels. Anti-satellite technology (ASAT), long-range air defense, anti-radiation missiles and an active air superiority campaign would be some of the measures used to limit our national-and theater-level reconnaissance capabilities.

On the battlefield itself, the intermingling of forces, presupposed by AirLand Battle-Future, is a very likely occurrence. Soviet doctrine calls for using reconnaissance patrols, forward detachments and advanced guards to maneuver and reconnoiter forward of their main forces. The advanced guard has among its missions that of preventing the penetration of the main body by enemy reconnaissance.

By the year 2004, the options open to the Soviet advanced guard for preventing penetration by enemy reconnaissance will include the use of directed-energy weapons along with the more standard solutions of today. And these weapons are marvelously suited for such use.

Laser weapons, to include the laser range finders found on the current generation of tanks in the Soviet inventory, can be used to destroy, damage or degrade the effectiveness of our optical and electro-optical systems. These include night-vision and thermal-imaging devices and other image intensifiers, upon which our visual acquisition is becoming more dependent daily.

Radio frequency weapons use high-power microwave radiation to damage or destroy electrical circuits and connections. These weapons would not be targeted as single targets but would instead "blanket" portions of the battlefield. They can damage or destroy target acquisition radars, fire-control computers such as TACFIRE [tactical fire direction system] and AFATDS [advanced Field Artillery tactical data system], radio and radar direction-finding (RDF) equipment, night-vision devices and avionic systems, among others.

In addition, the Soviet's ability to locate command posts with RDF equipment, while perhaps not as refined as our own, is adequate for these facilities to be targeted and destroyed by long-range artillery and (or) aviation assets. While this would not strike directly at reconnaissance assets, it would damage the channels through which the information must flow for action.

Conclusion

The point of this letter is not that AirLand Battle-Future will not work. In fact, it would be very effective in lower intensity conflicts, such as in Korea or the Middle East. But as the doctrine with which we would have to fight a very potent adversary, such as the

Soviet Union, it falls short.

Our capabilities to gather intelligence and produce targets is immense. But we also must remember that it is not infallible, as Pearl Harbor, the Ardennes and the Yom Kippur War have shown. There are clearly active measures that the Soviets and other potential enemies can use to thicken the fog of war.

The stakes in AirLand Battle-Future are high. The failure to acquire a single army forward detachment could spell a disaster for the forces operating in the battle zone. The effects of a regiment of T-80s [tanks] or their successors upon the artillery and other "soft" units that it might encounter enroute to the division laager areas are horrible to contemplate. One has only to remember the effects of Kampfgruppe Peiper in the 1944 Ardennes Campaign to realize that such a force could be devastating.

History clearly shows that all that is required is a successful counter-reconnaissance program to degrade our collection and targeting capabilities. It is difficult to imagine on the battlefield of the 21st century that any army will have effective enough intelligence-gathering capabilities to make AirLand Battle-Future work.

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CPT (P) Anthony M. Shilling, MP
Tactics Instructors
Field Artillery School, Fort Sill, OK

Response to "The Battle of Jaffna: Artillery Lessons Learned"

This letter refers to the article "The Battle for Jaffna: Artillery Lessons Learned" by Captains A.M. Schilling and D.R. Sims in your April 1990 issue.

The application of the "appropriate" levels of artillery firepower in LIC [low-intensity conflict]—especially in a MOUT [military operations in urban terrain] scenario—obviously has no cut-and-dried procedures. Too little artillery support and you allow ground troops to come under killing fire from buildings; too much may reduce entire city blocks to rubble. The latter consequence (apart from the resultant casualties and untold misery to the noncombatants) would alienate the local population and render the entire operation ultimately infructuous.

The article is a wide-ranging look at the deployment, strategy and tactics of the IPKF [Indian Peacekeeping Force] in the opening phase of its fighting in Sri Lanka. The authors have effectively pointed out the hazards faced by a peacekeeping force, especially when it does not go prepared to fight but views its mission only in terms of separating the belligerents. However, the article is rather generalized in terms of lessons for the artillery.

It would really have helped if some comparison could have been drawn between artillery employment (or lack of it) by the IPKF in Sri Lanka and that of US forces in Panama (Operation Just Cause). This may have highlighted the role of artillery in LIC/intervention in built-up areas.

As an aside, I would like to point out an incredible gaffe on Page 29. While the caption to the photograph would warm the heart of many an Indian hawk, you just could not have had "Indian 130-mm self-propelled guns move through the Independence Day Parade at Rawalpindi, 23 March 1987." It would be akin to US M109s trundling happily through the Moscow Red Square Parade—Rawalpindi is in Pakistan. And India celebrates its Independence Day on 15 August while that of Pakistan is on 23 March. The equipment looks like the M109A1 of the Pakistan Army.

This little slip aside, I congratulate you on taking on this very relevant topic. I also thank you for granting permission to use material from *Field Artillery* in *Universal Military Abstracts*, which finds a very appreciative audience among our readers.

Sudhir K. Arora
Managing Editor
Universal Military Abstracts
Dehra Dun, India

Response to "The FA Commander and MLRS"

First Lieutenant Charles I. McFarland's article "The FA Commander and MLRS" in the June 1990 issue of *Field Artillery* was well-written. However, while explaining how the MLRS FDS [fire direction system] automatically selects multiple aim points for effects-type targets, he was in error stating that the MLRS FDS will automatically select multiple aim points "*only* if . . . the long side of the target is in *excess* [emphasis added] of 1,000 meters." The Version 7 and newly fielded Version 9 software for the MLRS FDS can and will automatically select multiple aim points for targets with a long side of *less* than 1,000 meters.

This clarifies the effects processing portion of an otherwise informative article.

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In Defense of the Mortars

The lowest common denominator force structure—this is what Mr. Edward J. Stiles' article titled "No Mortars in Heavy Forces" [February, 1989] is about. While application of the lowest common denominator is a valid mathematical tool, it is hardly a basis for force structure decisions.

Witness mortar performance in places such as the National Training Center [NTC, Fort Irwin, California], the Middle East, Panama and the Iraq-Iran War: mortars have proved they are far from being the "dinosaurs" of the past. In the hands of well-trained and ably led soldiers and under the direction of well-trained and experienced fire supporters, mortars remain as effective a weapon in today's Army as in the past. Moreover, it is the quality of training and leadership of mortarmen and of fire supporters that is the deciding factor.

Soldiers put a mortar round down the tube of an 81-mm mortar during training in Panama.

Mortars in General

Aside from and nowhere addressed in Mr. Stiles' arguments, the fundamental advantages of mortars remain (1) a high volume of accurate fires with a range of effective munitions, (2) close-in fire capability, (3) the ability to operate in restricted terrain, (4) ease of employment and operation—in a word, "simple" and (5) responsiveness. Mr. Stiles discusses mortar problems but never fully addresses these important requirements mortars uniquely fulfill.

As to the arguments to the contrary, we have never seen the ammunition problems he described, and we have observed 96 task-force level live-fire iterations at the NTC during the last three-plus years. Mortar misfires are infrequent and are caused by improperly cleaning the tube. While it is true that improper indexing of the "A2" 107-mm round will cause the round to stick, such occurrences are rare. Just as rare are decreases in rate of fire using the new rounds or malfunctions of 107-mm illumination rounds.

Many have discounted the value of mortar illumination rounds. But thermal acquisition systems are not as effective as many believe. The live-fire experience at the NTC has shown that when illumination is used, direct-fire systems perform better.

In terms of lethality, mortar HE [high-explosive] rounds are very effective in suppressing a range of threats: dismounted breaching operations and assaults, anti-tank weapon systems and light-skinned armored vehicles such as the BMP [Soviet tracked infantry combat vehicle]. The high rate of fire of the mortars in such cases is devastating. And mortar smoke?—always highly effective in marking or screening.

While the M113-based mortar carrier lacks the mobility of the M1 tank and M2 Bradley fighting vehicle, so does the M113-based fire support vehicle [FSV] and M109 series artillery howitzers. But in the hands of well-trained soldiers and with proper planning, all three systems can easily keep up. Indeed, the M113s can more easily keep up with the tanks than the M109 self-propelled howitzers can.

Tactical Considerations

Some suggest that our heavy forces rely solely on artillery to cover the mortar requirements—in essence, "put all our eggs in one basket." As batteries are tied up firing counterbattery missions, supporting the main effort, displacing or being suppressed by hostile counterbattery, a task force may only have one, maybe two, batteries in support at any time. When faced with two or less batteries in support, the task force FSO [fire support officer] must have the flexibility to supplement the artillery with other assets. Mortars give the FSO that flexibility.

True, our Army now fights the deep battle. But as Custer learned, we still must win the close and rear battles. Mortars help us do so.

Training and Leadership

The key is training and leadership, and in this, we agree with Mr. Stiles. However, it is not because the mortars belong to the maneuver forces that the mortar platoons are not well-trained and led. Rather, it is the lack of emphasis by both the maneuver and artillery communities that detracts so substantially.

Many maneuver commanders do not provide the mortar platoons strong and knowledgeable mortar platoon leaders. When they do, these officers rarely stay long enough in the positions to have a lasting effect.

At home station, mortars routinely are left out of training or given poor training scenarios, such as firing "canned" data from the same firing point. It is not uncommon, even at the NTC, to see mortar platoons detailed out as ammunition guards. Nor is it uncommon that FSOs leave the mortars out of the fire support plan and (or) rehearsals and execution.

Conclusion

With command emphasis, good training and solid leadership, mortars (regardless of their caliber), artillery, FSVs and all the other equipment available in today's Army work. To take mortars from the heavy forces avoids tackling the real issue of providing effective fire support for them.

Clearly, the lowest common denominator approach advocated by some is not the most effective way for us to fight. Mortars remain a vital tool to commanders and, properly employed, a key asset for the combined-arms team.

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Live-Fire Trainers, NTC
*Fort Irwin, **CA***

Challenge and Change:

The Field Artillery and the Army of the 1990s

by General Carl E. Vuono

Since the earliest days of the Republic, the Field Artillery has been central to the success of the United States Army and to the defense of the nation. From the days of Henry Knox, Alexander Hamilton and Molly Pitcher, the men and women of the Field Artillery have been second to none in valor, skill and dedication in their service to the American people. And for more than two centuries, the thunder of the artillery has given voice to America's commitment to stand and fight for the principles of freedom and democracy.

. . . we are in the midst of a revolution of historic proportions . . . that will redefine many of the concepts of national security. . .

As an artilleryman of 33 years experience, I have witnessed the quality of the soldiers of this Branch—soldiers who, through shot and shell, have made the Field Artillery an integral part of the modern combined-arms team. In this article, I discuss the Field Artillery and the Army—where we are today, where we are going tomorrow and what professional qualities each of us must adopt as we move through an era of challenge and change. For it is vital that every officer, sergeant and soldier understand our vision of the future and the critical role Redlegs will play in our nation's security in the years ahead.

The International Environment

No discussion of the Army's future can begin without looking at the environment in which we are expected to operate. It dictates what we must be able to do as the nation's strategic land force. It is no secret that we are in the midst of a revolution of historic proportions—a revolution that will redefine many of the concepts of national security that have served this nation throughout the nuclear age.

Yesterday and Today

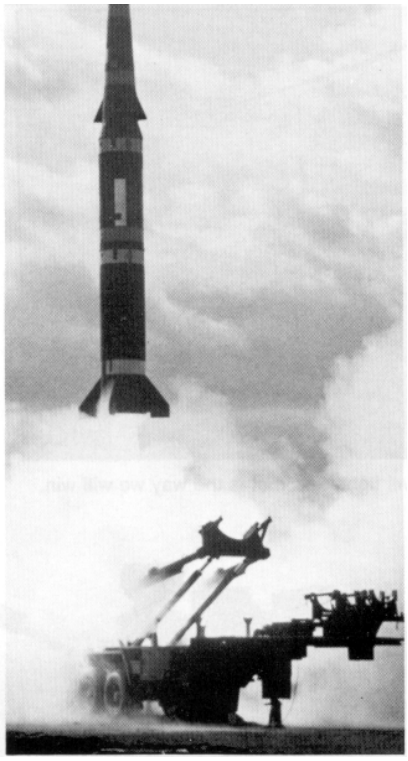
The changes we see today are even more dramatic when measured against the world of yesterday. Fifteen years ago, for example, I commanded the 82d Airborne Division Artillery, and the world and Army were profoundly different.

In those days, the Soviet Union was in the midst of the largest peacetime buildup of military power in history, and Moscow's influence was spreading like a cancer around the globe. The United States, on the other hand, was in the throes of social chaos and unsure of its national purpose. And the Army was grappling with the first years of an all-volunteer force in the turmoil of the post-Vietnam era.

Today, in stark contrast to 1975, the Soviet Union is in disarray and stands exposed for what it always has been—a potent military power built on the crumbling foundation of an oppressive political system and a discredited ideology. The United States has reasserted itself as a military, economic and political superpower and a model for emerging democracies around the globe. And the US Army is the envy of the world—an Army of quality soldiers, prepared to fulfill strategic obligations anywhere our nation calls.

As we survey the wreckage of the Warsaw Pact and witness the flourishing of democracy throughout the world, each of us should take enormous pride in the critical role the United States Army has played. For these changes are not the result of some accidental whim of history. They are the product of generations of committed, dedicated men and women who have prevented conflict in Europe and have confronted the forces of oppression in contingency operations worldwide.

...fundamental to the success of deterrence and defense is now and will forever be the Field Artillery...



Changing Times. The Field Artillery's Pershing II helped bring about the Intermediate-Range Nuclear Forces Treaty.

The Field Artillery has been central to our success. Our adversaries around the world know well the power of our infantry; they fear the sting of our aviation; they know the shock of our armor. And fundamental to the success of deterrence and defense is now and will forever be the Field Artillery, with its responsiveness, accuracy and devastating firepower massed with awesome effect on the enemies of our nation.

Europe's Old Order

But, even as we celebrate the headlong rush of current events, we must soberly recognize the struggle is not yet over, and the victory is not yet won. For the human experience is replete with conflict and suffering wrought by the collapse of mighty empires. The old order is dying, but it has not yet been replaced with a new and stable security structure that will ensure peace in a potentially explosive era.

...Soviet military capabilities remain massive....[their] armed forces well may emerge leaner and far more capable...

We must recognize that, even as the Soviet Union undergoes radical change, Soviet military capabilities remain massive. The Soviet armed forces—the largest military establishment in the world—well may emerge from their own *perestroika* leaner and far more capable than they are today. That possibility, coupled with the vast and enduring political and economic differences that separate the superpowers, demands a pragmatic approach to the future of our forces.

...the proliferation of arsenals of sophisticated weapons means we must recognize the developing world can threaten our vital interests as never before.

The Developing Countries

Moreover, even as the Soviet empire contends with the forces of change, the dangers rampant in the developing world continue to rise. As a global power inextricably enmeshed in a world growing increasingly interdependent, the United States can't afford to treat the developing world as politically marginal. And at the same time, the proliferation of arsenals of sophisticated weapons means we must recognize the developing world can threaten our vital interests as never before. These arsenals include modern tanks, heavy artillery, ballistic missiles and chemical weapons, to mention a few.

Whether against a resurgent Soviet Union or a modern, capable force in the developing world, our mettle may be tested by an enemy equipped with weapons that will challenge our war-fighting capabilities as never before. This is not business as usual; it is a new and dangerous reality that must become a focal point for the protection of the nation—a reality that demands an Army of unprecedented readiness and power. For in this complex world, there is one simple truth: if the United States is to remain a global power, it must have a mighty Army and a Field Artillery that is fully capable of supporting the combined-arms team across a range of challenges.

Shaping the Future

As we look to the 1990s and beyond, the Army must realize a simple, overarching vision—a vision of a trained and ready Army today and tomorrow capable of meeting its strategic obligations anywhere, anytime. As we build and sustain the Army to fulfill this vision, we begin from a solid foundation. For the Army of today is quite simply the finest peacetime force this nation has ever fielded, typified by the matchless ability of our Field Artillery. The quality of the Army has been consistently demonstrated in exercises throughout the world—in deployments to the far corners of the globe and in the crucible of combat.

As good as we are today, however, we must actively shape the future. For memories are sometimes short, and we must move ahead to confront the challenges and seize the opportunities in a brave new world. It is a simple law of politics that if we do not take command of our destiny, someone else will.

As we shape the Army for the future, we will build on the Army's six enduring imperatives. These principles anchor us in the stormy seas of change and serve as beacons to guide us into the next century. The six imperatives are vitally important to the Army and the Field Artillery and must be understood and adopted throughout our ranks.

1. Doctrine

First, we must maintain an effective and evolving war-fighting doctrine—effective for today and evolving for tomorrow. Put simply, an Army must know how to fight. We must understand our doctrine and the tactics, techniques and procedures that give it life on the battlefield.

In AirLand Battle and in AirLand Battle-Future currently under development, the role of the Field Artillery is of paramount importance. If we are to fight and win the battles of tomorrow, we must exploit the full potential of the Field Artillery to find targets, mass our fires and strike with devastating effect throughout the length and breadth of a complex and violent battlefield. The Artillery community must approach its doctrinal tasks with imagination, initiative and an implicit understanding of the integration of the combined-arms team.

2. Mix of Forces

Next, we must maintain the mix of forces—armored, light, and special operations forces (SOF)—that is necessary to support our national security requirements globally. Now, as a result of the Conventional Forces in Europe (CFE) agreement currently under negotiation, the United States will have to deactivate

some of our heavy forces. But this does not mean we are moving away from our force mix.

Indeed, whether we face a revitalized Soviet challenge or a threat in the tank-heavy developing world, armored forces will remain the centerpiece of the Army and the ultimate expression of this nation's land combat power. As an integral part of this mix of forces, the Field Artillery must continue to be ready to employ the massed fires of cannons of all calibers and rockets and missiles to support operations across the entire spectrum of conflict anywhere in the world.

3. Training

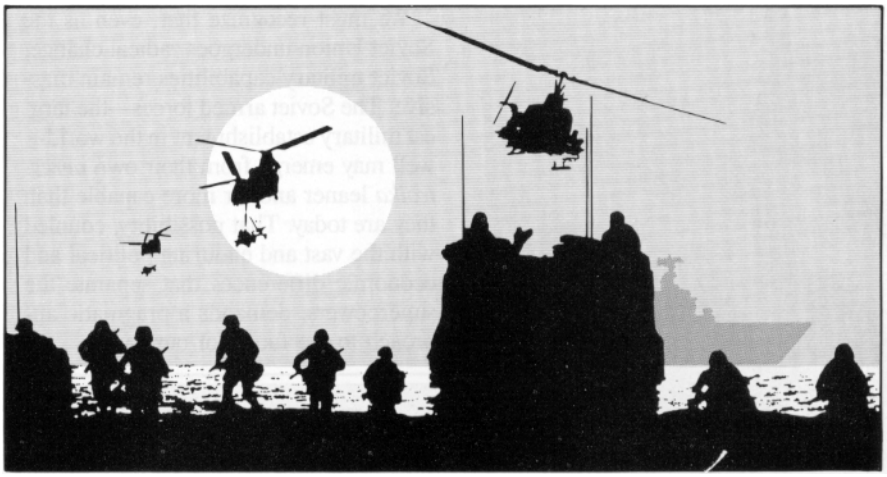
The third imperative is to conduct tough, realistic training, the cornerstone of readiness and the foundation of defense. With the fielding of the combined-arms training and integrated evaluation system (CATIES) at the National Training Center, Fort Irwin, California, and the mounting emphasis on fire support, Field Artillery is assuming its rightful prominence in the training of the combined-arms team. We are putting into practice that time-honored maxim, "the more we sweat in peace, the less we bleed in war."

These positive trends in training must be reinforced at all levels. Each soldier and leader committed to fire support must be assertive and unrelenting in teaching, coaching and leading maneuver commanders in the proper use and integration of the power of the Field Artillery. For that is the way we will fight, and that is the way we will win. And every one of us has a special responsibility to maintain the highest standards of proficiency in our nuclear tasks, reinforcing that indispensable link in the seamless web of deterrence.

4. Modernization

Fourth, we must modernize our forces continually, even in the face of tough budget choices. The Field Artillery today stands on the brink of genuine, leap-ahead improvements in range, responsiveness and lethality. Of special importance are systems on the horizon that will allow us to find and attack deep targets, changing the nature of warfare in a fundamental way.

In the context of the Army's overall modernization strategy, we will continue to invest in near-term improvements in fire support, as exemplified by the M109A6 Paladin (formerly called the howitzer improvement program or HIP),



Combined Arms Operations—that is the way we will fight, and that is the way we will win.

while we position ourselves to exploit the emerging technologies for the next generation of fire support systems beyond the year 2000. In every modernization program, we are committed to ensuring that no American soldier will ever brave the perils of 21st century combat with 20th century fire support.

5. Leader Development

The fifth imperative and our most enduring legacy to the future is the development of legions of artillery leaders—sergeants and officers who stand at the pinnacle of their profession. They must be caring, concerned, committed leaders who understand that their most sacred responsibilities are to the sons and daughters of Americans entrusted to their care.

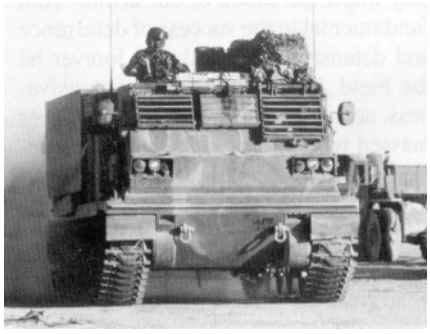
In the words of a great artilleryman, General Maxwell D. Taylor, "No man ever rose to military greatness who did not put his troops first above all else." This is the fundamental message of leader development—first, last and always.

6. Quality of the Force

The final imperative, listed last but first in importance, is the quality of the force. It is this imperative that has given the Army and the Field Artillery the unquestioned power and credibility we have today. In the complex and demanding world of tomorrow, quality will be essential if the Army is to realize its vision and fulfill global strategic responsibilities.

To meet the challenges we will face in the years ahead, we must continue to attract and retain the very best soldiers and leaders by providing an environment that meets their highest expectations for personal growth and professional achievement. The Army must sustain an environment

M109A6 Paladin



Multiple Launch Rocket System (MLRS)

that is characterized by dynamic training, excellent facilities, responsive services and an atmosphere in which every soldier, civilian and family member is treated with dignity and respect.

Those are the Army's imperatives and the fundamentals for the Field Artillery. As we shape a smaller force in the years ahead, we will measure every program and proposal against the yardstick of these imperatives. They are the lifeblood of the trained and ready Army our nation requires in this era of challenge and change.

[The six imperatives] are the lifeblood of the trained and ready Army our nation requires in this era of challenge and change.

Characteristics for Tomorrow

If we remain faithful to these imperatives and fulfill our vision of tomorrow, we will produce a force of quality soldiers who are trained to a razor's edge, equipped with weapons on the leading edge of technology and led by officers and sergeants of peerless dedication and ability. Sustained by the six imperatives, the Army and the Field Artillery of tomorrow will continue to have the characteristics essential to America's security in the decades ahead. These characteristics include versatility, deployability and lethality.

Versatility

First, the soldiers, units and leaders in the Field Artillery must be versatile to support a variety of force packages as we respond to crises around the world. For the foreseeable future, we will retain powerful forces forward deployed in Europe, the Far East and Central America. We will maintain forces for contingency operations worldwide coiled in readiness in the United States. They will be units in the active and reserve components trained and ready to reinforce combat operations anywhere America's interests are threatened.

The versatility the Army recently demonstrated when soldiers went from Christmas shopping to combat in Panama and from summer vacations to the Arabian Peninsula in a matter of days must continue to be the hallmark of the Field Artillery in the uncertain world ahead. Artillerymen throughout the Army must be ready to serve the cause of freedom in Europe, Asia, the Middle East, Central America—anywhere our nation calls.

In the quest for increased versatility, artillerymen no longer can afford to consider themselves exclusively towed or self-propelled cannon, missile or rocket. Each Redleg must be proficient in artillery weapons of every type to support packages made up of combinations of heavy, light and SOF.

A C-130 at the Joint Readiness Training Center, Fort Chaffee, Arkansas. Our Army must be versatile, deployable and lethal to respond to crises around the world.

Deployability

Second and equally important, the Field Artillery must be deployable. We must be able to project our combat power worldwide and be prepared to "march to the sound of the guns" anywhere our vital interests are threatened.

Now, deployable artillery is not synonymous with light artillery; indeed, the challenges we face in the years ahead demand we have the ability to "surge" force packages of all sizes to conflict areas throughout the world. Field Artillery units must stress the ability to deploy rapidly by sea and air, regardless of the caliber or design of our primary weapons.

Lethality

Finally, the Field Artillery must be lethal. An Army exists to fight and win. Demonstrated combat lethality is the most effective deterrent to aggression and the final determinant of the outcome of war.

The artillery has accounted for more than 75 percent of the casualties in the wars of the last two centuries, and we must never sacrifice our unquestioned ability to provide the margin of victory on the battlefields of tomorrow. As we field new generations of munitions and propellants and continue to improve our ability to acquire and engage targets, the Field Artillery will continue to fulfill its time-honored role as "the final argument of kings."

...deployable artillery is not synonymous with light artillery....[we must have] the ability to deploy rapidly by sea and air, regardless of the caliber or design of our primary weapons.

Professionalism

The Field Artillery has an unlimited future as an integral component of the combined-arms team. While the Army of tomorrow will be smaller, it will be an Army of unprecedented quality, rigorous training and undiminished readiness. In the midst of the changes we see, the Artillery and the Army will continue to be an exciting, challenging and rewarding way of life with room in the ranks for quality men and women dedicated to the defense of freedom.

As Field Artillery leaders prepare themselves to meet the challenges of the Army in this new era, there is a single, overarching characteristic that each must adopt as a personal creed. That characteristic is professionalism—a single word but a powerful concept that embraces everything each of us must be.

Professionalism is neither easy nor free. It comes from an unrelenting dedication to the qualities of competence, responsibility and commitment, each of which is essential to professional development and vital to the Army of tomorrow.

I have written about professionalism in other forums but reiterate the principles of this characteristic because of its singular importance to the future of the Army and the life of every leader.

Competence

Regardless of rank or assignment, each of us must be competent in the profession of arms and expert in the art of war. In the Field Artillery, we have a special obligation to be masters of fire support, from preparing fire plans in support of schemes of maneuver to delivering the last round in a fire for effect. Because of the central importance of fire support in deciding the outcome of battle, there is no room for compromise or equivocation in our unrelenting dedication to competence.

Men and women are not born with competence in the Field Artillery. Expertise such as we see throughout the Branch today is the result of years of study, experience and plain hard work.

Each must be competent in the profession of arms.

Each leader must embrace responsibility and be committed.

...professionalism—a single word but a powerful concept that embraces everything each of us must be.

In the business of fire support, competence can be a fleeting quality; the proficient artilleryman of a generation ago would be hopelessly out of date today. And, as we cross over into an era of integrated automation, longer range systems and increasingly lethal munitions, building and maintaining competence will become an even greater challenge, but one every professional must meet.

Responsibility

It is not enough to be competent. To be a professional, each leader must willingly embrace responsiblity for the performance of his unit and every soldier entrusted to his care.

Artillerymen share a special responsibility to the rest of the combined-arms team. Leaders in other branches may not understand the details of the gunnery solution; all they know is the lives of their soldiers depend on timely and accurate fires. It is the Field Artillery's responsibility to provide those fires, even under the most arduous of circumstances.

And artillerymen must be responsible for themselves, maintaining uncompromising integrity, self-discipline and honor. In everything we do and in everything we are, each of us must be able to look confidently into the eyes of soldiers and say "Follow me, and do as I do."

Commitment

Finally, professionals must be committed to the profession of arms and to the nation. They must be willing to serve in the difficult assignments on isolated posts doing tasks that drain every measure of energy from their beings. And they must be willing to give their very lives in the defense of the nation. It is this commitment that lends meaning to sacrifice and brings honor and humility to personal achievement.

Those qualities of competence, responsibility and commitment make up the professional artilleryman of today—a leader of unmatched ability who is a model for future generations.

Conclusion

As members of the Field Artillery, we have a tradition of heroic service symbolized by the success and sacrifice of artillerymen since the Revolution. Redlegs have always understood the simple truth that "freedom isn't free" and have paid for freedom with their sweat and blood on battlefields that span the centuries of our national existence from Bunker Hill to Panama. The history of the Field Artillery is not one of individual valor alone but of the courage of thousands of soldiers drawn together into a common purpose—support of freedom in a hostile world.

And so it must be in the future. As the King of Battle, the Field Artillery must be trained and ready to fulfill its strategic obligations in an environment of social and political revolution. This is our sacred obligation to the soldiers who have gone before us and our solemn responsibility to the American people.

This article is based on an address by General Vuono at the 319th Field Artillery Dining-In, Fort Bragg, North Carolina, 23 May 1990. It is part of an ongoing effort to communicate the Army's vision through each branch journal. Although the address was presented before the Iraqi invasion of Kuwait, the crisis underscores the importance of the Army's vision and the characteristics we must have in the years ahead.

General Carl E. Vuono has been Chief of Staff of the Army since June 1987. He was Commander of the Training and Doctrine Command (TRADOC), Fort Monroe, Virginia, and served as Deputy Chief of Staff for Operations and Plans, Washington, D.C., and Deputy Commanding General of TRADOC and Commanding General of the US Army Combined Arms Center and Fort Leavenworth, Kansas. He also commanded the 8th Infantry Division (Mechanized), US Army Europe, and was Assistant Division Commander of the 1st Infantry Division, Fort Riley, Kansas. General Vuono commanded several Field Artillery units, including the 82d Airborne Division Artillery, Fort Bragg, North Carolina, and the 1st Battalion, 77th Field Artillery, and later the 1st Battalion, 21st Field Artillery, 1st Cavalry Division, both in Vietnam.

Massed Fires—Room for Improvement

by Colonel Thomas R. Hogan and Captain Brendan L. Wilson

Major Law anxiously checked the situation map and the intelligence summary for the 10th time in as many minutes. As the operations duty officer for the Div Arty TOC [division artillery tactical operations center], it was his job to issue the fire order that would result in the simultaneous firing of more than two brigades of cannon and rocket artillery.

The target was the lead battalion of an attacking motorized rifle regiment [MRR]. Thanks to a first-rate division intelligence estimate, the planning had proceeded smoothly, and the enemy's probable courses of action had narrowed with each new intelligence or targeting report.

The covering force had nearly completed the battle handover, and most of the artillery assets were back in their main battle positions. Meanwhile, aerial observers had confirmed the ground scout reports that the MRR was committed to the major east-west avenue of approach, labeled "Charlie" on Major Law's overlay.

The Division Commander had decided to engage the lead battalion as soon as it reached a choke point approximately four kilometers from his forward line. Major Law was in contact with several observers, each capable of reporting when the enemy reached the trigger point. The OPLAN [operations plan] called for a devastating massing of artillery followed by a counterattack from the Division's attack helicopter battalion.

According to his calculations, Major Law expected the word any time now. Suddenly, two different radio nets crackled to life with reports that the first elements were crossing the north-south trail used as the trigger point. Major Law's voice almost broke as he issued the fire order that should cause the largest wartime massing of US artillery since Vietnam.

Within two minutes, one of the direct-support battalions reported "shot" for the initial volley. Another minute passed before other units began to report. But after five minutes, only half the units had fired.

The tactical fire direction system (TACFIRE) controls and coordinates calls for fire, to be replaced by the advanced Field Artillery tactical data system (AFATDS) in the mid-1990s.

Suddenly, the command net came to life with the angry voice of the Div Arty Commander calling from his command and control helicopter. "What the hell is going on down there?" asked the Colonel. "The first battalion volley was perfect, but the column immediately buttoned-up and dispersed. The rounds are sporadic now. Almost no effect. Tell the S3 I want ***everyone*** to fire together from now on!"

Even before the majority of the units reported "rounds complete," they started receiving heavy counterbattery fire. It was the worst possible situation since the MRR was now closing with the US main battle positions and the fire support officers were screaming for artillery support and getting little.

In addition, the air battle captain responsible for the counterattack was pressing for the start of the planned suppression of enemy air defenses so he could continue with the mission. The helicopters were already airborne, burning precious fuel while waiting for the word to attack. The radios suddenly went dead as the van rocked from a nearby explosion.

Later, in a field hospital, Major Law conceded that the battle had been lost largely through his failure to effectively mass the Div Arty's fires at the critical time.

The above account is obviously fictitious, but the theme is deadly serious. According to reports from the Combat Training Centers (CTC), US artillery

units continually fail to mass fires effectively. The purpose of this article is to reemphasize the importance of massed fires, review some of the basics of massing fires and solicit support to correct current deficiencies.

Why Mass?

Effective massing requires multiple units to cause their fires to impact at the same place nearly simultaneously. For example, consider the situation in which a 3x8 Div Arty has three targets to engage within three minutes. If effects is the overriding criterion, the best solution is to fire a "Div Arty Four" at each target. Without violating the maximum rate of fire, 288 rounds will impact on each target per minute, increasing casualties by up to 300 percent, depending on the type and posture of the target.

Surprise

The fundamental reason for this increased effect of massed fire is the element of surprise. For stationary targets, soldiers will begin to take protective cover as soon as the first rounds impact; a standing soldier who immediately falls to the ground increases his survivability by up to 50 percent. Given enough time, the soldier will find better cover, further reducing his vulnerability to less than 10 percent.

Protective Postures

To assess how quickly soldiers will take cover, the Army conducted the Troop Reaction and Posture Sequencing Test in the 1970s. Part of the test determined how fast soldiers can achieve degrees of protective postures.

Figure 1 shows a sample result from the test. In this case, a squad was occupying a defensive position but hadn't completed preparing fighting positions at the time of an artillery attack. At the moment the first round impacted (0 seconds), nine percent of the soldiers were prone, 33 percent were prone protected (i.e., prone with some additional cover) and 58 percent were standing.

However after two seconds, only 29 percent remained standing while the majority (56 percent) were prone protected. After eight seconds, all soldiers achieved a prone-protected posture, thus reducing their initial vulnerability by up to 66 percent.

Stating the obvious, when we attack personnel targets, we have a small window of opportunity to take advantage of surprise fires. It's imperative that such engagements be intensely violent.

Moving Targets

For moving targets, the time requirement is even more critical because late rounds will miss the target entirely. Figure 2 shows what effects late rounds have when massing on moving vehicles. In this case, a group of vehicles is traveling at 15 kilometers per hour; if a massed round is 15 seconds late, the vehicles will still be within the 100-meter target (or damage) radius but 62 meters away from the "expected position." The expected position is the location massed on, based on the vehicles' and rounds' travel times. As Figure 2 shows, if a round is one minute late, the vehicles will be 250 meters away from the aim point.

What are the Basics?

To achieve the near simultaneous engagement of a single target with multiple units, we need a firm grasp of some

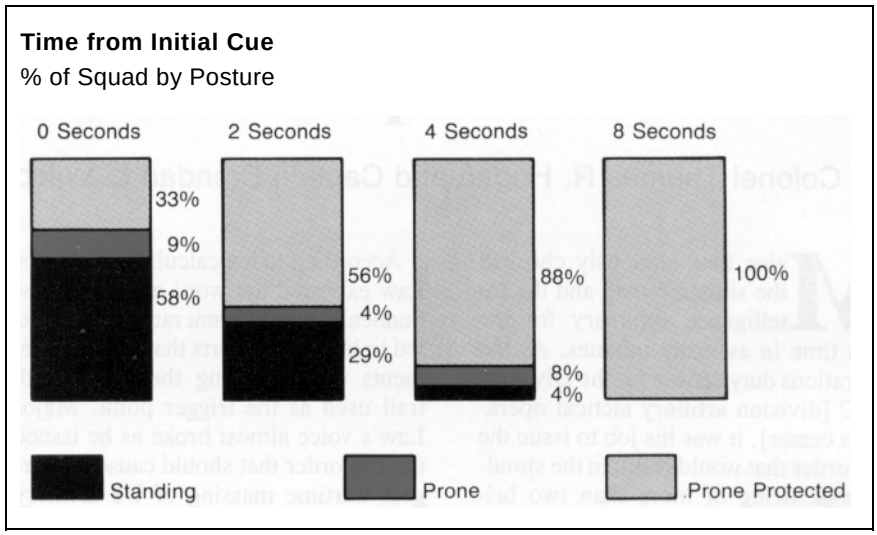


Figure 1: Sample Results of the Troop Reaction and Posturing Sequencing Test. In this sample, a squad was occupying a defensive position but hadn't completed preparing fighting positions. With an eight-second delay between rounds impacting during massing, all the soldiers in the squad can be in a protected prone posture, reducing their vulnerability by up to 66 percent.

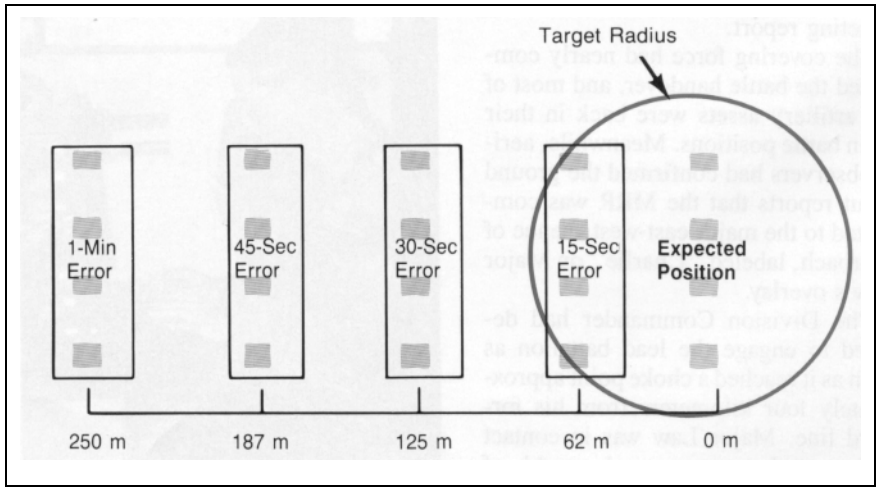


Figure 2: Massing on Moving Targets. This Figure shows the effects of late rounds massed on vehicles moving at 15 kilometers per hour. If rounds massed on the vehicles' expected position are 15 seconds late, the vehicles will still be in the 100-meter target (or damage) radius, but they'll be 62 meters away from the aim point. With a round one minute late, the vehicles will be 250 meters away.

basics of massing. These basics include the decision to mass, the technical ability to mass and a method of controlling massed fires.

Making the Decision

The decision to mass fires results from the fire direction officer's (FDO's) target analysis. Appendix C of *TC 6-40 Field Artillery Manual Cannon Gunnery* provides the details of this process.

The FDO's target analysis begins during the planning stages and continues throughout the operation. From the fire support plan, he extracts the commander's guidance to determine key information for massing decisions. This includes (1) the precedence of attack for individual target types, (2) specific effects to be achieved for differing targets and (3) specific times and places where the commander expects the fires from all fire units to be available. Then the FDO identifies likely targets to be engaged by massed fire, working closely with the S2, fire support officer (FSO) and targeting officer.

Concurrently, as the S3 develops the movement plans for the batteries to support the scheme of maneuver, the FDO defines those opportunity windows (where and when) for which the battalion must be available to mass fires. During the fire support rehearsal, the FDO alerts the S3 and FSOs of the times and places on the battlefield when the requirements (to mass) and opportunities are out of balance. Adjustments to the plan are then applied to ensure success.

During the operation, the decision to mass by the FDO must be made rapidly. The quality of his decisions depends on the planning and preparation conducted by the entire battalion and the continuous dialogue among critical members of the gunnery team.

Computing the Solution

Once the decision to mass has been made, the fire direction center (FDC) must know certain precise information to compute a ballistic solution. This information is commonly referred to as the five requirements for accurate predicted fire. All five requirements must be met to mass effectively. They are accurate—

(1) Target Location
(2) Fire Unit Location
(3) Weapon and Ammunition Information
(4) Meteorological Information
(5) Computation Procedures

Having satisfied the five requirements for accurate predicted fire, units are able to engage the correct point on the ground or aim point. To produce the maximum effect, however, the FDO must now control the fires to get a near simultaneous impact.

Controlling Massed Fires

Major Law could have used several methods to control massed fires and achieve better results in our fictitious account.

When Ready. A mission fired with a method of control "When Ready" means that each howitzer of each fire unit will fire as soon as possible. The advantage of this method is that each projectile is fired sooner than would be the case if the FDC or the observer were to command the firing. The "When Ready" method of control is appropriate when time is critical, and therefore some rounds fired now will be better than a simultaneous engagement of the aim point after the enemy is long gone.

"When Ready" has a potential disadvantage in that the total time required to fire the mission will vary according to the level of training of the battery FDCs and the individual howitzer sections. All rounds that impact after those critical first seconds have a reduced effect because of the enemy's ability to seek protective postures.

If the method of control is not specified, the default is "When Ready." This is probably what Major Law did in his fire order. The result was that one unit fired almost immediately while other units still hadn't fired after five minutes.

One would be wrong to assume that this is a pessimistic prediction. According to observer/controllers at the National Training Center (NTC), Fort Irwin, California, the average time from receipt of the fire order to the first lanyard pulled for "When Ready" missions is between six and seven minutes, depending on the weapon system.

At my Command. A mission fired "At My Command" requires each howitzer and fire unit to load, report "Ready" and fire at the order of the FDO or observer. "At My Command" missions are appropriate for stationary targets or moving targets where the firing is timed to engage the enemy at a predetermined intercept point. It has the advantage of all howitzers firing at the same instant, resulting in near simultaneous impact in the target area (impact will vary by differences in the time of flight).

Major Law could have used this method, which would have greatly improved the effects. Although it's possible that the total mission time might have been longer, the increased effects should outweigh the slower response. In a somewhat surprising report, NTC observations are that "At My Command" missions rarely take longer than "When Ready" missions and, in some units, are even faster.

Time on Target. A "Time on Target" mission is designed to achieve simultaneous impact in the target area. The battalion FDO announces the time of impact, and each fire unit controls firing to comply. Under this type of control, the FDO may choose one of three methods.

(1) A Specified Time—for example, "Time on Target, 0700 hours."

(2) A Time Interval—for example, "Time on Target, 5 Minutes from my Mark . . . five, four, three, two, one, mark."

(3) A Short Countdown. In this method, each fire unit first reports "Ready" and gives its own time of flight. Then the controlling FDO announces a time interval just longer than the longest time of flight. For example, if the controlling FDO receives the following reports after issuing the fire order:

"Alpha ready, time of flight 21."
"Bravo ready, time of flight 19."
"Charlie ready, time of flight 20."
The FDO would then announce:
"Time on target, 30 seconds from . . . now."

The short countdown is the fastest method of delivering a "Time on Target" and may be the preferred method if the controlling FDC is using voice fire orders and the subordinate units are well-trained.

Why aren't we doing it?

The preceding discussion sounds simple enough to achieve. After all, there's nothing new here—the American Army historically has massed fires with astonishing effectiveness during major wars. However, the information listed in Figure 3, collected during four recent NTC rotations, shows we're not massing during training.

Massing of Fire Units		
# of Fire Units Massed Per Mission	3x8 Missions	3x6 Missions
1	179	30
2	50	2
3-4	19	3
5-6	5	0
Total Missions	253	35

Figure 3: This data taken from four recent NTC rotations shows that only five of 253 3x8 missions (1.9%) massed the fires of five or six fire units (platoons). Of the 35 3x6 missions, only three massed three to four fire units (batteries), which is 8.5%. The data was taken from live-fire, high-explosive missions only.

As you read Figure 3, keep in mind that a fire unit is as small as a platoon of four howitzers. In only five of a possible 253 3x8 missions (less than two percent) did a battalion fire more than two-thirds of its assets. Admittedly, not all targets warrant battalion fires, but certainly more than two percent do.

Consider possible causes of the problem. Does the fault lie in institutional training? Do units not practice massing during command post or field training exercises? Are leaders failing to emphasize the importance of massing? Is there a disfunction in the "scoring" system for indirect fire at the CTCs that fails to reward massing or perhaps even penalizes it?

What Can Be Done?

Whatever the causes, each of us at our own level needs to move forward toward a solution. Within the Field Artillery School, Fort Sill, Oklahoma, massing is receiving renewed emphasis during platform instruction, practical exercises and live-fire shoots. In addition, a review is being conducted of the casualty tables distributed to the CTCs. This review will ensure the tables not only reflect the most recent munition effects data, but also consider the increased effects of massed fires.

Twice each year, a capabilities exercise is conducted where all resident students observe the massed cannon fires of the entire III Corps Artillery, integrated with Army aviation and Air Force close air support. Parallel emphasis in the field will ensure continued momentum.

There are success stories. At the October 1989 Fire Support Conference, Colonel Larry D. Aarons, Senior Fire Support Observer/Controller at the NTC, surfaced the issue of massing and reported a general lack of understanding of muzzle velocity and ammunition management in the units he observed.

In response, the Field Artillery School began to emphasize the problem and recommend solutions to future commanders during the Pre-Command Course and in the Officer Advanced Course. Additionally, assistance teams were made available to offer pre-deployment help to units bound for Fort Irwin. Officers and NCOs from the academic departments also participated in rotations at the NTC and Joint Readiness Training Center (JRTC), Fort Chaffee, Arkansas, offering assistance and returned with recommendations for improvements in instruction.

As a result of these efforts and field support, Colonel Aarons recently addressed senior Field Artillery commanders at the Senior Artillery Leaders Training Seminar at Fort Sill with better news. He now observes: . . . *a dramatic change in the concern for meeting the requirements for accurate predicted fire. It is enjoyable to watch FDOs, section chiefs and even battalion executive officers wrestling with the challenges of understanding and maintaining calibration data and muzzle velocity histories and working real ammunition problems. The Gunnery Gods are elated.*

Even with these efforts, we still have a way to go. Our goal must be to achieve a peak level of performance before the next conflict, as future wars will most likely be fought according to our peacetime level of training.

We need to take the opportunity now to continue to move in the direction of maximizing the use of fire support assets. The effective massing of fires is one important step toward that objective.

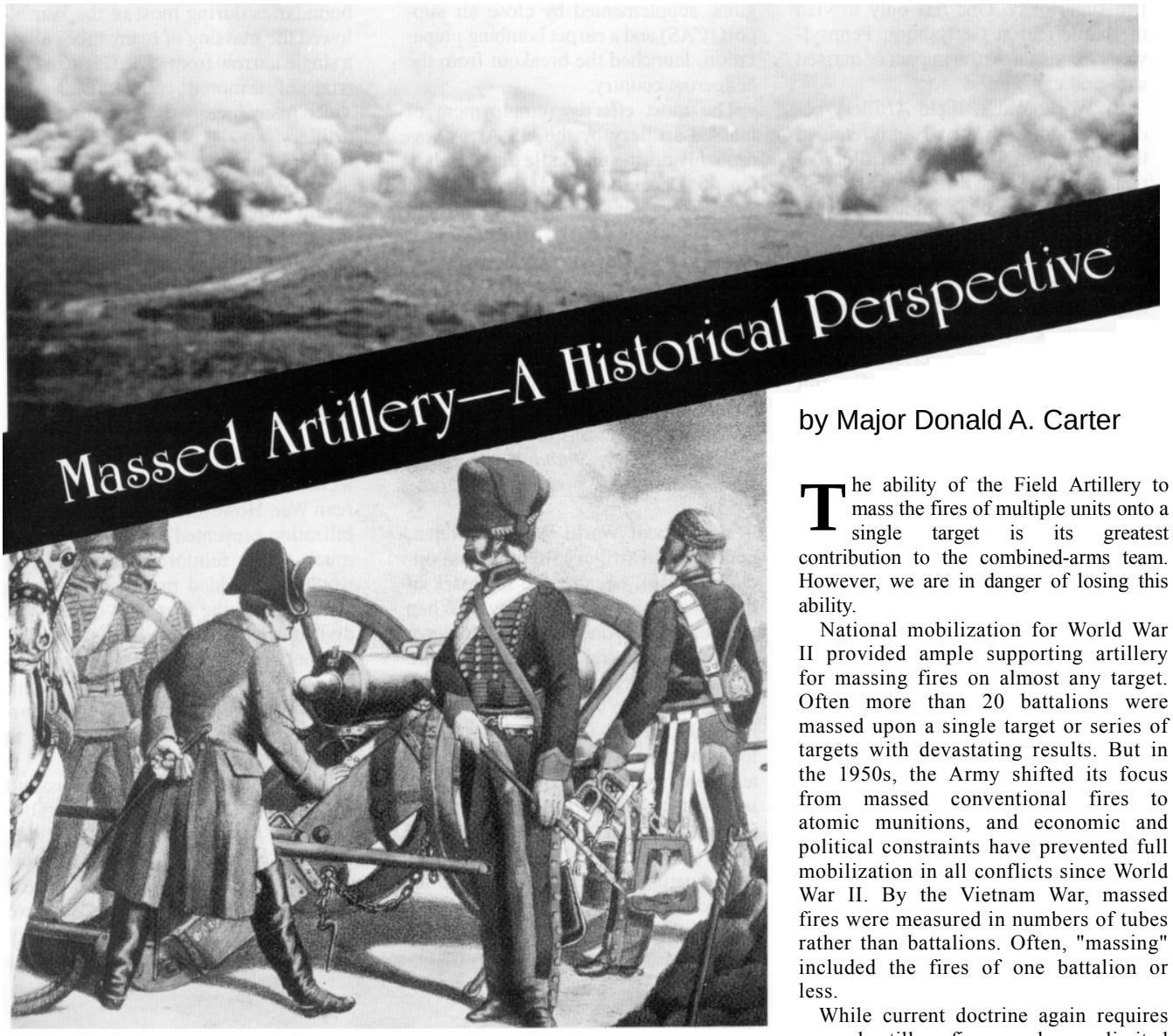
Michael Thompson, TEXCOM FA Board

With its semiautonomous operations, the Paladin enhances survivability and provides support for massing of fires.

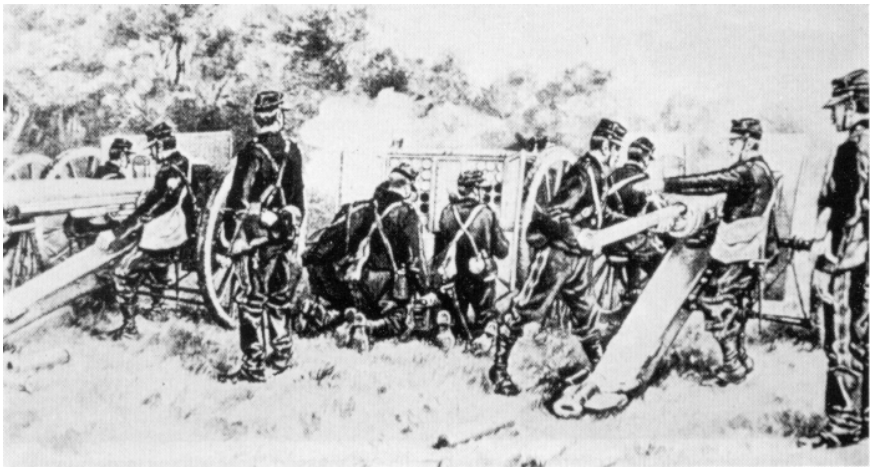
Colonel Thomas R. Hogan is Director of the Gunnery Department, Field Artillery School, Fort Sill, Oklahoma. He commanded a 105-mm battalion in the 10th Mountain Division (Light Infantry), Fort Drum, New York, and two batteries in the 1st Cavalry Division, Fort Hood, Texas. He also commanded a Security Company in the First Regional Assistance Command, Vietnam. Among other assignments, Colonel Hogan has served as a battalion executive officer and S3, Assistant Division Fire Support Coordinator and Division Artillery Executive Officer, all in the 82d Airborne Division, Fort Bragg, North Carolina. He holds a master's degree from Syracuse University, New York, and is a graduate of the Army War College, Carlisle Barracks, Pennsylvania.

Captain Brendan L. Wilson is Assistant Professor of Military Science at the University of Colorado in Boulder. Until recently, he was a Gunnery Instructor and Chief of the Software Documentation Team for the Gunnery Department at the Field Artillery School. Captain Wilson has served as a Company Fire Support Officer, Battery Fire Direction Officer and Executive Officer, Battalion Fire Direction Officer and Battery Commander. He's a graduate of the Airborne, Ranger and Air Assault Schools and the Field Artillery Officer Advanced Course, Fort Sill. Captain Wilson holds a master's degree in business administration from Oklahoma City University.

Massed Artillery—A Historical Perspective



In the early 1800s, France's Emperor Napoleon originated the concept of massed Field Artillery.



In the 19th century, massing direct-fire artillery usually meant positioning the guns hub-to-hub.

by Major Donald A. Carter

The ability of the Field Artillery to mass the fires of multiple units onto a single target is its greatest contribution to the combined-arms team. However, we are in danger of losing this ability.

National mobilization for World War II provided ample supporting artillery for massing fires on almost any target. Often more than 20 battalions were massed upon a single target or series of targets with devastating results. But in the 1950s, the Army shifted its focus from massed conventional fires to atomic munitions, and economic and political constraints have prevented full mobilization in all conflicts since World War II. By the Vietnam War, massed fires were measured in numbers of tubes rather than battalions. Often, "massing" included the fires of one battalion or less.

While current doctrine again requires massed artillery fires, we have a limited number of tubes available. The division artillery headquarters must prioritize and control fires in support of maneuver forces to a greater degree than ever before.

Direct to Indirect Fire

The concept of massed Field Artillery originated while it was still a direct-fire system. Napoleon employed his Grand Battery at Wagram and Waterloo, hoping to gain in massed firepower what he had lost in trained infantry. At Waterloo, the French Artillerist massed 80 guns virtually hub-to-hub. The crashing volleys of massed artillery created gaps in the opposing line that the infantry or cavalry could exploit.

In the American Civil War, both sides

massed artillery hub-to-hub to attain fire superiority. One has only to visit the battlefield at Gettysburg, Pennsylvania, to visualize the impact of massed shot and canister.

By World War I, Field Artillery became an indirect system, but it retained the concept of mass. The artillery of that War lacked the technical capability to converge fires on a single target, but the prolonged heavy bombardments clearly reflected an appreciation for the effects of massed fires. By 1916, artillery fires lasting several weeks before a major attack were not uncommon.

During the interwar period, General Headquarters Chief of Staff General Leslie J. McNair increased the centralized control over artillery units. This increased the artillery's ability to mass its fires. In addition, improved radios allowed reliable communication between observers and the firing battery.

Instructors at the Field Artillery School developed indirect-fire procedures that enabled multiple units to mass fires on a single target. This system created battery- and battalion-level fire direction centers (FDCs) and made the artillery the most doctrinally advanced branch of the Army as it entered World War II (Jonathan House, *Toward Combined Arms Warfare*, Combat Studies Institute, Fort Leavenworth, Kansas, 1984).

Field Artillery Guns Increased

The key to the Army's ability to mass fires in World War II was the complete mobilization of the American war effort. By committing the entire resources of the nation, the Army was able to field more than 300 non-divisional Field Artillery battalions. This produced a ratio of almost three non-divisional artillery battalions per maneuver division, in addition to the division's organic assets.

This immense pool of artillery at the corps, army and theater levels provided the firepower for massed fires in the European Theater. The 8-inch and 155-mm guns and howitzers enabled supporting artillery battalions to mass their fires on targets far beyond the front lines.

As the American Army expanded on the European continent after D-Day, artillery played a critical role. During the breakout at St. Lo in late July 1944, the US VII Corps massed 19 non-divisional battalions plus the organic artillery of its six divisions. More than 1,000 guns, supplemented by close air support (CAS) and a carpet bombing preparation, launched the breakout from the hedgerow country.

The most effective employment of massed artillery by the US Army was probably during the Battle of the Bulge. On 16 December 1944, the German 326th Volksgrenadier Division attacked through a sector held by a thin screen of the US 38th Cavalry Reconnaissance Squadron. The Germans were driven back repeatedly by the combined fires of 15 battalions of Field Artillery. "So decimated were the assault columns that only one battalion of infantry succeeded in breaching the American line, and that remnant was quickly crushed" (Fairfax Downey, *Sound of the Guns*, David McKay Company, New York, 1955).

Throughout World War II, sudden, concentrated artillery fire, the time-on-target (TOT), became the hallmark of the American Field Artillery. "When the Germans on one occasion laid down a heavy concentration of artillery fire with devastating effect on some American infantry, an American gunner remarked that the Germans must have found an American artillery manual to tell them how to mass their fire" (Russell Weigley, *Eisenhower's Lieutenants*, Indiana University Press, Bloomington, 1981).

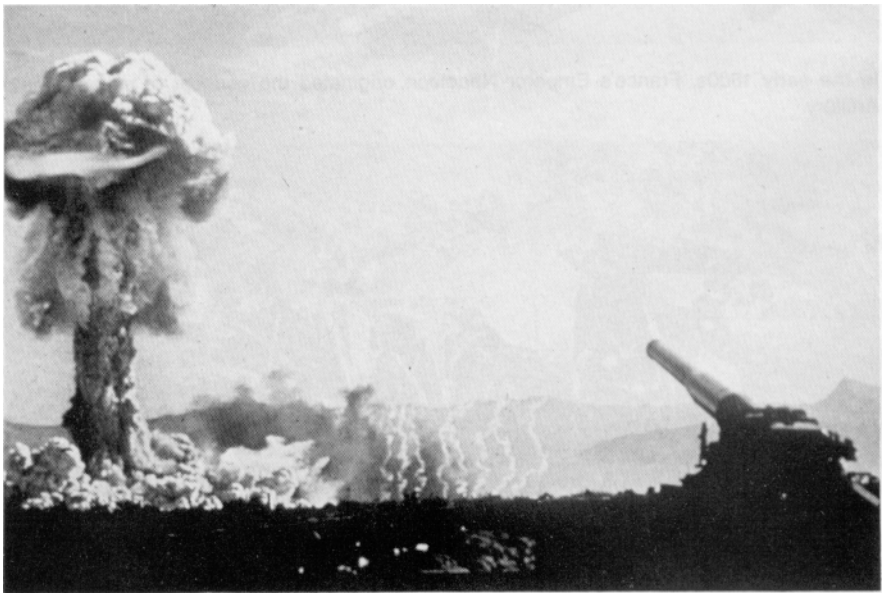
The nature of the War in Europe facilitated the artillery's application of massed fire. With the nation fully mobilized for war, there were always artillery assets available. Relatively stable boundaries during most of the War allowed the massing of many tubes along a single narrow front. The German doctrine of armored counterattack provided many lucrative targets for massed artillery.

The killing fires that the American artillery produced during the Second World War led Weigley, a prominent historian, to conclude, "On all fronts, artillery caused more than half the casualties of World War II battles, but the artillery was the American Army's special strong suit."

Field Artillery Guns Reduced

The American Artillery continued its technical excellence throughout the Korean War. However, the incomplete mobilization prevented the deployment of much of the reinforcing artillery that would have added mass to supporting fires. During the first year of the War, divisions measured artillery support by numbers of tubes rather than by numbers of battalions available. Ammunition shortages throughout the War further limited the artillery's ability to mass.

For the 2d Infantry Division's assault on Heartbreak Ridge, X Corps allocated four battalions of Field Artillery, which included the division's own organic assets. Although the prolonged volume of fires throughout the War gave this conflict the aura of an "artillery war," the lack of reinforcing units



In the 1950s, atomic artillery offered a means to achieve "massed" fires without large numbers of tubes.

usually prevented the artillery from massing fires as it had in Europe (Walter Hermes, *Truce, Tent and Fighting Front*, Office of the Chief of Military History, Washington, D.C., 1966).

After the Korean War, US Army organization and doctrine underwent radical changes in an attempt to keep pace with President Eisenhower's "New Look." Under the Pentomic structure implemented in 1953, infantry divisions deployed with five organic battle groups, each supported by a direct-support artillery battery. The division artillery commander retained control of a composite howitzer and rocket battalion.

This was a division designed to fight on an atomic battlefield and use atomic weapons as its fire support. Consequently, there was insufficient artillery to provide any sort of massed conventional fires.

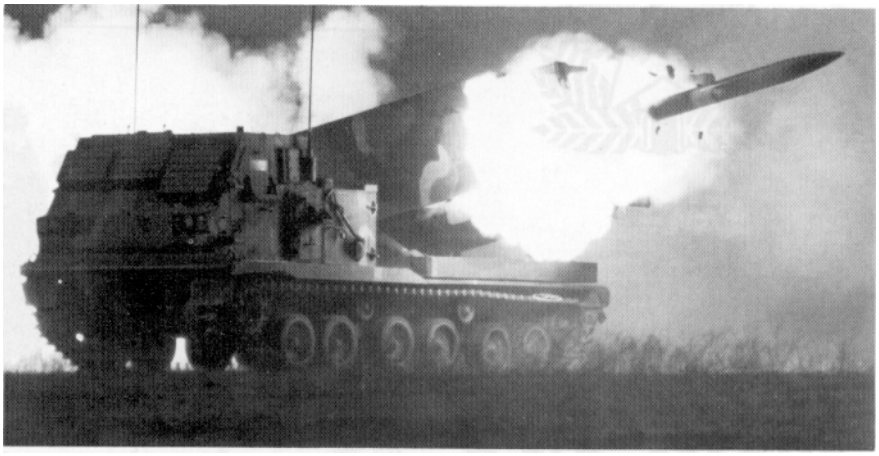
In addition, division commanders quickly expressed their concern about their lack of control over the direct-support artillery. By attaching the direct-support batteries directly to the battle groups, the division artillery commanders could no longer control them.

The Pentomic structure proved to be more of a political ploy to accommodate Eisenhower than a tactical organization. Once President Kennedy assumed office in 1961, the Army quickly scrapped the Pentomic Division and returned to a more traditional division structure—the reorganizing of Army division or ROAD Division. It used maneuver battalions as building blocks to create brigades and consolidated all artillery once more under the division artillery commander.

As the Army deployed to Vietnam in 1965, it again encountered difficulties in massing fires, similar to its problems in Korea. Once again political considerations prevented the full mobilization of the reserves.

Divisions often were limited to artillery assets organic to the division artillery. The wide dispersion of maneuver units often prevented mutual support among brigades, let alone divisions.

In addition, American commanders had been trained and accustomed to expect dedicated, responsive artillery fires. Division commanders often assigned individual batteries a direct-support mission for a maneuver battalion. This task organization, with the wide dispersion of units, made the massing of artillery difficult, if not impossible (Lieutenant General David E. Ott, *Field Artillery: 1954-1973*, Department of the Army, Washington, D.C., 1975).



With fewer available Field Artillery units, today's Army must rely on modern systems such as MLRS to provide massed fires.

Reliance on Air Firepower

The war in Vietnam presented unique challenges to Field Artillerymen. The North Vietnamese Army (NVA) and Viet Cong seldom presented lucrative targets for massed artillery fire. Because the Air Force had no air superiority battle to fight, they often were a more responsive source of mass firepower than the artillery. In those battles that most resembled a conventional conflict, divisions massed artillery to the greatest extent possible.

In the battle for Hue in 1968, the 3d Brigade, 1st Cavalry Division, received fire support from five artillery batteries, its own direct-support battalion plus two reinforcing batteries. In the three-week battle, these units fired more than 52,000 rounds. In what was to be the largest array of artillery in support of a single operation, the 1st Cavalry Division controlled the fires of 31 batteries during its relief of the Marine Base at Khe Sanh.

In both actions, the numbers represent batteries available. Seldom, if ever, were all tubes massed on a single target.

Today and Tomorrow

The Army has spent the years since Vietnam reflecting upon its experience there and sorting out doctrine to support its various missions. The Field Artillery currently faces the challenge of adapting itself to support these contingencies.

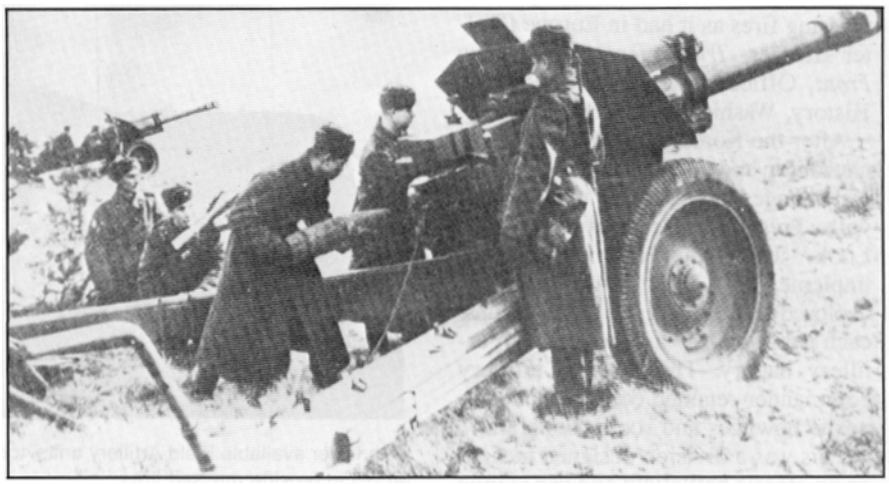
The advantages of massed Field Artillery support are obvious. Operations at the National Training Center, Fort Irwin, California, indicate that those commanders who effectively mass their fire support systems against high-payoff targets are most successful.

Unfortunately, organizational and doctrinal changes are making it increasingly difficult to retain this ability. Budget cuts and political constraints continue to erode the fire support assets available to the maneuver commander.

The conversion of 8-inch howitzers to multiple-launch rocket systems (MLRS) in many general-support battalions raises questions that have not yet been answered about the Army's ability to mass for close support. The division artillery commander and his staff must closely control the remaining fire support assets.

The division artillery's ability to mass its own fires will directly affect the next battlefield. And with the evolution of the AirLand Battle-Future doctrine of attack by fires, the destruction of the enemy by long-distance fires massed by the corps artillery becomes even more critical to our Army's success in combat.

Major Donald A. Carter is the Military History Instructor at the Field Artillery School, Fort Sill, Oklahoma. He holds a Doctorate of Philosophy in History from Ohio State University and taught history at the US Military Academy at West Point. Major Carter commanded batteries in the 2d Battalion, 34th Field Artillery, III Corps Artillery, Fort Sill, and in the 2d Battalion, 17th Field Artillery, in South Korea, and served as the S3 for the 2d Battalion, 18th Field Artillery, also in III Corps Artillery.



Breakout from the Sandomierz Bridgehead

by Captains Donald R. Sims, MI, and Anthony M. Schilling, MP

During January 1945, the Soviet Army launched what it hoped to be the final drive into Hitler's Germany. An integral part of the plan was to mass a tremendous amount of artillery to blast large gaps through the well-prepared German defensive lines and fortifications and destroy reserve forces and headquarters elements along the Vistula River in Poland. This would destroy these forces before they could react to the Soviet offensive drive. Using a *blitzkrieg* style of attack, the Soviets planned to advance to the Oder River, drive to Berlin and end the War in Europe.

The drive to the Oder River was successful, especially the First Ukrainian Front's breakout from the Sandomierz Bridgehead across the Vistula River near Warsaw. The Front Commander, Marshal Ivan S. Koniev, massed his artillery with his guns hub-to-hub, causing devastating effects on the Germans.

Though the drive didn't end the War in Europe, the effectiveness of massed fires was a lesson the Soviets learned well, and they kept the concept as a vital part of their offensive operations. Today the Soviets can use modern technology to mass fires without massing their guns as they had to in World War II.

Background

The Soviet 1944 summer campaign, Operation Bagration, began on 22 June 1944 and was extremely successful. By mid-August, the Soviets had forced the Germans back 450 miles, pushing the last German units out of the Soviet Union.

The cost to the Germans was tremendous. Army Group Center bore the brunt of the fighting and lost 25 of its 33 divisions. The Soviets killed 381,000 German soldiers and took another 158,000 prisoner. The equipment losses were staggering: 2,700 tanks and self-propelled guns, 8,700 artillery pieces and 57,000 motor vehicles captured or destroyed.

At the end of Operation Bagration, the Red Army held three bridgeheads across the Vistula River south of Warsaw. The largest was the Sandomierz Bridgehead. Further north were two smaller ones, the Magnusew and the Pulawy Bridgeheads.

From September 1944 to January 1945, the Soviet command provided massive logistical support for the next offensive. The Soviets converted the railroads in eastern Poland to Russian gauge and, at the Vistula Bridgeheads, extended the railroad across the river.

They also repaired the railroad bridge across the Vistula at Baranow, which serviced the Sandomierz Bridgehead. This allowed a more rapid movement of supplies onto the western bank of the Vistula. More than 64,000 carloads of provisions went over this bridge to fill the supply dumps of Marshal Koniev's First Ukrainian Front.

The Red Army made good the losses suffered during Operation Bagration, and there was no shortage of equipment.

Marshal Ivan S. Koniev, Commander of the First Ukrainian Front

The First Belorussian and Ukrainian Fronts deployed opposite the German Army Group A and enjoyed a substantial numerical advantage. They had 2,204,000 troops poised to attack only 400,000 Germans and 6,400 tanks and self-propelled guns opposed by only 1,150. The Russians' 46,000 artillery and mortar pieces of various types were prepared to pulverize a front of only 4,100, and they had 4,700 aircraft against which the Luftwaffe could put up only 270.

Two-Phase Plan

Strategically, the Soviets intended to end the War in a 45-day operation. They conceived the operation in two phases.

Only the initial phase was planned in detail; the Soviets allotted it no more than 15 days.

They planned the two phases as offensives that were related but separated geographically by the Vistula River. Marshal Georgi K. Zhukov's First Belorussian Front would strike out of the Pulawy Bridgehead toward Lodz, out of the Magnusew Bridgehead toward Kutno and encircle Warsaw on the right flank (see Figure 1).

Koniev's First Ukrainian Front would break out of the Sandomierz Bridgehead westward toward Radom, turning one force northwest to cooperate with the First Belorussian Front's left flank in destroying the Germans in the Kielce-Radom area and another southwest toward Krakow and the Upper Silesian industrial area. Then both fronts would advance abreast west and northwest toward the Oder River.

The second phase required somewhat more time and daring. The Soviets knew the Army Group A sector was weak. Allowing only 30 days for the second phase, they intended to conduct a strategic pursuit with the First Belorussian and Ukrainian Fronts straight through to the Oder River and Berlin.

Russian Deployment

Of the three bridgeheads across the Vistula south of Warsaw held by the Red Army, the broadest was the Sandomierz Bridgehead, also known as the Baranow Bridgehead (see Figure 2). It stretched for 45 miles along the west bank of the Vistula and was 40 miles deep. The size allowed the Soviets to mass a large force on the German side of the Vistula in this area.

Koniev's First Ukrainian Front deployed seven armies in the Sandomierz Bridgehead. These armies were the 3d Guards Tank, 4th Tank, 5th Guards, 6th, 13th and 52d. In addition to these, Koniev had at his disposal the 21st, 59th and 60th Armies.

Koniev's maneuver plan was relatively simple. He planned to push west from his line on the Czarna River on a front of 20 to 25 miles. The first echelon, consisting of four field armies (the 3d and 5th Guards and 13th and 52d) supported by six artillery divisions, would conduct the main attack. Two field armies (21st and 59th) and an independent tank corps made up the second echelon. Two other formations, the 1st Guards Cavalry Corps and 7th Guards Mechanized Corps, constituted the front reserve.

Between the first- and second-echelon forces, the Soviets deployed the 4th Tank Army in the north and the 3d Guards Tank Army in the south. These two forces served as the Front's mobile groups and were committed early to move rapidly to seize crossing sites over the Oder.

Their mission was to take them 500 kilometers across Poland, far in advance of the main forces. Once on the

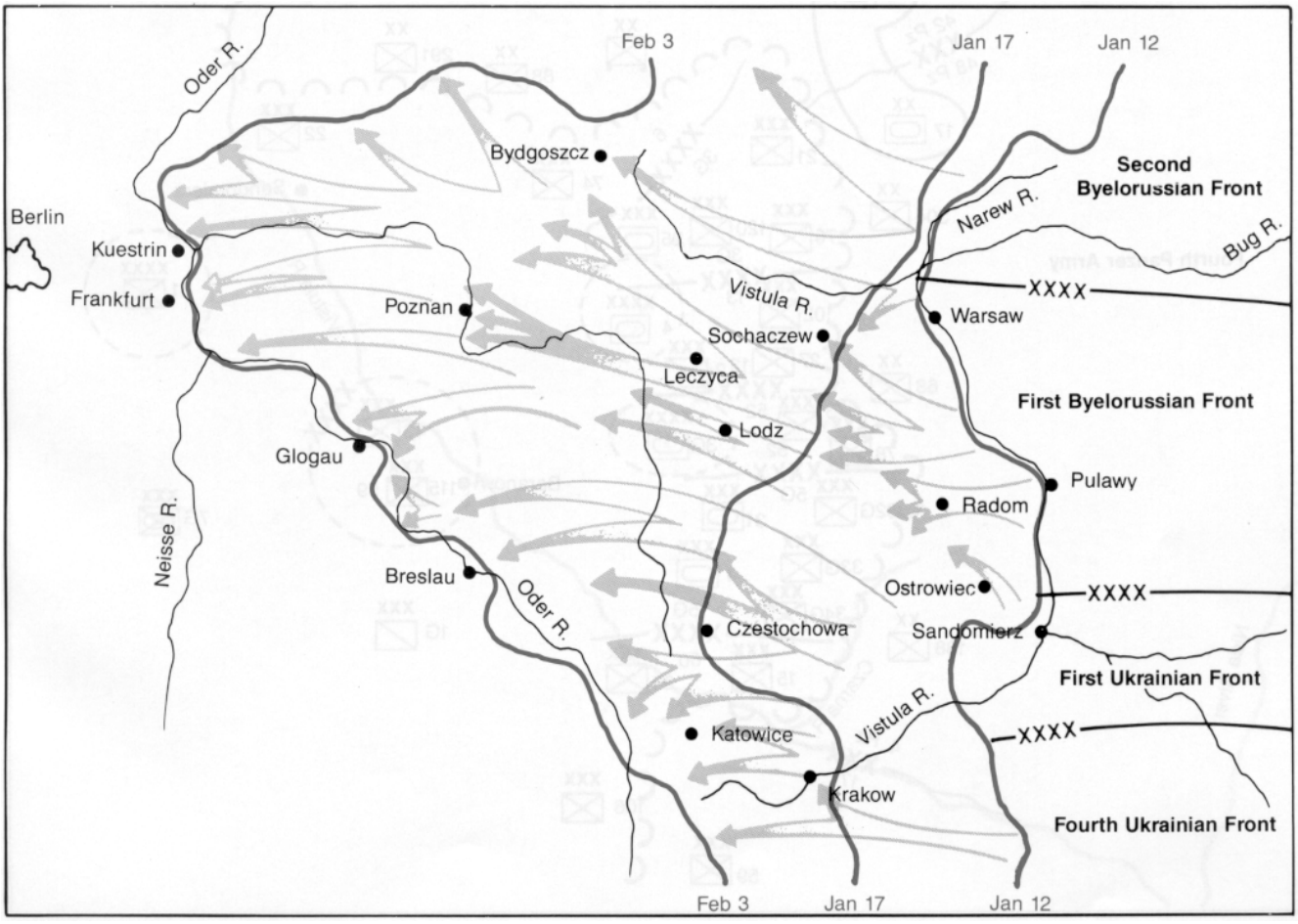


Figure 1: The Vistula-Oder Offensive, 12 January to 3 February 1945. The Soviets' two-phase offensive was very successful. They drove through the Germans to the Oder River ahead of schedule but had to stop short of their final objective, Berlin. The massive barrages of Marshal Koniev's artillery at the Sandomierz Bridgehead contributed significantly to the Soviets' success.

Oder, they were to defend until the main force could re-establish contact with them. The Soviets' operational maneuver group (OMG) concept of today is a direct descendant of the mobile group.

German Deployment

Deployed opposite Koniev's 10 armies was the German Fourth Panzer Army, consisting of three Panzer Corps and a part of the 24th Panzer Corps as a reserve. The 48th Panzer Corps, an infantry unit in all but name, had deployed three divisions across the face of the Sandomierz Bridgehead. The 42d Panzer Corps, also infantry heavy, defended the northern portion of the Bridgehead with elements of three divisions forward. The front line was nothing more than a series of strongpoints since the Germans could only muster one man for each 15 yards of front.

The 4th Panzer Army reserve, part of the 24th Panzer Corps, was split in half with two divisions (the 16th and 17th) forward as a mobile reserve, and the other divisions (19th and 25th Panzer Divisions) constituted the Army Group A reserve. Hitler, from his headquarters hundreds of miles away, dictated the shallow deployment of the Sandomierz forward reserve, placing it only 12 to 15 miles back. This left it vulnerable to enemy artillery strikes once the battle started and deprived it of critical reaction time. Troop dispositions of this type led the Chief of the German General Staff Heinz Guderian to warn Hitler that the "Eastern Front is like a house of cards" (Guderian, *Panzer Leader*, E. P. Dutton and Company, New York, 1952).

Koniev's Artillery Offensive

Koniev divided his artillery into two groups: those providing close support to the maneuver forces and those engaged in long-range fires. He employed the first group against the enemy forward defenses while the second was involved in counterfire with supplementary missions of disrupting command posts and delivering fires on the flanks of the attacking forces.

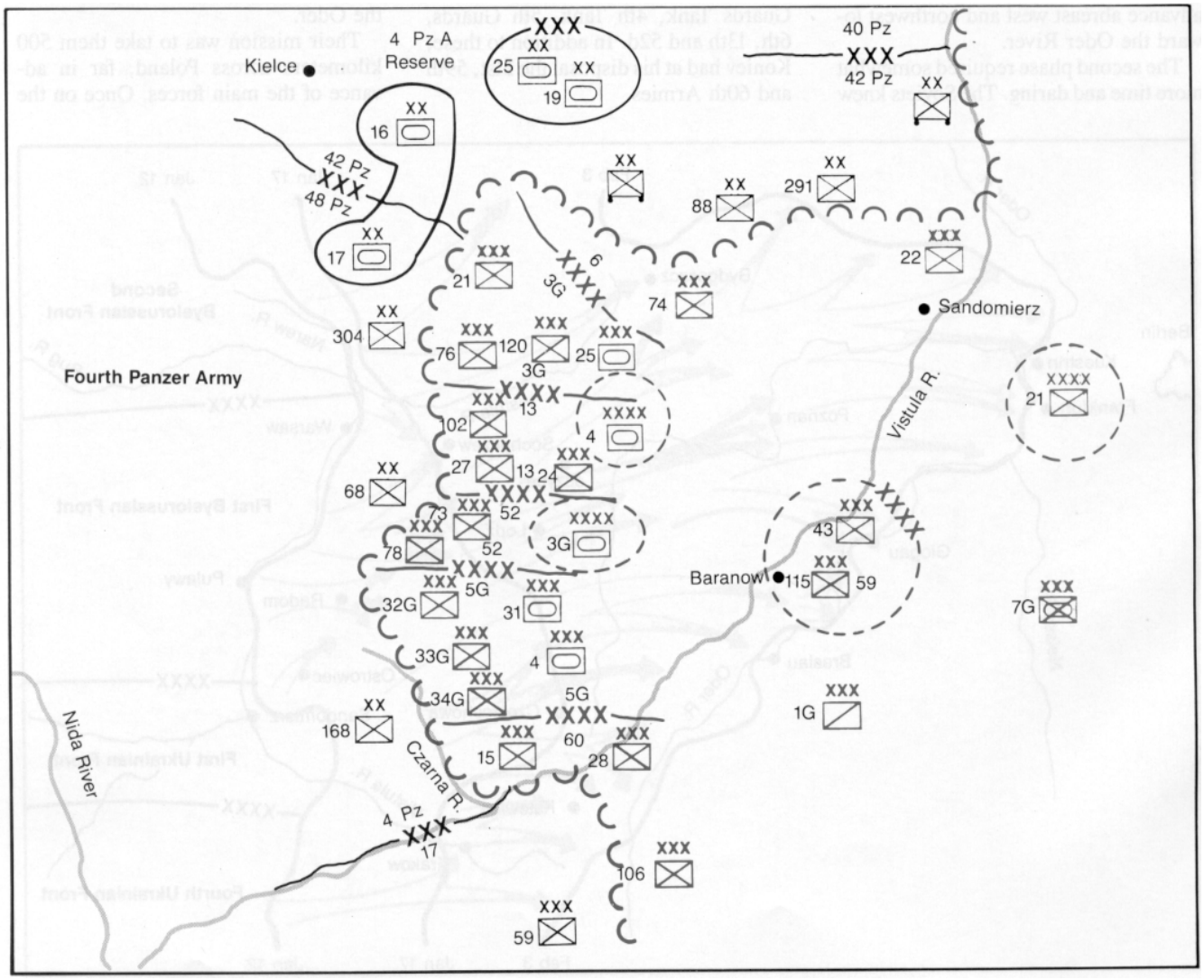


Figure 2: Sandomierz Bridgehead. Soviet Marshal Koniev of the First Ukrainian Front massed fires against the German Army Group A in two artillery preps with devastating effects, starting on 12 January 1945. After the opening artillery barrage the first day, Koniev's forces broke through the Fourth Army's defenses to a depth of about 15 miles across a 25-mile front.

Positioning. Field Artillery commanders positioned their guns immediately behind the maneuver units to enhance their ability to strike deep targets. They assigned targets out to a depth of 1,000 meters to the mortars. The artillery in support of close operations, usually 122-mm and some 152-mm howitzers, was limited to targets no deeper than 2.5 kilometers. The long-range artillery, 130-mm guns, 203-mm howitzers and the Katyusha multiple rocket launcher (MRL) systems, was farther back but still capable of striking deep targets. The Soviet Air Force served as "flying artillery," hitting targets beyond artillery range.

The artillery commanders set up their command posts with or adjacent to those of the supported maneuver units to ensure better command, control and coordination. Soviet targeting and reconnaissance elements conducted an extensive reconnaissance, identifying more than 2,700 targets before the start of the artillery preparation.

These Soviet 122-mm howitzers are firing during World War II.

First Prep. The standard Soviet offensive began with a reconnaissance-in-force conducted a day before the offensive. An all-out attack was then launched after a single powerful artillery preparation.

But Koniev realized the Germans had seen this approach many times before. The reconnaissance-in-force merely provided them ample warning so they could pull back before the prep and then re-occupy their defenses after it was over. To prevent this, Koniev did not conduct a reconnaissance-in-force and divided the prep into two phases.

The early morning of 12 January 1945 was cold, foggy and overcast. Ice was forming on the roads, and after a short while, snow began to fall in great amounts. The silence of the early morning was broken at about 0130 hours by the earth-shattering reports that marked the opening barrage of the Vistula-Oder Campaign.

Koniev massed some 420 guns per mile of front, concentrating them on the northern 20 miles of the 48th Panzer Corps sector. The initial barrage was short but powerful, raining hundreds of thousands of rounds on the forward German positions.

Massing Effects. The effects were devastating. The fires pulverized men, equipment and fighting positions. At about 0500 hours, the artillery shifted the fires to a strip pattern, and Soviet forces began their advance with forward battalion-sized detachments of infantry with some armor support. These forces easily took the forward positions and saw the effects of their own massed artillery offensive.

According to S. Borzenko, a battle-front *Pravda* correspondent:

The infantrymen soon reached the enemy's forward positions and broke into the first line of trenches. Here they saw the results of the artillery preparation. Disfigured bodies of Germans, shreds of clothing [and] splinters of smashed logs lay everywhere. Those German soldiers who remained after the artillery barrage offered very little resistance. They were stunned by the hurricane of fire which had swept over their positions. Blood streamed from their noses and ears ("Launching the New Offensive," "Information Bulletin," Embassy of the USSR, Volume V, Number 8; Washington, D.C., 1945).

Second Prep. Once in their initial positions, the forward detachments went to ground in anticipation of German artillery fire. The Soviets then conducted a second longer and more powerful prep. It lasted for an hour and 47 minutes and was, according to Marshal Koniev, "So powerful, judging from a number of captured documents, that it seemed to the enemy to have lasted for at least five hours" (Koniev, *Sorok Piatyi*, Moscow, 1966).

German forces in the second and third lines of defense came under fire and were severely mauled. German Captain Reinhardt Mueller, whose battalion occupied positions in the 3d defensive line, said the Soviet barrage decimated many of the defending units: "I began the operation with an understrength battalion. After the smoke of the Soviet prep cleared, all I had left was a severely depleted company. Many of the survivors were dazed, disoriented and bleeding. I had [only] a platoon of combat effective soldiers left." (Captain Sims interviewed the late Mueller in West Germany in 1984. Mueller was a battalion commander in the 68th Infantry Division at the Sandomierz Bridgehead in January 1945.)

The Fourth Panzer Army forward reserve became demoralized and was temporarily combat ineffective. The Fourth Panzer Army command post suffered heavy damage from Koniev's long-range artillery strikes, reducing German command and control effectiveness. Huge gaps were torn throughout the German defenses. The Germans, caught forward without a chance to withdraw their defending forces out of artillery range, were decimated.

Main Assault

At 1030 hours, the main assault began. It consisted of two waves of tanks

followed by three waves of infantry and was supported by self-propelled artillery pieces in the direct-fire role. Koniev's forces carved through the blasted remnants of the 48th Panzer Corps. They moved so rapidly they cut up the 16th and 17th Panzer Divisions while these units were reorganizing in their assembly areas. By the end of the day, only the 42d Panzer Corps, deployed on the northern face of the Bridgehead, could offer any organized resistance.

Koniev's forces had broken through the Fourth Panzer Army defenses to a depth of about 15 miles across a 25-mile front. The elements of the Front's mobile groups moved even further behind German lines—some 20 to 25 miles from the starting point.

In a single day's combat, the Fourth Panzer Army suffered a strategic defeat. Much of this initial Soviet success was due to the massive effects of their opening artillery barrages.

Race for the Oder. The Soviet advance continued at a phenomenal pace during the next several days. So quickly did the 3d Guards Tank Army advance that it overran the 42d Panzer Corps headquarters, capturing the Corps commander and killing the staff. Kielce fell on the 15th of January, and the mobile groups reached the open countryside.

Virtually unopposed, the Soviets raced toward the Oder River. On the 17th of January, the Russian main forces completed the breakout phase of the operation nine days early, and it was, time for the pursuit and exploration phase.

Koniev's forces organized into march columns and forward detachments, pushing up the roads following in the tracks of the 3d Guards and 4th Tank Armies. The artillery took on the accompanying role, incorporating itself into the advancing columns. This accompanying artillery was particularly useful in helping the forward detachments seize river-crossing sites along the axis of advance and in providing direct fire against enemy tanks.

Battle's End. The Germans were no longer able to mount an organized defense along the entire front. Koniev's mobile groups arrived at the Oder River 11 days after the start of the offensive. Once there, the 3d Guards Tank Army moved southeast to seize Silesia, the last remaining German industrial area. It completed this operation in less than two weeks.

The main forces closed on the Oder River on 30 January. At the Oder, a combination of a surprisingly tenacious defense by ad hoc Panzer and infantry battle groups and Volksturm units composed of old men and boys, supply problems and worsening weather brought the Soviets to a halt short of their objective, Berlin. But they were successful in seizing the Frankfurt and Kuestrin Bridgeheads across the Oder. Koniev launched his final assault against Berlin on 16 April from these same bridgeheads, which contributed to the Soviets' taking Berlin on 7 May.

Artillery Analysis

The Vistula-Oder Campaign was the largest single Soviet offensive of World War II. During the January 1945 offensive, Soviet forces advanced an average of 15 to 20 miles a day. The density of artillery at the breakout points was the highest ever achieved by any army in World War II. Both Koniev and Zhukov stress the importance of the artillery to the success of their operations.

Massing Fires

The massed fires of Koniev's six artillery divisions at the beginning of the Vistula-Oder Campaign were key to the rapid breakout from the Sandomierz Bridgehead. Although the First Ukrainian Front enjoyed a tremendous advantage in arms and equipment, it was the artillery preparations of the first day that enabled Koniev's troops to penetrate the prepared German defenses that had repulsed Soviet forces the summer before.

The massive fires cleared the way for the mobile groups to slide into the enemy rear area and push on toward key objectives virtually unopposed. The artillery prep also made the main force's mission much easier to achieve. By all accounts, the first prep devastated the enemy's forward positions to such an extent that the forward detachments seized them almost unopposed.

The second prep and counterfire operation so crippled the German second and third lines of defense, artillery, command and control and reserves that the Fourth Panzer Army was never able to mount a coordinated and credible defense. It suffered a defeat of strategic magnitude within the first 24 hours of the battle.

Accompanying Artillery

Once the First Ukrainian Front began pursuit operations, the artillery continued to support the attack. Accompanying both forward detachments and main forces, self-propelled artillery often was vital in forcing river crossings and for direct-fire operations against armor forces. Soviet artillery doctrine still calls for using artillery in this manner.

Conclusion

Today, the Soviets still believe in massing fires. But with modern, automated technology, this is accomplished without massing an awe-inspiring hub-to-hub concentration of guns. Thus, it's possible for the Soviets to achieve the same effects as in January 1945 without offering themselves as a lucrative nuclear target.

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Target Acquisition Challenges to Enhance Massing Fires

by Master Sergeant (Retired) Jerry D. Shelley
and Major Kenneth P. Ziebarth, RAA

Target acquisition (TA) must be accurate, timely, synchronized, sustained, survivable and employed in the best way to ensure it supports the total fire support mission. We must be able to perform in any contingency environment on a global scale.

The importance of TA, including survey and meteorology (Met) technical support, can't be overemphasized. It's the glue that holds the total fire support system together. To transfer target data and mass surprise, unobserved fires effectively, the shooters and locators must be surveyed on an accurate common grid, Met data must be timely and accurate and systems must be employed where needed on the battlefield. Fire-finder radar employment must be maximized to support counterfire, which includes massing fires. The challenges we face are many, and the time to meet those challenges is now.

Firefinder Capabilities and Limitations

The effective employment of Field Artillery (FA) radars depends on commanders and FA controlling headquarters' understanding the radars' capabilities and limitations, and they are often misunderstood.

Weapons Locating Radars (WLR), AN/TPQ-36 and AN/TPQ-37

The missions of FA radars are well-known and documented. These Fire-finder WLRs easily can support the commander's intent and operational concept if you understand what they can and can't do for you.

Generally, WLRs find the enemy better if the enemy's projectile is closer, bigger and fired at a high angle. However, accurate detection and location of enemy weapons depends on several factors. (See Figure 1.)

Q37 Firefinder Radar

Q36 Firefinder Radar

Firefinder Capabilities and Limitations	
Electronic Warfare (EW) Threat	It dictates how long WLRs can remain in position, affecting cueing time and the number of targets detected.
Number of Weapons	A large number of enemy guns firing could fill the WLR temporary display queue, and the WLR won't detect enemy guns firing from new locations unless the operator quickly reduces the backlog in the queue.
Weapons Types and Projectile Sizes	The larger the projectile, the higher the probability of detection; also high-angle trajectories increase the detection and location probabilities.
Range-to-Enemy	The closer the target, the higher the probability of detection and location.
Radar Screening Crest	The lower the crest, the higher the probability of detecting enemy targets.
Radar Position	The position must facilitate moves to maximize operations for the battle's next phase. Critical questions: • Do the Q36 and Q37 complement each other? • Do they cover the maximum range to detect the majority of enemy weapons? • Do the positions provide for future movements?
WLR Max Ranges	Q36: 24 km. Q37: 50 km.
WLR Planning Ranges (Provide the highest target detection probability.)	Q36: mortars and artillery—12 km (further than 12 km, more easily detect mortars than low-angle artillery); rockets—24 km. Q37: mortars and artillery—30 km; rockets—50 km.

Figure 1: Firefinder radars (Q36 and Q37) can detect and locate enemy targets considering these factors.

Counterfire Role

To optimize the counterfire effort, the appropriate command level—brigade, division or corps fire support elements (FSEs)—must plan employment of TA assets to best support the maneuver commander's mission and priorities. The FA headquarters that controls the TA assets then must employ them as planned.

Massing fires effectively requires many considerations and executions within the *decide*, *detect* and *deliver* methodology. The employment of TA assets is most critical to the *decide* and *detect* steps in support of the *deliver* function. (See Figure 2 for key soldiers in FA TA operations and Figure 3 for a sample radar deployment order, or RDO, the primary document for executing TA operations.)

Command and Control Relationships

The division artillery (Div Arty) S2 recommends a combat organization for TA assets to best meet the division and corps commanders' intent. Command and control of radars can be centralized at the Div Arty or FA brigade headquarters, decentralized by attaching radar sections to a subordinate FA unit or a combination of the two, based on the situation.

Centralized Control

All TA assets may be centrally controlled by the Div Arty or its reinforcing FA brigade. Centralized control of assets optimizes coverage to support the division commander's intent. The S2, in concert with the counterfire officer and the FSE, designates each radar's general position area, sector of search and firefinder zones; establishes cueing agents; controls the movement of the radars and designates to whom the radar passes targets.

If an FA brigade has the division's counterfire mission, it must have the Div Arty's target production section plus enough TA assets to perform that mission. Regardless of which headquarters is in control, subordinate battalions must provide logistical, survey and security support because of the radars' dispersion across the division zone.

Decentralized Control

Radar sections may be attached to direct-support battalions or reinforcing FA battalions, when available. When the radar sections are attached, the FA battalion S2 controls them, executing the same responsibilities as the Div Arty S2 and counterfire officer. The brigade FSO coordinates mission requirements and priorities with the S2, based on the maneuver commander's guidance and intent. Radars also may be attached to maximize their effective range and facilitate their control, especially for movement in a fluid battle.

Radar Employment

The controlling headquarters must consider several factors when employing radars to support the overall counterfire mission. Doctrine states the Q36 radar usually is positioned three to six kilometers behind the forward line of own troops (FLOT) and the Q37, eight to 12 kilometers behind the FLOT. But the doctrine just gives general guidelines. Several factors dictate the actual positioning of the radars.

Sectors of Search

These areas on the battlefield are where the WLRs focus their TA capabilities. The sectors of search are determined during the *decide* step of the targeting process, based on an intelligence preparation of the battlefield. It's during this step that decisions are made about which targets should be acquired and attacked, where and when targets are likely to be found and who can locate them.

Doctrinal employment considerations, in conjunction with the templates and intelligence produced in the IPB process, dictate the areas in which radars should focus their searches. The location of friendly boundaries and fire support coordination measures also may affect the assignment of sectors of search.

Firefinder Zone Management

Assigning zones is a method of prioritizing a radar's sectors of search, which are the maneuver commander's battlefield priorities. Zones are geometric figures around an area that designate it as more or less important than other areas. Each Firefinder can have up to nine of four types of zones.

These zones usually will be time-sensitive. Therefore, their activation must be noted on the operational factors matrix of the decision support matrix, or DST (part of the intelligence preparation of the battlefield, or IPB).

Fire Support Coordinator (FSCOORD)	Ensures FA TA assets are in the maneuver collection plan; develops target selection standards and TA priorities; advises commander on employment of FA radars.
Div Arty S3	Maintains status of Div Arty TA assets; incorporates the TA tab, including radar deployment orders (RDOs), into the FA support plan; and coordinates the operations of the tab.
Div Arty S2	Primarily responsible for planning and coordinating the operations of the division's FA TA assets using an IPB and considering mission, enemy, terrain, troops and time available (METT-T), aided by the counterfire officer; coordinates with the G2 and division FSE to ensure FA TA operations support the commander's intent and corps operations. Factors to consider: command and control relationships, sectors of search, zone management, cueing, communications and survivability.
Counterfire Officer	Principal adviser to the S2; recommends FA TA asset employment and coverage and directs their operations for the division; and prepares the RDOs for the Div Arty or an FA brigade's TA assets.
FSO	Coordinates the position of TA assets with the G3 and S3, using his knowledge of FA TA capabilities, optimum radar positioning and radar survivability; and recommends Firefinder zones to the commander, focusing the radar and supporting artillery on the commander's priorities.

Figure 2: These key fire supporters plan and employ FA TA assets to support the commander's intent and his concept of operations.

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RADAR DEPLOYMENT ORDER
For use of this form, see FM 6-121. The proponent agency is TRADOC.

SECTION 2/F/25	-25A | -58B (36) -37	MISSION ATTACHED 1-30 FA	
LOCATION	Primary NB 230200	Alternate	

SEARCH SECTOR

	Left Edge	Right Edge	Minimum Range	Maximum Range
Primary Azimuth 1100	−800 mils	+800 mils	750 meters	24,000 meters
Alternate Azimuth	mils	mils	meters	meters

EW THREAT ASSESSMENT

EW Threat (Yes or No)	Affecting Friendly Assets (Yes or No)	Type of Threat (Air or Ground)

NOTE: Use the Firefinder survivability flowchart in FM 6-121 to determine emission limits.

CUEING AGENTS (CALL SIGN AND DESIGNATION) IN PRIORITY

A4Q02	S2, 1-30 FA	BZN44	FIST A/1-44 AR	C2022	FSO, 1 BDE
NZN08	AFSO, SEC 1	NZN09	AFSO, SEC 2	D6C01	9TH DIV ARTY TOC

REPORTING CHANNELS

FD1 (1-30 FA)	A4Q01	1-30 FA CMD NET	A4Q06

ZONE DATA

Type and Number	Description and /or Command Priority	Grid Coordinates of Zone Corner Points					
CFFZ-1	RAG PRI 1	NB 290245	NB 300250	NB 320250	NB 330245	NB 320240	NB 300240
CFFZ-2	DAG PRI 2	NB 370270	NB 430250	NB 390220			
CFFZ-3	SUSP ARTY PRI 2	NB 300220	NB 320220	NB 320190	NB 300190		
CFZ-1	2/F/25	NB 228202	NB 232202	NB 232198	NB 228198		
CFZ-2	1-30 FA TOC	NB 205233	NB 210235	NB 220235	NB 225233	NB 220230	NB 210230
CFZ-3	3-30 FA TOC	NB 240350	NB 250360	NB 260350	NB 250345		
CFZ-4	1 BDE TOC	NB 160215	NB 170220	NB 180220	NB 180210	NB 175205	NB 170205
CFZ-5	1/F/25	NB 268182	NB 272182	NB 272178	NB 268178		
ATIZ-1	SUSP ARTY	NB 400190	NB 430210	NB 450210	NB 450170	NB 430170	

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Figure 3: The radar deployment order (RDO) is the primary document used to execute radar operations. (Sample taken from *FM 6-121 Tactics, Techniques and Procedures for Field Artillery Target Acquisition*, due to be fielded in the first quarter of FY 91.)

1. Critical Friendly Zones (CFZs). These areas designate friendly units or locations that are critical and whose loss would seriously jeopardize the mission. When the computer predicts that enemy rounds will impact in a CFZ, the location of the hostile weapon is sent as an immediate call for fire to the tactical fire direction system (TACFIRE)—(FM;RFAF) (Priority One).

A CFZ provides for the most responsive transmission of targets to the fire support system. Minefield breaching operations, river crossings, assembly areas and headquarters are examples of areas designated as CFZs.

2. Call-For-Fire Zones (CFFZs). These are search areas forward of the FLOT that the maneuver commander wants suppressed, neutralized or destroyed. An area designated as a CFFZ is likely to be a suspected regimental artillery group (RAG) or division artillery group (DAG) position and is closely tied to information developed during the IPB. CFFZs provide the second most responsive priority of requests for fire—TACFIRE's (FM;RFAF) (Priority Two).

3. Artillery Target Intelligence Zones (ATIZs). Areas in enemy territory that the maneuver commander wants to monitor closely are ATIZs. This type zone is similar to CFFZs, except targets are sent to TACFIRE as target reports (ATI;CDR;).

4. Censor Zones (CZs). These are any areas in which the commander wants to ignore all target detections. CZs must be used very judiciously because when the computer detects a round originating from a CZ, it isn't reported to the operator.

A CZ protects friendly artillery positioned on the battlefield when its angle of fire to the radar could make the radar mistakenly detect it as enemy artillery. This situation could occur when an uneven FLOT exists, friendly units are in enemy territory or artillery fires in support of rear operations. (See Figure 4.) CZs should not be used for any other purpose when CFZs are in effect.

Common Sensor Boundary (CSB). Target duplication between Firefinders is likely; therefore, different headquarters might attack the same target. A tool that's effective in reducing this duplication of attack and maximizing the radar's effective ranges is to establish a common sensor boundary (CSB) for CFFZs.

The CSB is a line usually established by the Div Arty S2. No CFFZs are established forward of the CSB for the Q36 radars (thus maximizing their range) and none to the rear of the CSB for the Q37s. This allows CFFZ targets to be processed and attacked without duplication, helping to mass fires. (See Figure 5.)

The CSB isn't dependent upon fire support coordination measures. If a radar moves, the CSB may have to be adjusted. The placement of the CSB is determined by the range of the FA attack systems, availability of attack assets, effective range of TA assets, likely enemy indirect-fire weapon deployment areas and availability of ammunition.

Cueing

Cueing tells the radar to begin radiating to acquire hostile fire. Determining when and how to cue the radar is one of the most difficult planning factors. Random cueing schedules are often ineffective and unnecessarily subject the radars to threat electronic warfare (EW)—jammers and direction finders.

The radar should be cued by designated cueing agents (i.e., forward observer, aerial fire support observer,

combat observation lasing team, fire support officer, etc.) who operate under specific guidance. The cueing guidance must exploit the radar's potential while minimizing or eliminating unnecessary radiation. Cueing must be based on real-time information so the radar has a high probability of tracking projectiles when it's turned on.

Communication links used to cue radars should be defined in the cueing guidance. Voice radio nets, usually monitored by the radar, are the most responsive means. This link is often an FA unit's command net.

Radar Survivability

Radars are active emitters. The enemy may detect, jam or seek to destroy the radar. Because of Firefinder's capabilities, it will be a high-priority target for enemy EW.

Firefinder survivability depends on the controlling headquarter's decisions about optimum positioning, survivability moves and cueing, based on the enemy threat—his maneuver forces and EW. (See Figure 6 for the Firefinder Survivability Decision Matrix.)

Survey Operations

A common grid is critical to the ability to mass artillery fires. It must be established among all elements of the fire support system (weapons and TA assets). Knowing how to achieve a common grid is the key to success.

The fire support coordinator (FSCOORD) must analyze the maneuver commander's scheme of maneuver, rates of movement, anticipated enemy threat and critical phases of the battle to visualize the survey requirements for the fire support assets and other assets requiring survey (e.g., military intelligence). The S3 takes the FSCOORD's analysis and supervises survey operations, to include giving clear orders to the reconnaissance survey officer (RSO).

The orders should be issued directly to the RSO and included in the FA support plan. They should include survey priorities; accuracy requirements; primary, alternate and supplementary positions; and future plans. The RSO must give the S3 feedback constantly about his ability to provide survey as requested and, when necessary, the need to modify the original survey guidance.

Survey planning and coordination elements (SPCEs), formerly known as survey information centers (SICs), are

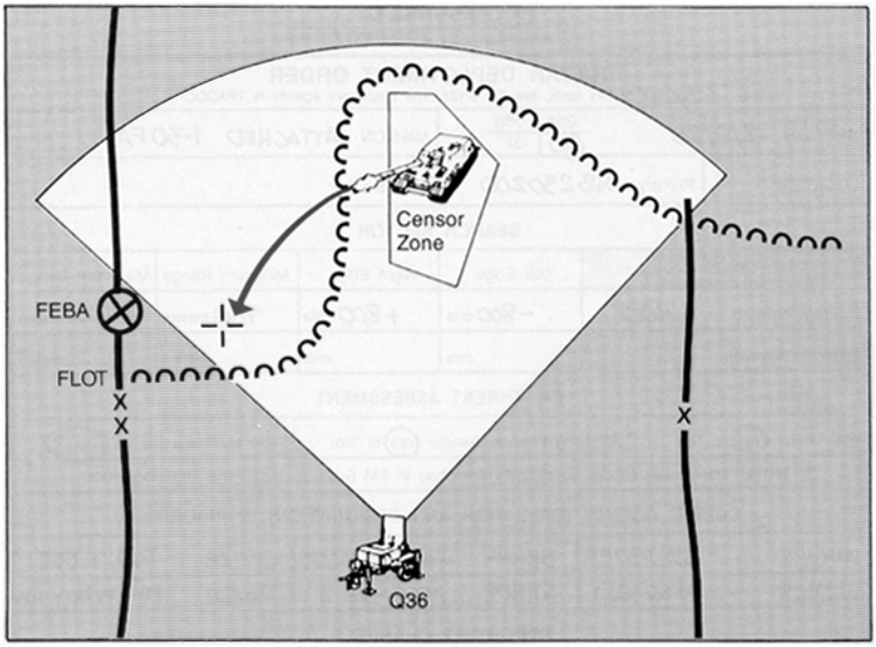


Figure 4: An Uneven FLOT with a Firefinder Censor Zone (CZ). CZs protect friendly artillery in locations near the forward edge of the battle area (FEBA) that could cause the radar to detect it as enemy artillery.

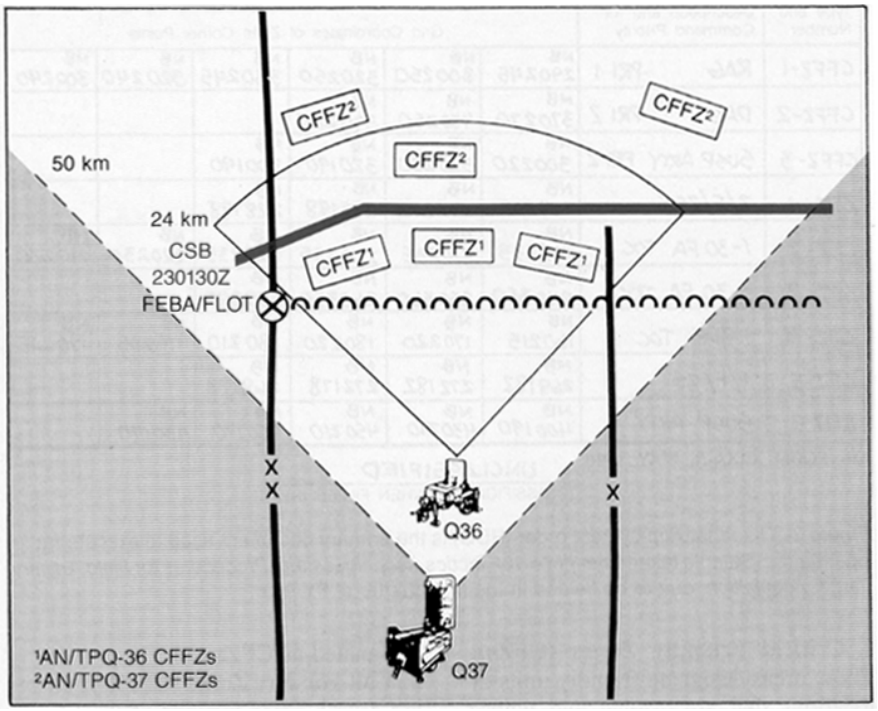


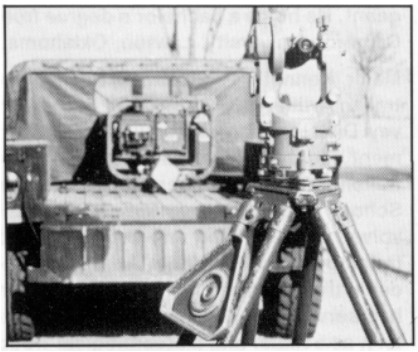
Figure 5: The common sensor boundary (CSB) is a radar line established to reduce the duplication of targets and to maximize the radars' range effectiveness.

the principal planning and controlling elements for survey operations. Planning elements are in the command posts (CPs) of the corps artillery, Div Arty, FA brigade and multiple launch rocket system (MLRS), Lance and cannon battalions. The TA batteries survey platoon headquarters plan survey. Top-down planning will maximize the effectiveness of the survey assets and avoid duplication of efforts.

The SPCEs use the corps, division and brigade artillery survey nets to implement the survey plan. Integration of the position and azimuth determining system (PADS) and conventional survey provide the flexibility to perform the survey missions.

<table>
<tr><th>Radar</th><th>Screening Crest</th><th>Tunneling</th><th>EW Threat (Airborne Threat Not Covered)</th><th>Radar Position Has Screening Crest and Tunneling</th><th>Radar Position Has Screening Crest Only</th><th>Radar Position Has Neither Screening Crest Nor Tunneling</th></tr>
<tr><td rowspan="2">AN/TPQ-36</td><td rowspan="2">• Within 1,000 Meters of Radar Position
• In Friendly Territory
• From 15 to 30 mils
Enemy can't achieve electronic line of sight with his direction-finding systems.</td><td rowspan="4">Use of Foliage, Berm or Buildings to Reduce Side-Lobe Radiation</td><td>Ground EW Threat
Review with S2 current EW threat to Firefinder.</td><td>Accumulate 15 or more minutes of radiation.
-but-</td><td>Accumulate 8 or more minutes of radiation.
-but-</td><td>Radiate 8 minutes minus march-order time or 2 minutes, whichever is greater; make survivability move.
-but-</td></tr>
<tr><td>None</td><td colspan="3">• No EW Time Limit
• Radiate as Mission Requires
• Monitor EW Situation</td></tr>
<tr><td rowspan="2">AN/TPQ-37</td><td rowspan="2">• Within 1,000 Meters of Radar Position
• In Friendly Territory
• From 5 to 15 mils
Enemy can't achieve electronic line of sight with his direction-finding systems.</td><td>Ground EW Threat Review with S2 current EW threat to Firefinder.</td><td>Accumulate 15 or more minutes of radiation.
-but-</td><td>Accumulate 8 or more minutes of radiation.
-but-</td><td>Radiate 8 minutes minus march-order time or 2 minutes, whichever is greater; make survivability move.
-but-</td></tr>
<tr><td colspan="4">DO NOT EXCEED 2 MINUTES OF CONTINUOUS RADIATION</td></tr>
</table>

Figure 6: Firefinder Radar Survivability Decision Matrix (FM 6-121)

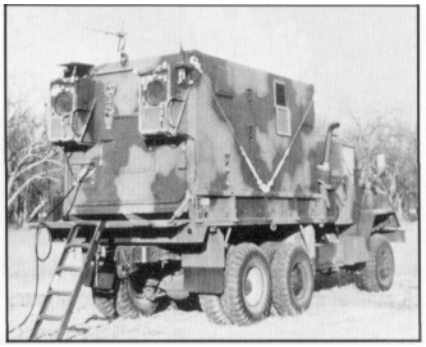


AN/USQ-70 PADS

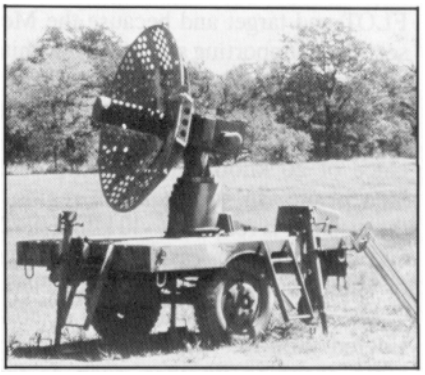
Meteorological Operations

To mass FA fires on targets, correction for the effects of atmospheric conditions the artillery projectiles will encounter must be included in the computation of the firing data. The meteorological element of the gunnery problem is corrected by using three meteorological parameters to correct such atmospheric effects: wind, air density and temperature. The meteorological data system (MDS) is the primary one used to measure these parameters.

- **Wind.** Wind can affect the artillery projectile's range and (or) deflection. A tail wind increases the projectile's range and a head wind decreases it; a crosswind causes an error in deflection.
- **Temperature.** Temperature affects the artillery projectile in range only. Higher temperatures increase the projectile's range, and lower ones decrease its range.
- **Air Density.** Density affects the artillery projectile's range. The denser the air, the shorter the range of the projectile. Of the meteorological elements, air density has the greatest effect on the range of the projectile.



AN/TMQ-31 MDS



MDS Radio Direction Finder

If only standard Met data are used instead of the data from the Met section, the combined effects on the target can equate to as much or more than 477 meters. (See Figure 7.) This magnitude of error will not enable FA units to effectively mass fires.

155-mm Howitzer
Charge 7, Range 11,000 Meters, Elevation 379 mils

Ballistic Tail Wind of 20 Knots	+218 Meters
Ballistic Temperature 105.0%*	+ 56 Meters
Ballistic Density 95.0%*	+203 Meters
Total Weather Effects	+ 477 Meters

*The percent is in relation to the standard computation; the standard considers no wind, the temperature as 15° C with a 6.5° C lapse rate per 1,000 meters and air density as 1,225 grams per cubic meter, decreasing with heights.

Figure 7: Total Weather Effect Using Standard Met. If only standard Met data is used instead of the data from the Met section, the weather effects can cause a round to miss its target by as much as 477 meters in this example.

Met Section

The S3 is responsible for employing FA Met sections, including their positioning and sounding schedules. The elimination of the Met warrant officer has created a void the S3 must fill.

Ideally, the atmosphere should be sounded by the FA Met section about

CPT John M. House

A soldier cues the radar in his Q36 shelter.

mid-way between the firing unit and the target. However, this isn't always possible due to the terrain, location of the FLOT and target and because the Met section is supporting several firing units at different positions on the battlefield.

On fairly level terrain, a Met message is considered valid to a maximum distance of 20 kilometers from the Met launch site. In mountainous regions, the distance is reduced to 10 kilometers, and along coastal areas and large bodies of water, the distance is 15 kilometers.

The Met message usually is considered valid for two hours. However, rapid changing weather, such as the passage of a weather front, will decrease the time validity, requiring a new message.

Daily diurnal temperature changes also affect the time validity of a Met message, as depicted by Figure 8. The S3 must allow for this, especially when planning operations during or around periods of transition (sunrise and sunset). For example, a Met message issued two hours before sunset won't be accurate at sunset.

Met and Massing Fires

The massing of fires on an enemy target using standard Met data instead of an up-to-date Met message could result in rounds landing short of the target, overshooting it or being deflected either left or right of the target, depending on the ballistic density. And depending on the location of the firing units on the battlefield, the ballistic wind could provide a tail wind for projectiles from one unit and a crosswind for projectiles from another. To mass artillery fires on an enemy target effectively, the Field Artillery must have a current Met message and make corrections for the three meteorological parameters—wind, temperature and air density.

Summary

The FA has fielded proven TA, survey and Met systems. The FA community must fully understand the capabilities of these systems and how they're integrated into the total fire support system.

But we also have to keep up with changing doctrine and various threat and environmental scenarios. Nothing is ever "locked in concrete." An example of this is our successful small war in Panama. We deviated from our traditional fire support doctrine by having the radars commanded and controlled at the highest task-force levels.

We've made several advances in technology in terms of survey and meteorology, but we're still pushing the limits to perform all survey and Met requirements. We need lighter systems and those that can see targets at longer ranges. We need target area Met capabilities and a passive target acquisition system.

Even though the Soviet threat appears to be decreasing, we in the Army must continue to build on lessons learned, doctrine and state-of-the-art technology to meet any challenge.

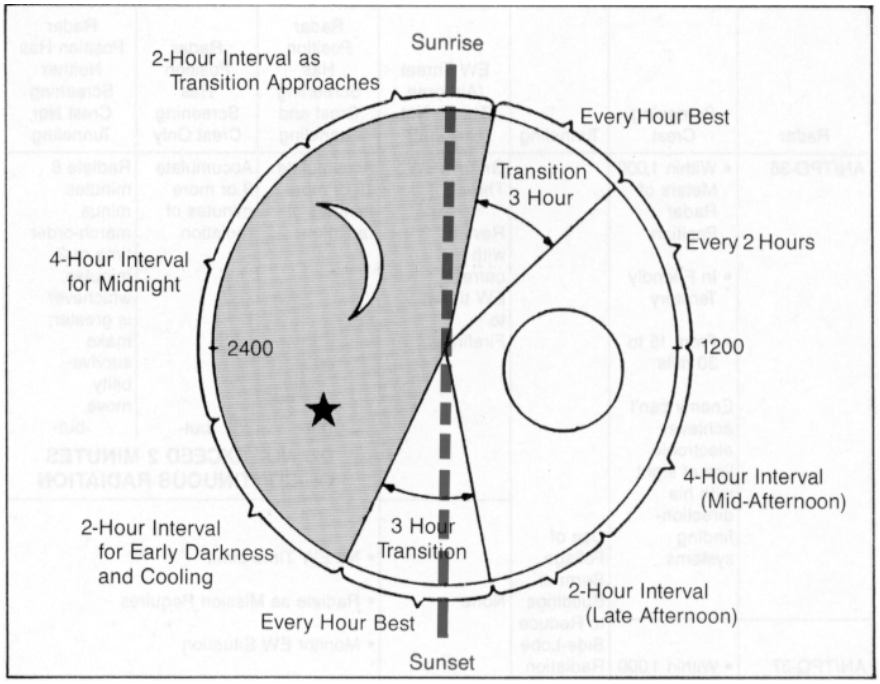


Figure 8: Diurnal temperature changes affect the validity of Met messages. This Figure shows the frequency with which artillery units must receive Met messages, based on diurnal temperature changes. The Figure assumes the weather patterns are stable; if the pattern should change (e.g., a front moves in), more frequent Met messages are required.

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Starting Off on the Right Foot

by The Honorable John Patterson

It's basic military policy that troops new to battle should not only be well-trained, but also, where feasible, be committed gradually. If possible, their initial commitment should be in such a way that they'll be successful in their first engagements with missions well within their capabilities. In other words, starting off on the right foot in combat increases the likelihood of the unit's reaching its ultimate potential quickly.

Field Marshall Sir Harold Alexander issued such instructions to his troop commanders shortly after taking command of the Allied Forces in North Africa after the Battle of Kasserine. The wisdom of this policy is aptly demonstrated by what happened to the 17th Field Artillery Regiment (17th FA) in its first engagements in Tunisia, North Africa.

The Wrong Foot

The 17th had spent the interim between the two world wars as the School Artillery Regiment at Fort Bragg, North Carolina. It consisted of the Regimental Headquarters and two battalions, each with three gun batteries. Each battery was equipped with four 155-mm 1918 Schneider howitzers.

The Regiment arrived in Oran, French Morocco, on 6 December 1942, well after the completion of the Allied invasion of North Africa, known as Operation Torch. For the next few weeks, it trained intensively in the desert terrain of Morocco.

During this period, the battle lines were being drawn in Tunisia, 700 miles to the east. The Germans had begun occupying Tunisia almost simultaneously with the Allied landings in Algeria and Morocco, and as Operation Torch ended, the Allies began rushing troops to Tunisia. By 1 February 1943, the line in Tunisia had become fairly well established and ran north and south generally along the mountain ranges commonly referred to as the Eastern and Western Dorsals.

The Allied troops consisted of three corps—the British V, the French XIX and the American II—under the command of the British First Army. The American II Corps occupied the southern end of the line with the Corps front extended over approximately 100 miles. The Corps and division units were not deployed as integral units but were split into small parcels, sometimes mixed and spread thinly over a wide area. Little effort had been made to prepare defensive positions even though German attacks were expected.

General Dwight D. Eisenhower visited the Corps sector on 13 February and expressed concern about the lack of preparation and the disposition of the troops. The Corps Headquarters was 60 miles behind the front in Tebessa and was largely out of touch with realities.

In the meantime, Field Marshall Erwin Rommel's African Panzer Army, withdrawing before the British Eighth Army, had crossed the Libyan-Tunisian border and, on 1 February, was in a defensive position in the old French fortifications at Mareth. The stage was set for the final chapter of the War in North Africa.

The Battle of Kasserine

On 1 February, the 2d Battalion of the 17th FA (2-17 FA) was ordered to move from Morocco to Tunisia and, by 12 February, was in position in the Faid Pass with the mission of supporting elements of the 1st Armored Division and the 168th Infantry Regiment of the 34th Infantry Division. Early on the morning of St. Valentine's Day, 14 February, the German 10th Panzer Division attacked the American forces in Faid Pass without warning. (See Figure 1.)

The German armor, which included massive 60-ton Tiger tanks, rolled through the Pass, driving everything before it. The enemy tank attack was well-coordinated with supporting artillery fire, strikes by Stuka dive-bombers and strafings by fighter aircraft.

Two American artillery battalions quickly were overrun and destroyed by the tanks. Two battalions of the 168th Infantry were left behind in the mountains. One of the artillery battalions overrun was the 2-17 FA—it was destroyed in its first engagement.

The Impact

The 2d Battalion lost 50 percent of its soldiers and officers, all of its guns and most of its equipment. The German attack on the Battalion was preceded by Stuka dive-bombings followed by an attack on its flanks by at least 60 German tanks. The 2d Battalion had been improperly deployed in the Faid Pass and simply abandoned.

Early in the Tunisian Campaign, the Corps Commander had deployed his artillery incorrectly with isolated units scattered here and there. This piecemeal employment made it impossible to take advantage of the technique of massing fires that the American artillery, including the 17th FA, had been trained to use. Massing the fires of the many guns would have given the Allies a tremendous striking power.

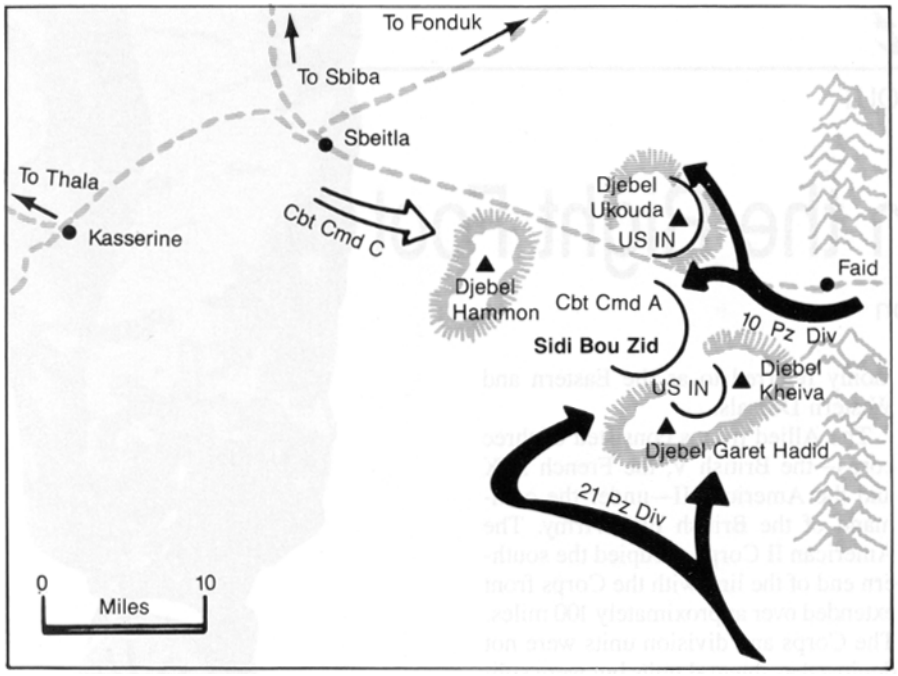

Figure 1: The Battle at Sidi Bou Zid, known as the Battle of Kasserine, 14 to 15 February 1943. The 2-17 FA near Faid Pass was overrun early the first day. In the Battle, the Germans advanced more than 50 miles to seize Kasserine and Thala.

When the 2d Battalion's batteries were overrun, many of the soldiers scattered into the hills and eventually worked their way back to friendly lines. Many were captured and spent the remainder of the War in prison camps in Germany and Poland.

The 2d Battalion ultimately was refitted and rejoined the Regiment; however, it was a long time before it recovered from its harrowing experience. It had, unfortunately through no fault of its own, stepped off on the wrong foot and paid dearly for it.

Changing Feet

The Battle of Kasserine went on for another week while II Corps retreated more than 50 miles to the Western Dorsal, giving up Kasserine Pass and suffering additional losses. British and American units finally stopped the German drive. The 9th Infantry Division Artillery played a leading role in breaking up the German offensive by massing the fires of the entire Division Artillery.

When it was over, the Americans had severe losses. More than 3,000 Americans were killed and wounded in the Battle, and nearly 4,000 became prisoners of the Germans. More than 200 tanks were lost—in the Faid Pass alone, Americans lost 44 tanks, 59 half-tracks and 26 artillery pieces.

After the Battle of Kasserine, the piecemeal deployment mistake wasn't made again. Thereafter, the artillery was used as it was supposed to be. Battalions were concentrated and deployed in substantial numbers to be able to mass the fires of all available guns on any target. And the effect was devastating.

While the Battle of Kasserine was at its height, the Regimental Headquarters and the 1-17th FA, which were still in Morocco, received their marching orders. They began their march from Morocco on 21 February and arrived in the Thala area of Southern Tunisia five days later.

They came upon the survivors of their 2d Battalion in the Thala area and learned for the first time what had happened to them. The survivors of the 2d Battalion filled the soldiers of the 1st Battalion with stories of the invincible German Tiger tanks and the terror of Stuka attacks.

The Plan

On 6 March, General Eisenhower ordered General George S. Patton, Jr., to assume command of II Corps. Patton immediately began to revitalize the Corps with due regard for the costly lessons learned during the Battle of Kasserine. Time was short, for the Corps had less than two weeks to get ready for action again. From then on, divisions were to live, train and fight as divisions. There would be no more withdrawals. Discipline would be strict.

The plan for the next phase of the fighting called for the Eighth Army to breach the Mareth Line on 17 March and seize the port city of Gabes. This was clearly to be the main show. The remainder of the Allied forces in Tunisia, which included II Corps, were to tie down the enemy forces in their sectors and, if possible, force the enemy to withdraw troops from the Mareth Line to protect their flanks and rear.

Field Marshall Alexander intentionally had given II Corps what he thought would be a limited role in this operation. It was in keeping with his idea that the Americans needed battle experience. They were to be committed in a limited way and in such a manner that there would be no repeat of Kasserine.

Accordingly, II Corps was given the mission of seizing the oasis of Gafsa and, if all went well, to demonstrate eastward along the Gafsa-Gabes Road. It also was ordered to move on Maknassy and instructed to avoid becoming heavily engaged. Patton resented this role and made his views known.

The Right Foot

On 17 March, simultaneously with the Eighth Army's attack at Mareth, Patton sent the 1st Armored Division toward Maknassy and the 1st Infantry Division toward Gafsa. The 1st Armored Division made good progress at first but ran into strong German resistance in the hills east of Maknassy and by 21 March, was halted.

The 1st Infantry Division with the Regimental Headquarters and the 1-17 FA attached, seized Gafsa on 17 March, which was lightly defended by Italian troops. The 1-17 FA, whose mission was to support and reinforce the fires of the 1st Division Artillery, fired its first combat mission at Gafsa, neutralizing an enemy artillery battery. The Division pushed ahead, seizing El Guettar on 21 March and occupying the ridges to the east after an early morning attack that netted 1,000 Italians and a few German prisoners.

As the Division continued its advance on 21 to 22 March, it came under frequent Stuka dive-bombing attacks. It was not uncommon to see from 25 to 30 Stukas overhead at one time. The 1-17 FA experienced its first Stuka attack and took casualties on 21 March as it

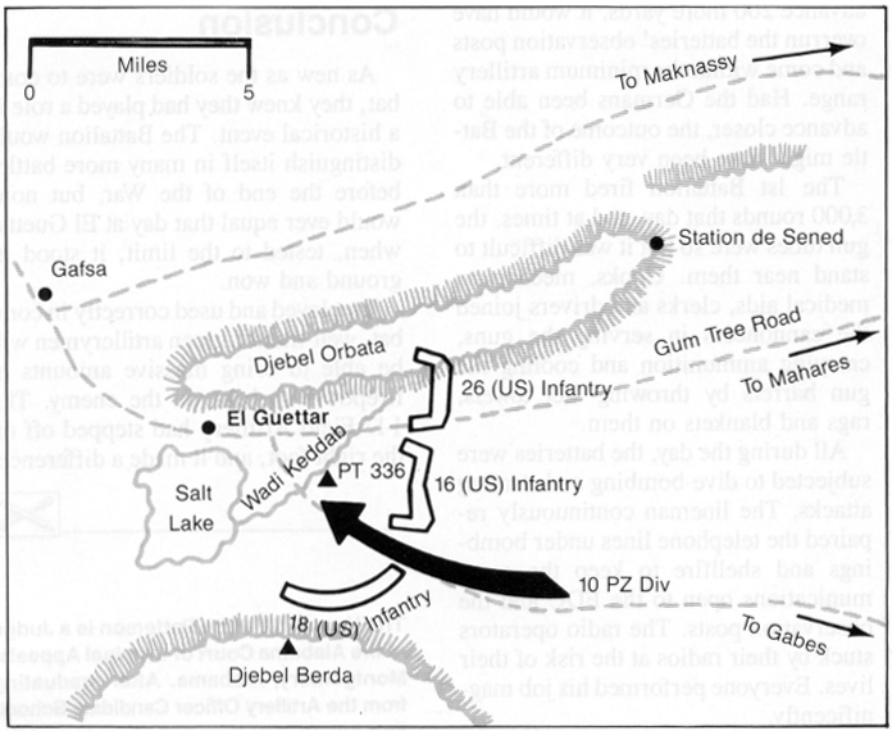

Figure 2: 10th Panzer Division's attack at El Guettar, 23 March 1943. The Germans seized Point 336 and almost reached the 1-17 FA behind the hills of the Wadi Keddab on the Gafsa-Gabes Road.

moved into position behind the ridges east of El Guettar.

The Battle of El Guettar

On the night of 22 March, the Division was deployed across the valley between two mountains, Djebel Orbata on the north and Djebel Berda on the south. To the east stretched the open plain to Gabes, and down the middle of the valley running east and west was the Gafsa-Gabes Road. (See Figure 2.)

The 26th Infantry was on the left with its left flank hinged on Djebel Orbata. The 16th Infantry was in the center occupying low ridges in the valley, and the 18th Infantry, reinforced by a battalion of rangers, was on the right with its right flank hinged on Djebel Berda and its left flank just south of the Gafsa-Gabes Road.

Word had been received that a German counterattack was imminent. It had been reported that the 10th Panzer Division was moving toward El Guettar. Forward observers began reporting tank noises approaching from the east. Indeed, the intelligence reports were accurate.

German Attack. The 10th Panzer Division launched its attack along the Gafsa-Gabes Road at 0300 on 23 March and by daylight, had passed between the 16th and 18th Infantries and was fanning out to the rear. The 5th and 32d FA Battalions of the 1st Infantry Division were overrun.

These developments were reminiscent of the early phases of Kasserine. An observer recounted the Gafsa-Gabes scene: "The huge hollow square of tanks and self-propelled guns interspersed with carrier-borne infantry carried all before it."

The advancing German armor was engaged by the remaining artillery, some infantry and the 601st Tank Destroyer Battalion. After losing more than 30 tanks in the wild melee that followed, the Germans withdrew to regroup.

Just before sundown, they came again. They were determined to break into the artillery positions. Their attack was preceded by heavy bombing and strafing of the American positions by Stukas, JU88 medium bombers and ME109 fighters. They concentrated particularly on the artillery and its fire direction centers. The air attack was immediately followed by an all-out frontal assault by German tanks and infantry.

The American artillery was ready, and the fire it brought down upon the advancing Germans was massive. Many of the advancing tanks were destroyed or disabled, and the accurate time fire of the 1-17 FA, adjusted by Major Joseph R. Couch, burst just over the heads of the waves of advancing German infantry and cut them down like wheat falling before a sickle.

The time fire tore great gaps in the lines of the oncoming Germans. They closed the gaps and kept coming, but their ranks were thinning. Finally they faltered, and those left began falling back.

Darby's Rangers. The 1st Ranger Battalion was attached to the 1st Infantry Division and was heavily involved in the fighting, performing splendidly. On 23 March, it was at Djebel Berda, protecting the 18th Infantry Regiment's right flank. The 1st Ranger Battalion was commanded by the swashbuckling Colonel William O. Darby and was the famous Darby's Rangers.

Colonel Darby had a ringside view of the action and described it as follows:

From the heights in our segment, the Rangers looked down on a developing attack of Germans in parade-ground formation. . . . Excitement rippled through the American forces. . . . Every Ranger could see the Germans far below them on the plain, forming for attack. Six battalions—two each of tanks, infantry and artillery—of the 10th Panzer Division. . . . The German general, thinking to awe the rather green American troops, gambled on a frontal attack.

The infantry leading was followed by some 60 tanks in what looked like an attack in the American Civil War. The Germans took no cover, seeming not to be aware of the almost certain deathtrap into which they were moving.

I was never so wildly excited as when watching this mass of men and vehicles inching toward us. The caterpillar-like force rolled irresistibly forward.

When the Germans were within 1,550 yards, the Yankee artillery boomed one salvo on top of another. The shells were concentrated dead on the enemy troops. Soon the eerie black smoke of the time shells showed that they were bursting above the heads of the Germans. Then a hole would appear in the oncoming carpet of the attack. There was no slowing up by the Germans, but their number was being hacked away by the artillery.

A few minutes later the remaining Germans charged the last hundred yards. There was no running, just a

relentless forward lurching of bodies. Sputtering gunfire kept up ceaselessly.

The Americans did not yield ground, and the attack was broken up. The Germans, still on their feet, retreated down the mountain while flecks of sand puffed up beside them.

End of the Battle. When night came, there was no respite. German Dornier bombers were overhead dropping flares and bombs, and word was passed that renewal of the German attack could be expected that night or early the next morning. Everyone was instructed to dig in and give no ground.

At first light the following morning, it became apparent the enemy had withdrawn. The Americans had won. They had stood, fought and defeated one of the enemy's finest divisions.

The Impact

The Germans had left the field littered with burned-out tanks and hundreds of dead. The American losses also had been heavy. The 601st Tank Destroyer Battalion had given a good account of itself but had paid a high price. After the Battle, it had only three command half-tracks left. However, the 601st as well as the 5th and 32d FA Battalions were refitted and back in action in a matter of days.

To the soldiers of the Regimental Headquarters and 1-17 FA, 23 March 1943 would be the most exciting day of their lives. The Battalion began to fire upon the advancing German tanks at first light and fired almost continuously until the final attack was broken up at sundown.

The German drive came within 1,000 yards of the 1st Battalion's batteries. If the German infantry had been able to advance 200 more yards, it would have overrun the batteries' observation posts and come within the minimum artillery range. Had the Germans been able to advance closer, the outcome of the Battle might have been very different.

The 1st Battalion fired more than 3,000 rounds that day, and at times, the gun tubes were so hot it was difficult to stand near them. Cooks, mechanics, medical aids, clerks and drivers joined the cannoneers in serving the guns, carrying ammunition and cooling the gun barrels by throwing wet towels, rags and blankets on them.

All during the day, the batteries were subjected to dive-bombing and strafing attacks. The lineman continuously repaired the telephone lines under bombings and shellfire to keep the communications open to the FDC and the observation posts. The radio operators stuck by their radios at the risk of their lives. Everyone performed his job magnificently.

When the climax of the Battle approached, the 1-17 FA began to run low on ammunition. The 17th Regimental Commander directed the ammunition trains of the 5th FA (overrun earlier in the day) into the 1st Battalion's positions, thus saving the day. Even with this additional supply, when the day was over, there were only six rounds left per gun.

On the following morning when it became known that the enemy had broken off the fight, a feeling of great elation spread through the 1st Battalion. Many of the soldiers and officers gathered at the FDC to congratulate each other and discuss the events of the previous day. The firing chart was signed by everyone present and kept as a memento.

Conclusion

As new as the soldiers were to combat, they knew they had played a role in a historical event. The Battalion would distinguish itself in many more battles before the end of the War, but none would ever equal that day at El Guettar when, tested to the limit, it stood its ground and won.

Employed and used correctly in combat, well-trained green artillerymen will be able to bring massive amounts of firepower to bear on the enemy. The 1-17 Field Artillery had stepped off on the right foot, and it made a difference.

The Honorable John Patterson is a Judge in the Alabama Court of Criminal Appeals, Montgomery, Alabama. After graduating from the Artillery Officer Candidate School, Fort Sill, Oklahoma, in 1942, he joined the 1st Battalion, 17th Field Artillery, in Morocco and remained with the Battalion until the end of World War II. In the Battalion, he served as a forward observer, the Battalion Survey Officer, Commander of Service and C Batteries and S2. At the Battle of El Guettar, he commanded the Battalion Anti-Tank Platoon, armed with six 37-mm anti-tank guns. In addition to North Africa, Judge Patterson served in Sicily, Italy, Southern France and Germany and was discharged in 1945 as a major. He was recalled and served two years with the 42d Field Artillery in the Korean War and in the Staff Judge Advocate Section of the 4th Infantry Division, Europe. Afterward, he served in the US Army Reserves and was discharged as a Lieutenant Colonel. Judge Patterson is a former Attorney General of Alabama (1955-1959) and Governor of Alabama (1959-1963).

Redleg Review

BOOK REVIEWS

Military Misfortunes: The Anatomy of Failure in War

Eliot Cohen and John Gooch. New York: MacMillan Free Press, 1990. 246 pages. $22.95

At first glance, this book would seem to be just another in a long line of "military-bashing" exposes. Happily, the authors take an entirely different approach in explaining why things go wrong in war. Even their introductory question, "Why do competent military organizations fail?" begins with refreshing objectivity.

More correctly, as the authors continue, "True military misfortunes, as we define them, can never be justly laid at the door of any one commander. They are failures of the organization, not of the individual."

The authors use a series of case studies to illustrate patterns of failure in organizations. Leaders of the 1942 American anti-submarine campaign in the Atlantic failed to learn and employ lessons from external sources. The 1915 British campaign at Gallipoli illustrates an organization's failure to take advantage of opportunities. Other historical vignettes are

used to illustrate the authors' analyses of military organizations and the manner in which they failed.

They also have included a series of matrices illustrating the path to critical failure. However, I found them to be more distracting than useful, my only real complaint.

The authors' notes reflect a wide range of in-depth research. Each case study is solidly documented, and the authors' analyses seem sound. Military organizations are, by nature, complex and bureaucratic entities. Cohen and Gooch provide an interesting study of the dangers inherent in these complexities.

This book uses lessons learned from military history to analyze contemporary problems. While the authors offer no specific solutions, they clearly identify potential problems. It's well worth reading.

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Field Artillery School

Paris Kanonen—The Paris Guns and Project Harp

G. V. Bull and C. H. Murphy. Herford, West Germany: Verlag E.S. Mittler & Sohn, 1988. 246 pages.

Take an artillery battery with guns that can shoot more than 120 kilometers, whose guns reach their maximum range at an elevation of 889 mils (instead of 800 mils like everyone else's), whose commander is a three-star flag officer and what do you have? Many people would answer "Big Bertha." Many people would be wrong.

In March 1918, the German military stunned the world by dropping artillery rounds into Paris using guns 127 kilometers away. When World War I ended, the Germans destroyed their super guns (they had at least three) along with all the test and development records to prevent them from falling into Allied hands.

In the years between the wars, the *Reichwehr* maintained a tight security lid on the guns by vigorously prosecuting anyone who talked about them. As a result, much of what we knew about the great guns was based on speculation, hearsay and myth. Even the name they are most commonly known by is wrong.

The Big Berthas were the massive 420-mm Krupp howitzers used to demolish the Belgian forts along the Meuse in 1914. The 210-mm Paris Guns were properly called *Wilhelm-geschuetze* (Wilhelm Guns) in honor of the Kaiser.

Writing more than 70 years after the end of the War, ordnance experts G. V. Bull and C. H. Murphy have cleared away much of the fog surrounding the Paris Guns with a brilliant new analysis. Even before starting their research project, Bull and Murphy probably knew more about long-range guns than anyone else in the world. During the 1960s, they were the project leaders on the Canadian-American High Altitude Research Programme (HARP), which used conventional gun tubes to launch atmospheric research probes to altitudes in excess of 180 kilometers.

Bull and Murphy had some major advantages over previous investigators. Most importantly perhaps, the authors managed to discover the location in Germany of the long-lost personal papers of Professor Dr. Fritz Rausenberger, the Director of Artillery Development and Production for Krupp at the time the big guns were built. Among those papers was a manuscript on the Paris Guns that the *Reichwehr* suppressed in 1926. Working with the data from the Rausenberger Manuscript, the authors used previously known round impact data on Paris coupled with modern computer analysis techniques to produce the first clear picture of the great guns. They conclude that the technical achievements of Rausenberger and his Krupp team were impressive, even by today's standards.

The Paris Guns were strange-looking monstrosities by any standards. To achieve the muzzle velocity required for the range, the tubes had to be at least 30 meters long. The Krupp rifling machinery could handle only 18 meters, so a 12-meter smooth-bore extension was added on.

The transition from rifled to smooth bore as the round traveled down the tube caused a problem in maintaining obturation. That was solved with a combination of fixed and partially slipping rotating bands on the round itself. The 90-mm tube droop at the muzzle was corrected by a bizarre-looking truss and counterweight system.

Because of their experience with larger guns, the German Navy provided the gun crews in combat operations with a vice admiral in charge of the three-gun battery. Firings were carefully coordinated with 30 surrounding Field Artillery batteries to mask the big guns from Allied sound-ranging systems.

Shooting at a quadrant elevation of 889 mils, the Paris Guns achieved a maximum ordinate of more than 42 kilometers. At that altitude the air density was so sparse, the rounds encountered less drag and, therefore, traveled farther.

During their operational life from late March to early August 1918, the Paris Guns dropped 351 rounds into Paris. At first, the result was utter panic. After a few days, however, the Parisians settled into the routine of being shelled, and the Paris Guns failed to achieve the military effect hoped for by the German High Command. In this respect, it was a foreshadowing of the civilian resistance to the aerial bombing of cities in World War II.

Although the book is published by a German company, it is in English. It's really two books in one. The first part deals with the analysis of the Paris Guns and includes a complete reproduction of the Rausenberger Manuscript. The second is a brief overview of the author's own Project HARP. This is not objective as the authors make it clear that shortsighted forces beyond their control caused the premature demise of their beloved project.

This book is not for the casual reader. Although it is well illustrated with photographs, charts and tables, some sections are highly technical and difficult to wade through. For the serious student of artillery, ordnance or World War I, however, the book is a must.

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Fire Support on the Non-Linear Battlefield: **The Shape of Things to Come**

by Lieutenant Colonel C. William Rittenhouse, USAR

The times are changing for the US Army, and the threat we've faced in Europe for the past 40 years appears to be evaporating. International events that were unthinkable a year ago now occur on a daily basis. The German reunification, the break-up of the Warsaw Pact and a new role for NATO are prime examples of a world in transition. At the same time, we're faced with the emergence of regional powers posing an even greater threat to our national security. All of these actions have a direct bearing on the United States Army and its mission to defend the nation.

A transitional state of world affairs makes the Army's effort to define its future arduous. The problem is how to probe beyond this period of political and military turbulence to the mid-years of this decade and the early years of the next century. How large will the Army be, and how will it be organized? How and where will it fight?

The Combined Armed Center at Fort Leavenworth, Kansas, and the Training and Doctrine Command (TRADOC) schools and centers are now in the process of answering these kinds of questions. A major objective of this project is to determine how best to apply AirLand Battle Doctrine to future combat conditions.

This article describes some of the results of the ongoing work. It outlines a developing concept for warfare on a non-linear battlefield, and it specifically addresses an expanded role for fire support.

The Shape of Future Battles

The prevailing thought is that the geometry of tomorrow's battlefield will be less defined than today's. It'll be characterized by groups of forces separated by gaps—non-linear in nature.

Non-linear warfare is not a new phenomenon. It has existed from classical times until the modern era. In fact, large-scale military operations under linear conditions have become the norm only in this century. (In many ways, Vietnam represented a non-linear action, but at the time, it was something of a doctrinal aberration.)

One way to understand the non-linear battlefield is to compare it to a linear one. Linear battles occur between opposing lines of forces. Units are linked together to prevent breaks or bulges in the defense and to attack along a unified front in the offense. In a linear conflict, there are established rear areas, bounded flanks and contiguous forward lines of own troops (FLOTs). Linear battlefields have been a dominant feature of most of the conflicts of this century, but this condition seems to have run its course.

The Shift to Non-Linear Warfare

There are several reasons for the growing shift toward non-linear warfare. One major factor involves force reductions. For the United States, it's becoming too costly and politically difficult to maintain large forwardly deployed forces in light of the changing threat.

As a result, in the not-too-distant future, troop density on a given piece of terrain will be low. Surely this will be the case following troop reductions in Europe or in the desert expanses of Southwest Asia.

Commanders won't be able to position units along front lines. Gaps will exist between units, not only along flanks, but also in the rear. Flanks will be exposed and the idea of a "front" will be less important. On a non-linear battlefield, an enemy could attack or be attacked from any quarter. Of course, there may be occasions when tactical areas could develop into a linear configuration, but this would be the exception rather than the rule.

Intelligence

Another factor affecting the shape of the battlefield concerns technology. In the coming years, technological advances will enable commanders to "see" the battlefield better than ever before. We'll have the ability to know where major elements of an enemy

force are most of the time. Moreover, when we find these elements, we'll be able to destroy them with long-range fires.

The non-linear concept centers around a phased cycle of finding the enemy with sensors, fixing his location with reconnaissance assets, fighting him first with long-range fires and then with maneuver forces and, finally, recovering to fight another enemy force. A big difference between this concept and fighting a linear battle is one of orientation.

Focus on Enemy Forces

On the linear battlefield, commanders tend to focus on either seizing or retaining terrain. On the non-linear battlefield, commanders must orient on the enemy force. There may be times when they must take or hold key terrain, but for the most part, they'll gear their operations to defeat the enemy.

But our forces will be spread too thinly to hold ground for any length of time. Non-linear engagements are envisioned to be short in duration, intensely violent and decisive in outcome. In such a scenario, reliance is placed on a commander's ability to find an enemy, set the conditions for engagement with fires and then attack and decisively defeat him.

Command and Control

Success on the non-linear battlefield requires an even greater adherence to the AirLand Battle tenets of synchronization and agility. In such a scenario, the corps commander is the key player for synchronizing combat power. Highly agile divisions will command and control maneuver brigades, which will be the main maneuver fighting units.

In this environment, the corps commander is challenged to maneuver combat power rapidly and effectively over large areas. To do this, it's often easier and less costly in terms of lives to maneuver fires as opposed to forces. By fires, I mean traditional fire support: Field Artillery (FA), tactical air, aviation, naval gunfire and non-lethal means (e.g., electronic warfare).

Attack by Fires

Fires will be used to achieve devastating effects on the enemy. For example, long-range precision fires can destroy enemy units long before they come in contact with friendly forces. Fires also can cover the gaps between units.

In fighting the enemy with fires, the commander can force the enemy to mass when he doesn't want to or prevent the enemy from massing for an attack. Most importantly, a commander maneuvers fires to "set up" the enemy for destruction either by additional fires or by the maneuver brigades.

The concept for fires on the nonlinear battlefield adds a new dimension to the traditional use of fire support. We will, of course, continue to provide fires in support of the commander's scheme of maneuver. But there will be times during the fires phase of the concept cycle when we'll fight the entire battle with fires independent of ground maneuver actions.

Then as the attack by fires succeeds in attriting and disorganizing the enemy, the commander will commit his maneuver forces to exploit the results of the fires. As always, the primary reason for attacking by fires is to achieve favorable conditions for the final and decisive defeat by the maneuver force.

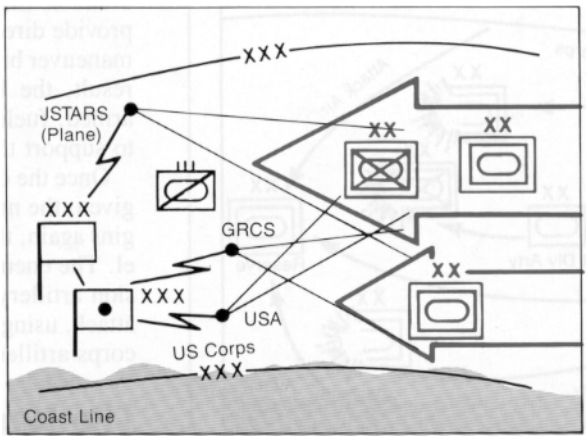
Controlling the attack by fires almost always will be a corps-level function. For this reason, we need to expand the operational capabilities of the corps artillery headquarters.

Roles of Corps Artillery and FA Brigade Commanders

The attack by fires adds to the responsibilities of both the corps artillery commander and his subordinate FA brigade commanders. Today, the corps artillery commander functions mainly as an allocator of assets. He fights the deep

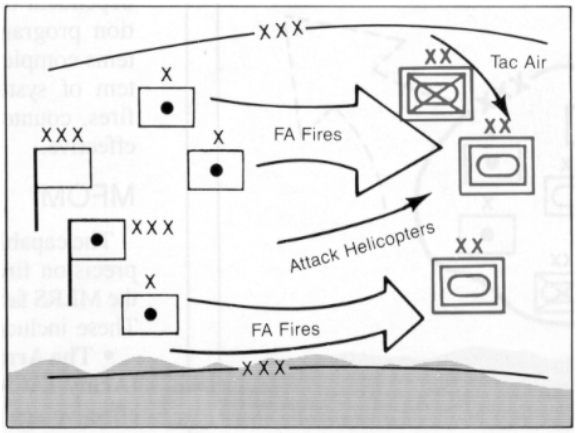
1. Detect the Enemy

- Locate and track the main attack with sensors and reconnaissance assets.
- Select kill zones.
- Link sensors to shooters.



2. Attack by Fires

- Corps artillery coordinates tactical air (Tac Air), aviation and FA in attack of enemy.
- Maneuver forces are not yet committed.
- Corps attacks selected units; emphasis is on destruction.
- Targets include surface-to-surface missiles (SSMs), MLRS, air defense, etc.



Non-Linear Warfare. These two battlefield vignettes illustrate the first two phases of non-linear warfare. You detect the enemy forces with long-range sensors and then attack them with long-range fires to destroy as many as possible before the friendly maneuver forces are committed.

battle with Lance and tactical air support. But for the most part, he doles out his brigades to reinforce division artillery units early on in the battle.

In the non-linear concept, the corps artillery commander retains control of all of his brigades during the fires phase of the battle. Each brigade will be assigned specific attack objectives against planned segments of the enemy force. The corps artillery commander as corps fire support coordinator (FSCOORD) coordinates his artillery fires with the fires of Army aviation, tactical air, etc.

New Frame of Mind

In executing the fires phase, corps-level FA commanders must put themselves in the same frame of mind as maneuver commanders. They must deal with terrain management in areas where there are no maneuver units.

Survivability will be a challenge in this environment. FA commanders must coordinate engineer support, air defense, logistical support and, sometimes, maneuver units with missions to provide security for the Field Artillery.

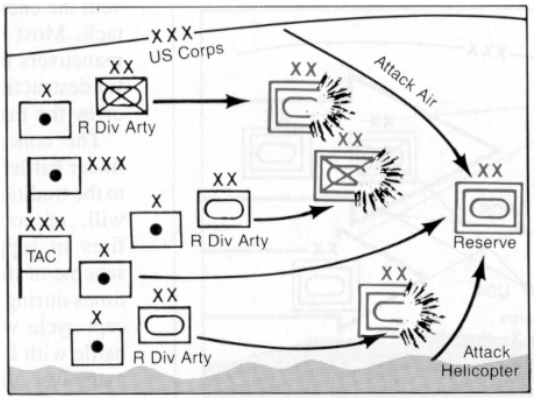
Fires Battle

The corps fires battle is unparalleled in FA history because of its scale, intensity and lethality. It's not a preparation nor is it a time on target (TOT). It doesn't happen all at once, but rather it occurs over a period of hours or even days.

The fires attack involves a detailed plan to link specific target acquisition means to specific shooters. Entire enemy units are attacked at depths ranging from approximately 200 kilometers with battlefield air interdiction (BAI) to 20 kilometers with cannons and multiple-launch rocket systems (MLRS).

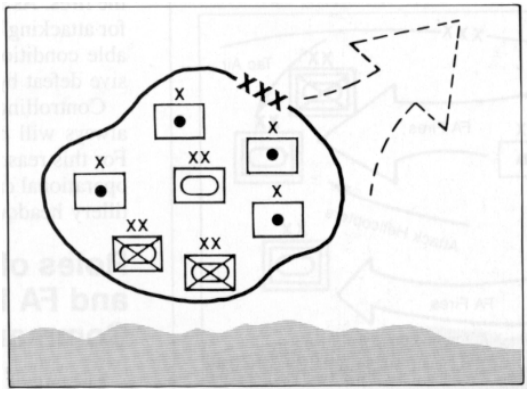
3. Attack with Maneuver

- Maneuver attack delivers coup de grace.
- FA Brigades, on order, reinforce the Div Artys (R Div Arty).
- Corps fires continue against enemy reserves and other deep targets.



4. Recover

- Units rearm, refuel and recover.
- Units prepare to execute next mission.



Non-Linear Warfare. These battlefield vignettes show the last two phases of non-linear warfare. You commit friendly maneuver forces to finish off the enemy, attacking his flanks and rear area, and then regroup to prepare for the next mission.

Role of the Division Artillery Commander

When the enemy has been sufficiently weakened by fires, friendly maneuver units attack, delivering the final crushing blow. At this point, designated FA brigades would, on-order, assume missions to reinforce the committed division artillery units. Other corps assets will continue to deliver long-range fires against high-payoff targets.

On the non-linear battlefield, the division artillery direct support (DS) battalions seldom will be withdrawn from their habitually supported maneuver brigades. Based on the factors of mission, enemy, terrain, troops and time available (METT-T), they'll continue to provide direct support, even before the maneuver brigades are committed. As a result, the DS battalion will be fully armed, fueled and supplied and ready to support the attack.

Once the order to commit the force is given, the non-linear concept cycle begins again, this time at the division level. The enemy is detected and the division artillery commander supports the attack, using the reinforcing fires of the corps artillery.

The Need for Modernization

Our ability to provide effective fires on the non-linear battlefield is heavily dependent on our ongoing modernization programs. The fire support systems complement other systems (a system of systems) to make long-range fires, counterfire and reinforcing fires effective.

MFOM

The capability to provide long-range, precision fires requires the fielding of the MLRS family of munitions (MFOM). These include:

● **The Army Tactical Missile System (Army TACMS).** The Army TACMS is effective against targets at ranges in excess of 100 kilometers and is fired from the MLRS launcher. Block 1 submunitions will give us a destructive capability against materiel and personnel. Block 2 submunitions provide a precision attack

capability against a variety of point targets.

• **Ground-launched Tacit Rainbow (GLTR).** This is a weapon that's fired from an MLRS launcher and loiters above the battlefield. When it encounters a predetermined frequency, such as an enemy radar, it homes in on and destroys the target.

• **MLRS Sense and Destroy Armor (SADARM) and Terminally Guided Warhead (TGW).** These weapons provide an effective precision attack of self-propelled artillery and moving armored combat vehicles.

Cannons

The highly fluid, non-linear battlefield will present challenges in mobility and survivability for DS and reinforcing cannon FA. These requirements strengthen the argument for developing the howitzer improvement program (HIP), which is the M109A6 now called the Paladin, and its follow-on system, the advanced Field Artillery system (AFAS). The smart munitions associated with the modernized 155-mm systems are SADARM and the terminally guided projectile (TGP).

The fielding of smart munitions for cannons and for MLRS also is critical for success on the non-linear battlefield. They'll not only improve our combat capability with their lethality, but they'll also reduce our logistical burden. For example, an MLRS unit armed with the family of smart munitions can expect to achieve the same results against the enemy with a 40 percent reduction in the number of "dumb" munitions.

Target Acquisition

The advanced target acquisition counterfire system (ATACS) is a radar that combines both artillery- and mortar-locating capabilities. This system employs "leap-ahead" technology in the form of passive, highly survivable emitters.

The joint surveillance and target attack radar system (JSTARS) is an Army-Air Force airborne acquisition system capable of covering large areas of the battlefield. The Guardrail Common Sensor (GACS) detects electronic emissions and is also an airborne system. And unmanned aerial vehicles (UAVs) are critical for extended battlefield target acquisition. All of these systems will have specific down-links to FA units.

Fire Support Coordination

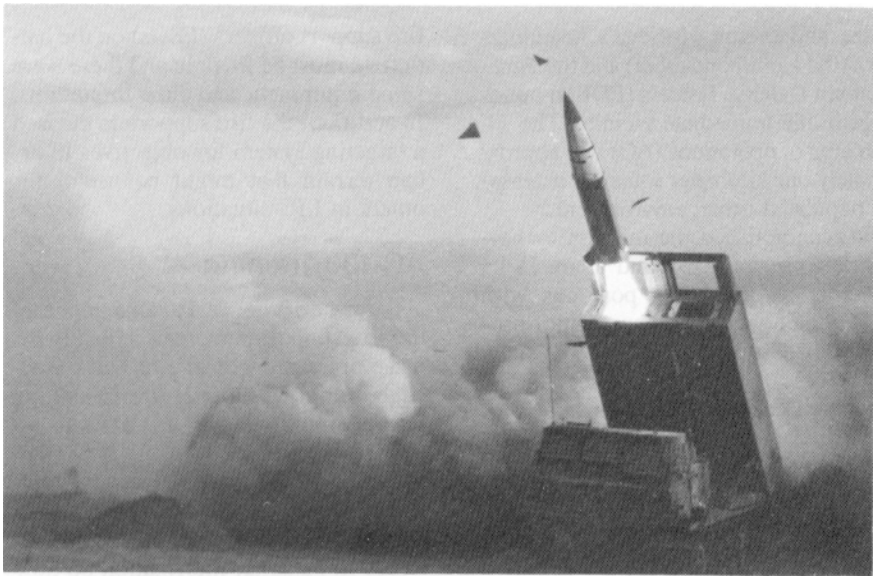
The advanced Field Artillery tactical data system (AFATDS) is essential for the synchronization of FA, tactical air, aviation and non-lethal attack means. It replaces the antiquated tactical fire direction system (TACFIRE), automates the fire support system and interfaces with the Army tactical command and control system (ATCCS).

Challenges

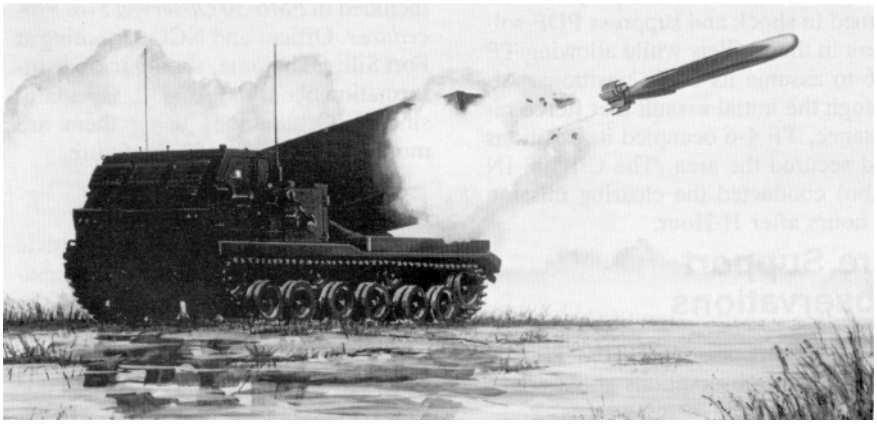
The concept for fighting on a nonlinear battlefield has worldwide applicability. It's equally suited for heavy and light contingency areas as well as a future European setting.

The non-linear concept presents challenges and opportunities for the future Field Artillery. These challenges underscore the importance of modernizing the fire support system.

The key to success on the future battlefield is clear. Long-range, precision fires are absolutely essential for early enemy attrition and shaping the nonlinear battlefield—**the shape of things to come.**



The 6-27 FA, III Corps Artillery, fires Army TACMS at White Sands, New Mexico, May 1990.



Drawing of Tacit Rainbow (GLTR), which Homes in on a Predetermined Frequency

Lieutenant Colonel William C. Rittenhouse, US Army Reserve (USAR), is a Field Artillery Specialist in the Concepts and Studies Branch, Directorate of Combat Developments, Field Artillery School, Fort Sill, Oklahoma. He serves as an Instructor of Phase I of the Command and General Staff College (CGSC) for the 4155th USAR School, Oklahoma City. Before Lieutenant Colonel Rittenhouse left the active Army in 1983, he commanded two batteries, one in the 2d Battalion, 37th Field Artillery, 212th Brigade, Fort Sill, and one in the 6th Battalion, 10th Field Artillery, 72d Field Artillery Brigade, West Germany. For the latter battalion, he also served as S3. Lieutenant Colonel Rittenhouse is a graduate of CGSC, Fort Leavenworth, Kansas, and Pennsylvania State University.

Red Devil Redlegs:

Fire Support in Operation Just Cause

by Colonel Robert S. Ballagh, Jr., and First Lieutenant Robert A. Nabb

The 4th Battalion, 6th Infantry—4-6 IN (M)—assigned to the 2d Brigade, 5th Infantry Division (Mechanized), Fort Polk, Louisiana, deployed to Panama in September 1989. The Battalion took its usual complement of fire supporters from the 5th Battalion, 1st Field Artillery (5-1 FA).

During Operation Just Cause in December, the 4-6 IN became Task Force (TF) 4-6 and was very successful, having several nonstandard operations. The observations of its 5-1 Fa fire supporters during those operations emphasize that FA must be flexible and prepared to meet the diverse contingencies possible in low-intensity conflict (LIC).

TF Organization and Mission

The 4-6 IN was attached to the 193d Infantry Brigade (Light) along with the 5th Battalion, 87th Infantry (Light), and 1st Battalion, 508th Infantry (Airborne). During Operation Just Cause, TF 4-6 was organized as follows: Team Delta, consisting of D/4-6 IN (M) with an additional mechanized platoon (2/C/4-6 IN(M)) and an engineer platoon (1/A/7 EN); B/4-6 IN (M); C/1-508 IN (Abn); and Team Armor (a platoon of M551 Sheridans and a platoon of Marine Corps light armored vehicles with 25-mm guns, or LAV-25s).

The mission of TF 4-6 was to isolate, seize and secure Noriega's headquarters (the Commandancia) and the Panamanian Defense Force's (PDF's) buildings in the immediate vicinity. The TF 4-6 area of operations (AO) was approximately one kilometer square of a densely populated urban environment.

It accomplished the mission by having B Company (IN) and Team Delta assume platoon battle positions with 360-degree security. Team Armor provided fire support into the objective from its battle position on Ancon Hill, which was 500 meters from the Commandancia. (See Figure 1: TF 4-6 Command and Control and Fire Support Coordination Measures.)

The TF's fire support plan called for a 5-minute, 30-second preparation by two AC-130 aircraft, starting 30 seconds before H-Hour. The prep was designed to shock and suppress PDF soldiers in their billets while allowing TF 4-6 to assume its battle positions. Although the initial assault met fierce resistance, TF 4-6 occupied its positions and secured the area. The C/1-508 IN (Abn) conducted the clearing mission 14 hours after H-Hour.

Fire Support Observations

Fire support personnel from TF 4-6 made several observations about combat in Just Cause. In some areas, Redlegs need more training, the position of fire support officers (FSOs) on the battlefield must be flexible and there were some equipment and fuze limitations. In addition, the fire supporters devised a targeting system for objectives in urban terrain that might be useful for others in LIC situations.

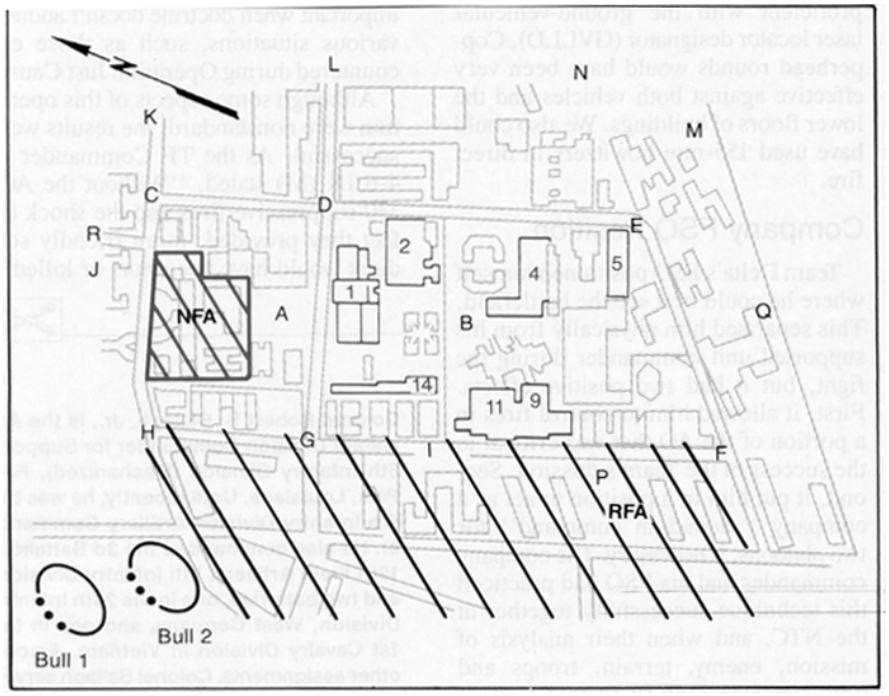
AC-130 Training

Before arriving in Panama, none of the fire support personnel with TF 4-6 had ever trained with or even had knowledge of the AC-130 aircraft. Obtaining information about the AC-130 was extremely difficult.

Although all TF 4-6 fire support personnel were able to call for and adjust AC-130 fires within the first couple of weeks in Panama, information on how to adjust fire with the AC-130 should be included in *FM6-30 Observed Fire Procedures*. Officer and NCO schooling at Fort Sill, Oklahoma, should include information about the AC-130, especially since LIC situations using them are more likely to occur in the future.

FSO Needs

The TF FSO needed his own vehicle with a four-net communications capability. To accomplish this, he used the Team Delta fire support team (FIST) M113 vehicle, forcing the Team Delta FSO and his radio-telephone operator (RTO) to ride in one of the platoon leader's vehicles.



Element	Position
TF and Team D Commanders	G
TF S3	R
Team Armor	Bulls 1 and 2
TF FSO	Bull 1
B Company FIST	C
Team D FIST	E

Fire Support Coordination Measures.

The coordination measures are marked with diagonal lines as a no fire area (NFA) and restricted fire area (RFA). The numbers indicate the buildings hit with indirect fire, the Commandancia's being 1.

Figure 1: Command and Control

The TF FSO monitored the TF command net, battalion mortar net, AC-130 call-for-fire net and the brigade counterfire net. He wouldn't have been able to monitor the required nets if he had been in the TF commander's vehicle.

Also, the TF FSO stayed near Team Armor instead of collocating with the TF commander. This allowed the FSO to view most of the AO and control fires from all fire support assets. The TF FSO cleared and requested all fires for company fire support personnel. The rules of engagement, which demanded safeguarding the lives of many civilians in the AO and preventing fratricide in such a small AO with severely restricted visibility, made this centralized method of fire control necessary.

Experiences at the National Training Center, Fort Irwin, California, have identified the need for a separate combat vehicle for the heavy TF FSO in mid-intensity warfare. Our experience in Just Cause confirms this is also a valid requirement for the LIC environment.

Targeting System in Urban Terrain

The TF 4-6 AO was densely populated and required precise fires to avoid civilian and friendly casualties. To provide strict control over all fires onto the objective, the maneuver graphics section split the objective in half, with the main road into the objective the boundary between B Company and Team Delta. The two parts of the objective were lettered A and B, relating to B Company and Team Delta, respectively. All platoon battle positions were lettered from C to N. To identify the buildings in each company AO, the buildings were numbered clockwise. (See the Figure 2: Urban Terrain Targeting System.)

To call for fire with these graphics, the company fire support personnel gave a letter (A or B) and a building number (1-15) to the TF FSO. The TF FSO then relayed the request to the AC-130, using the same letter and number. Everyone—air crews, fire supporters and maneuver personnel—had the same overlay and graphics. This technique was key in providing timely, effective and sate fires.

Mortars in Urban Terrain

After assuming platoon battle positions, TF 4-6 units were all within 200 to 300 meters of the Commandancia. Although the 4th Battalion's 4.2-inch mortar platoon was prepared to fire, no fires were allowed because of the close proximity of friendly troops in the AO and the large number of helicopters and

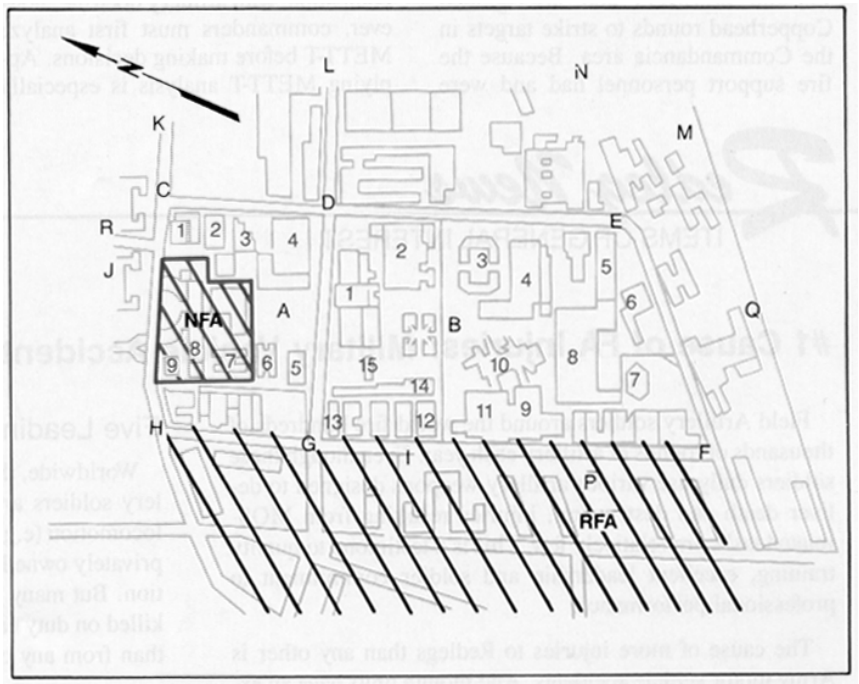


Figure 2: Urban Terrain Targeting System. TF 4-6 devised a graphic targeting system identifying the objective buildings in areas A and B, the platoon battle positions at letters C to N and the buildings numbered clockwise. The air, fire support and maneuver personnel all used the same overlay and graphic.

AC-130s flying over the AO.

Air space allocation was extremely difficult during this operation. That, along with the closeness of friendly troops, stopped the 4th Battalion from firing any mortar platoon missions.

Concrete-Piercing Fuzes

The AC-130 prep fires and additional requested fires on the PDF buildings within the Commandancia complex were effective. However, the damage to the lower floors of those buildings was limited. The point-detonating fuzes used on the AC-130's 105-mm rounds caused all damage to be focused on the top floors; very limited damage was done to the lower floors.

Although most of the buildings were empty, if personnel had been in the lower floors, they would have survived the preparation fires and continued fighting. The need for concrete-piercing fuzes still exists within the fire support community.

Cannon Artillery

Although a battery of 105-mm howitzers assigned to the 193d Brigade was available in Panama City during Just Cause, the battery wasn't used for the same reasons that prohibited mortar fire. Consideration should have been given, however, to deploying and using 155-mm howitzers and laser-guided Copperhead rounds to strike targets in the Commandancia area. Because the fire support personnel had and were proficient with the ground-vehicular laser locator designator (GVLLD), Copperhead rounds would have been very effective against both vehicles and the lower floors of buildings. We also could have used 155-mm howitzers in direct fire.

Company FSO Position

Team Delta's FSO positioned himself where he could best see the battlefield. This separated him physically from his supported unit commander during the fight, but it had two positive effects. First, it allowed him to control fires in a portion of the AO that was critical to the success of the Team's mission. Second, it put him in a position to act as a company "second in command" for two platoons, if necessary. The company commander and his FSO had practiced this technique successfully together at the NTC, and when their analysis of mission, enemy, terrain, troops and time available (METT-T) told them it would be appropriate in Just Cause, they felt comfortable doing so. In fact, during execution, the company FSO had to take charge of two platoons when they came under heavy fire.

Doctrine and METT-T

Some of the lessons of Panama are compatible with artillery doctrine; however, commanders must first analyze METT-T before making decisions. Applying METT-T analysis is especially important when doctrine doesn't address various situations, such as those encountered during Operation Just Cause.

Although some aspects of this operation were nonstandard, the results were successful. As the TF Commander of 4-6 IN (M) stated, "Without the AC-130 suppressive fires and the shock effect they provided, more friendly soldiers would have been hurt or killed."

Colonel Robert S. Ballagh, Jr., is the Assistant Division Commander for Support, 5th Infantry Division (Mechanized), Fort Polk, Louisiana. Until recently, he was the 5th Infantry Division Artillery Commander. He also commanded the 3d Battalion, 19th Field Artillery, 5th Infantry Division, and two batteries, one in the 24th Infantry Division, West Germany, and one in the 1st Cavalry Division in Vietnam. Among other assignments, Colonel Ballagh served as Special Assistant to the Chief of Staff, Supreme Headquarters Allied Powers Europe (SHAPE), Belgium.

First Lieutenant (P) Robert A. Nabb is a Platoon Leader in A Battery, 5th Battalion, 1st Field Artillery, 5th Infantry Division. During Operation Just Cause, he was the Company Fire Support Officer for D Company (Team Delta), 4th Battalion, 6th Infantry, part of the 5th Infantry Division, where he earned a Bronze Star with "V" device. Lieutenant Nabb also has served as the Counterfire Officer and Radar Officer for H Battery, 25th Field Artillery, 5th Infantry Division.

Redleg News

ITEMS OF GENERAL INTEREST

#1 Cause of FA Injuries: Military Vehicle Accidents

Field Artillery soldiers around the world fire hundreds of thousands of rounds of artillery each year. Even though these soldiers daily use various artillery weapons designed to deliver death and destruction, injuries resulting from MOS-related tasks are relatively few. This is a testimony to quality training, excellent leadership and soldier commitment to professional performance.

The cause of more injuries to Redlegs than any other is Army motor vehicle accidents. And though units have an excellent record working with their weapons and other equipment, there's much they can do to reduce vehicle accidents and, thereby, Branch injuries and deaths.

Five Leading Causes of FA Injuries

Worldwide, the five leading causes of injury to Field Artillery soldiers are (1) military vehicle accidents, (2) human locomotion (e.g., slips, falls, etc.), (3) materiel handling, (4) privately owned vehicle accidents and (5) sports and recreation. But many more Field Artillery soldiers are injured or killed on duty each year from Army motor vehicle accidents than from any other cause.

Driver Errors

Analysis of these military vehicle accidents indicates driver error is a contributing factor in more than 80 percent

of the crashes. The US Army Safety Center, Fort Rucker, Alabama, studies Army motor vehicle accidents and has identified four leading causes of driver error.

(1) Inadequate Standards to Cover an Operation. The standards may not be clear or practical or may not even exist. In this situation, even though driver error may have caused the accident, leadership must share equally in the responsibility for failure to ensure proper standards were established and all drivers knew them.

(2) Training Failure. In many cases, a driver's error may be the result of inadequate training. The best standards are worthless unless drivers are properly trained to follow them. Commanders must ensure all drivers in the unit thoroughly understand the safe operation of their vehicles.

(3) Leader Failure. Good standards are only good if the leadership enforces them. Failure to enforce a standard is no better than not having one at all.

(4) Individual Failure. This occurs when the driver knows the standards but chooses not to follow them—he fails to perform to established and enforced performance standards.

Commander Solutions

Although the four conditions described above are reasons for driver error, in each case, sound leadership is the key to solving the problems.

Accident Investigations. Commanders must thoroughly investigate the circumstances surrounding all accidents, even the minor ones, to identify all contributing factors. A complete investigation of minor accidents can identify causes, which if corrected, can eliminate the potential for more serious ones.

Peripheral Factors—Seat Belts. In many accidents, although excessive speed, improper backing, failure to yield right-of-way, following too close, etc., may be identified as the primary cause, other factors also are identified that could have prevented the accident or reduced injuries.

Most noteworthy is the failure to use seat belts. In many fatal vehicle crashes, whether the vehicle is Army or privately owned, using seat belts would have kept the victims alive. The use of seat belts should be included in all unit standards and strictly enforced.

Training and Standards. Safe vehicle operation doesn't just happen. It's a combination of quality driver training, established standards to fit the mission of the unit and vigorous enforcement of those standards.

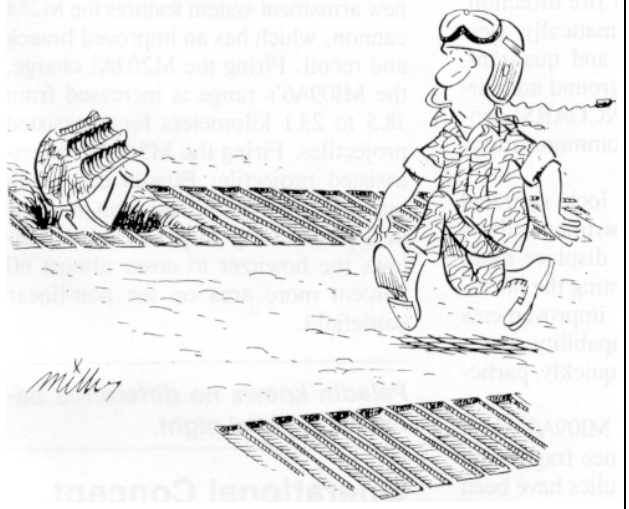
Studies show there are no *new* Army motor vehicle accidents, just different drivers. Although standards and enforcement are vital elements to a safe vehicle operation, a continuing quality driver training program is absolutely essential.

Conclusion

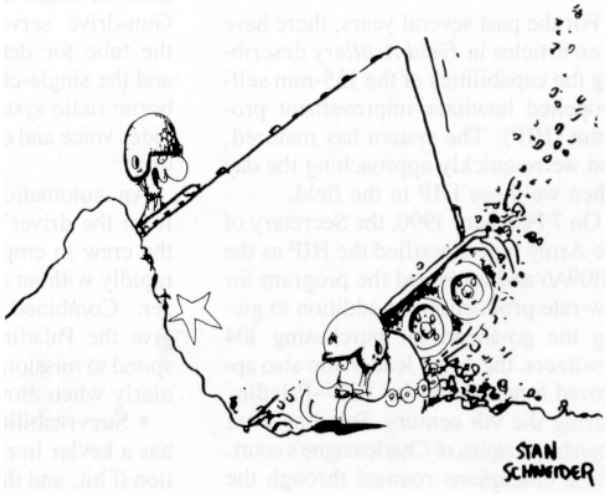
We know 80 percent of our Army motor vehicle accidents are caused by driver errors. With this information, commanders are in an excellent position to reduce injuries and the tragic loss of life caused by vehicle accidents.

If units have questions, call the Field Artillery Branch Safety Office at Fort Sill, Oklahoma, at AUTOVON 639-4701 or 4215 or commercial (405) 351-4701 or 4215.

Royse Samples
FA Branch Safety Officer
Fort Sill, OK



"Yeah. And then it took a hard left and headed south!"



"You were right, Sarge—I was in first gear!"

Paladin

by Colonel Ralph G. Reece and Captain Todd J. Travas

In the mid-1960s, fire direction personnel began to move into the computer age. The Field Artillery digital automatic control (FADAC), tactical fire direction system (TACFIRE), battery computer system (BCS), back-up computer system (BUCS) and now the advanced Field Artillery tactical data system (AFATDS) have completely revolutionized the way Redlegs compute firing data and coordinate fire support.

We're finally on the verge of fielding a system that brings that same state of technology to the cannoneer.

A Howitzer for the 90s

For the past several years, there have been articles in *Field Artillery* describing the capabilities of the 155-mm self-propelled howitzer improvement program (HIP). The system has matured, and we're quickly approaching the day when we'll see HIP in the field.

On 7 February 1990, the Secretary of the Army type classified the HIP as the M109A6 and approved the program for low-rate production. In addition to giving the go-ahead for purchasing 104 howitzers, the Army leadership also approved a new name for HIP—Paladin. During the 9th century, Paladins were legendary knights of Charlemagne's court. These champions roamed through the land in defense of noble causes.

The M109A6s will travel across tomorrow's battlefields as did the Paladins of the Middle Ages. They'll travel fast, strike hard in support of others and command respect from all.

Paladin is never out of action.

Paladin Improvements

The Paladin is a product improvement for the workhorse M109A2s and A3s that have provided close support to our heavy maneuver brigades for more than a quarter of a century. The technical improvements, which are impressive, can be roughly grouped into four areas.

- **Responsiveness.** An automatic fire control system includes position navigation and a ballistic computer that does on-board technical fire direction. Gun-drive servos automatically slew the tube for deflection and quadrant, and the single-channel ground and airborne radio system (SINCGARS) provides voice and digital communications links.

An automatic travel lock operated from the driver's compartment allows the crew to emplace or displace more rapidly without dismounting the howitzer. Combined, these improvements give the Paladin the capability to respond to missions more quickly, particularly when moving.

- **Survivability.** The M109A6 turret has a kevlar liner to reduce fragmentation if hit, and the hydraulics have been redesigned to decrease the risk of fire. In addition, ammunition has been relocated in the turret to reduce the vulnerable area, and the total number of on-board rounds has been increased from 36 to 39. Paladin's key survivability enhancement, however, is its ability to move out of position before the enemy can target it with counterfire.
- **Maintainability.** Suspension improvements include longer torsion bars and hydropneumatic bump stops to compensate for the increased weight. Automotively, engine cooling has been improved, the starter has been sealed, a protection circuit added and the electrical system has been improved. Paladin has a new transmission and a prognostic and diagnostic interface unit has been added to help identify maintenance failures.
- **Increased Range.** The Paladin's new armament system features the M284 cannon, which has an improved breech and recoil. Firing the M203A1 charge, the M109A6's range is increased from 18.5 to 23.1 kilometers for unassisted projectiles. Firing the M549A1 rocket-assisted projectile, Paladin can reach out to 30 kilometers. This is an increase of approximately 25 percent, but it allows the howitzer to cover almost 60 percent more area on the non-linear battlefield.

Paladin knows no difference between day and night.

Operational Concept

To take full advantage of the capability of Paladin, we have to change the way we operate. Paladin doesn't require the terrain for conventional laying techniques needed by the M109A3 howitzer.

Paladin locates and lays itself for firing by using its on-board position navigation system and technical fire control. Hence, there's no need to have 400 to 500 meters of flat, negotiable terrain for the firing platoon to occupy.

Ideally, the platoon howitzers will operate in pairs semiautonomously within a 1,000-meter radius. The pair, separated by 50 to 300 meters, will be free to shoot and move within the position area under the control of the platoon operations center (POC). The two howitzers will stay in sight of each other to provide mutual defensive support and, if necessary, fire control. (See Figure 1.)

Survivability

As a platoon moves into its assigned area, each M109A6 will stop at a survey control point, initialize its on-board navigation system and then move to its first position. Occupying in less than a minute, the howitzers will fire under the control of the POC, making 300- to 500-meter survivability moves, as necessary.

Because they're widely dispersed and capable of rapid displacement and emplacement, the howitzers present much more difficult counterfire targets for the enemy. Computer modeling done in conjunction with the initial operational test and evaluation (IOTE) last summer showed Paladins are 48 to 66 percent more survivable than the M109A3s.

Positioning

Positioning the artillery always will require close coordination with the brigade being supported, but Paladin requires less terrain than the M109A3. Single, widely dispersed gun positions, which might be too small for a platoon, are now usable. Free from the necessity of laying wire and the requirement to locate close to other platoon vehicles or a survey point, each Paladin can use previously untenable positions or share positions with other units.

Paladin's on-board navigation, fire control and improved communications allow the howitzer to respond quickly to calls for fire, even when widely dispersed or on the move. In fact, the M109A6 is not placed in an "OUT TIL" status in BCS when the howitzer is moving.

Massing Fires

Paladins aren't like waterbugs, flitting around the battlefield. Four guns still operate under platoon control and in a given area. Position areas may overlap, be shared with other units or be in areas too restricted for a traditional platoon formation, but a platoon leader remains responsible for controlling the movement and firing of the platoon.

The perception that 24 Paladins in a direct-support (DS) battalion are scattered haphazardly throughout a brigade zone shooting one or two rounds at a target is incorrect. Massed fires of a battalion or more are still needed to defeat major targets. The M109A6's technical capabilities allow it to participate

The M109A4 and M109A5 Howitzers

The Active Duty, Army Reserve and National Guard units that don't receive Paladin won't be left with 27-year-old technology. Two product improvements will be added to their M109A2 and A3 howitzers. First the howitzers will be converted to M109A4s, increasing the system's overall maintainability through improvements to the power train. The M109A4 also will have a nuclear, biological and chemical (NBC) protective system for crew survivability. The second product improvement is the modified armament system (MAS). By adding Paladin's cannon, breech and gun mount to the M109A4, you have an M109A5 that can deliver fires out to ranges equivalent to Paladin's.

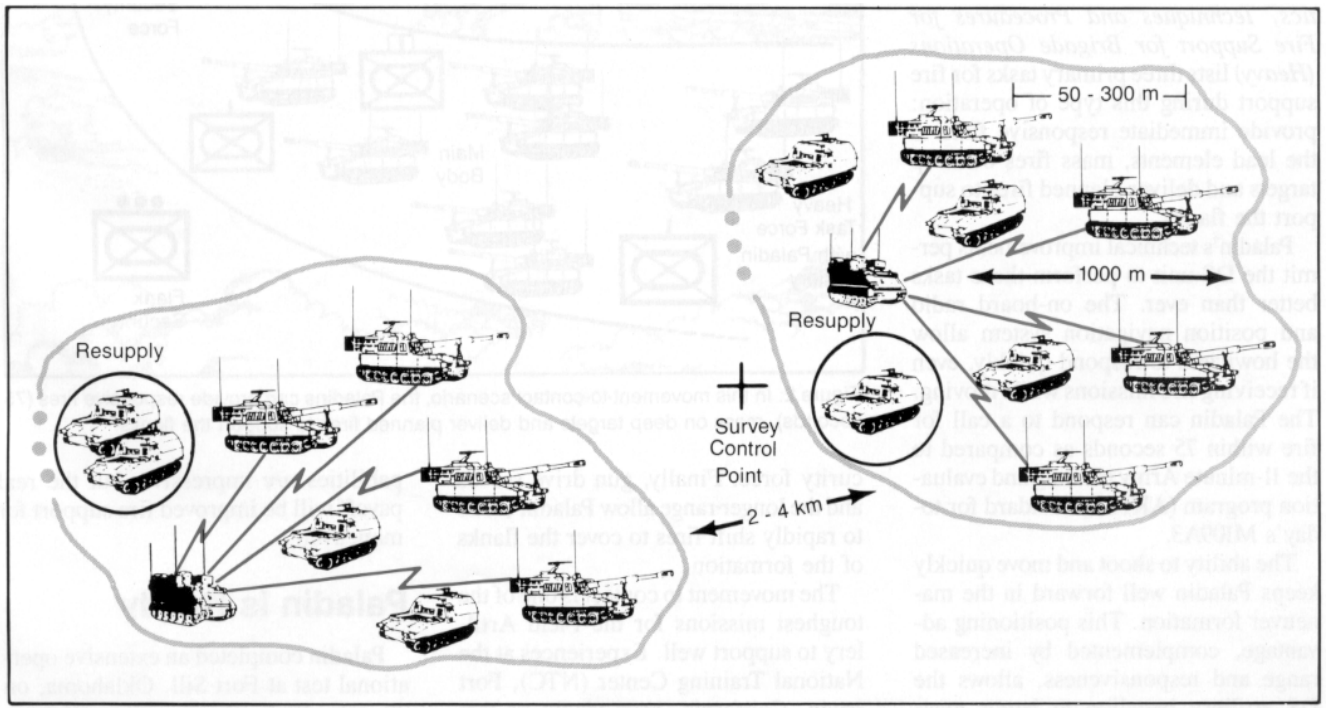


Figure 1: Paladins operate semiautonomously in pairs, requiring less terrain, and can occupy their positions in less than a minute.

in those massed fires while surviving to fight again.

Challenges of the 90s

While the technical enhancements are impressive and the artillery tactics innovative, they're simply a means to an end. The real challenge is to ensure increased fire support for the maneuver commander. Paladin meets that challenge.

As we look to the future, fire supporters must be ready to respond to a highly mobile, highly flexible maneuver force. We no longer can plan to defend along one front on the plains of Europe against the "Red Horde." Instead, we must be prepared to fight a variety of enemies. Their forces may exceed ours at a given point during the battle, but often we will be evenly matched in strength and technical capability.

The battlefield often may be nonlinear with each force searching for the other. In this highly fluid environment, we must focus on the movement to contact, the meeting engagement and the hasty attack. Paladin's ability to move, shoot and move again while providing responsive fire support makes it the ideal direct-support weapon on the maneuver-oriented battlefield.

Figure 2 shows a schematic of a task force making a movement to contact. Traveling with the task force in this scenario is one battery of the brigade's DS Paladin battalion. *FM 6-20-40 Tactics, Techniques and Procedures for Fire Support for Brigade Operations (Heavy)* lists three primary tasks for fire support during this type of operation: provide immediate responsive fires to the lead elements, mass fires on deep targets and deliver planned fires to support the flanks.

Paladin's technical improvements permit the DS unit to perform these tasks better than ever. The on-board radio and position navigation system allow the howitzers to respond quickly, even if receiving fire missions while moving. The Paladin can respond to a call for fire within 75 seconds as compared to the 11-minute Army training and evaluation program (ARTEP) standard for today's M109A3.

The ability to shoot and move quickly keeps Paladin well forward in the maneuver formation. This positioning advantage, complemented by increased range and responsiveness, allows the DS artillery battalion to better mass fires on deep targets in front of the security force. Finally, gun drive servos and the longer range allow Paladin crews to rapidly shift fires to cover the flanks of the formation.

A Paladin (left) parks next to the current M109 howitzer at the international demonstration at Yuma Proving Ground, Arizona, 23 January.

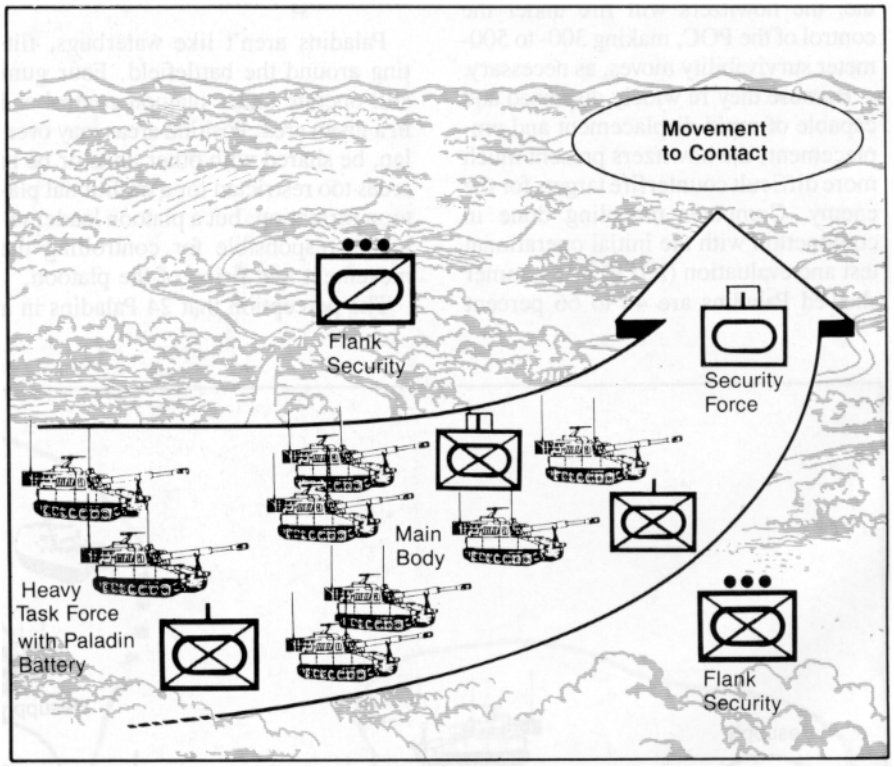


Figure 2: In this movement-to-contact scenario, the Paladins can provide responsive fires (75 seconds), mass on deep targets and deliver planned fires to support the flanks.

The movement to contact is one of the toughest missions for the Field Artillery to support well. Experiences at the National Training Center (NTC), Fort Irwin, California, have taught us this time and again. Paladin's technical capabilities *are* impressive, but the real payoff will be improved fire support for maneuver.

Paladin is Ready

Paladin completed an extensive operational test at Fort Sill, Oklahoma, on 28 July 1989. During three 96-hour field training exercises, a Paladin platoon

In a somewhat concealed position, the Paladin prepares to fire.

Paladin's 155-mm cannon fires during the January international demonstration in Arizona.

M109A6 "The Average"				M109A2/3			
	Miles	Hours	Rounds		Miles	Hours	Rounds
IOTE (2 Months)	374	331	2,861	USAREUR (Per Year)*	777	128	257
Tech Test (6 Months)	1,030	352	2,649	CONUS (Per Year)*	612	73	259
Total	1,404	683	5,510	Average (Year)	694	100	258
*Based on Sample Data Collection from 1980 to 1989 (Peco Enterprises)							

Figure 3: The M109A6 Paladin fired more rounds in eight months of testing than an M109A2 or M109A3 howitzer fires in 20 years.

was stressed to the limit. Hardware problems that were identified have been fixed and tested in detail at Aberdeen, Dugway and Yuma Proving Grounds.

Figure 3 gives some idea of the demands placed on the howitzer during testing. In eight months, Paladin fired more rounds than the average M109A3 does in more than 20 years.

Though initial production is about to begin, Paladin will undergo one final test. Early in 1992 the first unit to be equipped (FUE) with the new howitzer, the 2d Battalion, 17th Field Artillery, part of III Corps Artillery at Fort Sill, will participate in a follow-on test and evaluation (FOTE) to ensure the production howitzers are built to the same standards as the prototypes. The test unit will validate tactics, techniques and procedures before the M109A6 is fielded to other units.

Pending the results of the FOTE, the Army will go into full-rate production, buying about 700 Paladins to upgrade some of the M109 howitzers. The initial low-rate production buy of 104 Paladins will go primarily to active component units in US Army, Europe (USAREUR). Follow-on fielding will equip selected units in the continental US (CONUS).

Paladin is a quantum leap in capability over the 27-year-old M109 howitzer. It gives Field Artillerymen the howitzer they need to move into the 21st century.

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Captain Todd J. Travas is the Aide-de-Camp to the Commanding General of the Field Artillery Center and Fort Sill. Until recently, he was a HIP Action Officer at the Field Artillery School. Commissioned from Oklahoma State University, he's a graduate of the Field Artillery Officer Basic and Advanced Courses and the Cannon Course at Fort Sill, and the Combined Arms and Services Staff School at Fort Leavenworth, Kansas. In nine years, Captain Travas has served two tours with the 82d Airborne Division, Fort Bragg, North Carolina, and 13 months in Korea, assigned as a Battery Executive Officer, Battalion Fire Support Officer (FSO), Battalion S1, Battalion Operations Officer, Battery Commander and Brigade FSO.

155-mm DPICM Workarounds for BCS (Version 7) and BUCS

by Captains Brendan L. Wilson and George S. Whitbeck, USMC

In training, we rarely, if ever, have the opportunity to fire dual-purpose improved conventional munitions (DPICM). As a result, personnel have less accumulated experience and suffer faster learning decay of this skill.

At this juncture, it's important to reinforce the 155-mm DPICM workarounds for the battery computer system (BCS) Version 7 software and the back-up computer system (BUCS). This article explains why the workarounds are necessary; in the boxed chart are the steps you take in the workarounds—"Steps for the BCS (Version 7) and BUCS Workarounds for 155-mm DPICM," Page 50.

BCS Computations

There are two sources of fire control information (FCI) to use when firing DPICM. The first is the firing table (FT) 155-AN-1, which defines the standard muzzle velocities (MVs) for green bag, white bag and charge 8 and provides data for a self-registering (SR) DPICM projectile. This is the base tabular firing table (TFT) for this projectile family. The J-1 Addendum has corrections to AN-1 to provide for DPICM air bursts. *The MVs used in this table are obsolete; thus, firing data using this FCI is incorrect if MV corrections are not accounted for*.

Another source is the FT 155-ADD-R-1, which gives DPICM correction factors to high explosive (HE) firing data. The R-1 data was determined by firing DPICM after HE and measuring the change in MV resulting from the change in projectile.

According to the Ballistics Research Laboratory, the R-1 is currently the best available source for determining what the MV will be for 155-mm DPICM, short of actual calibration. However, BCS may apply either the R-1 or the AN-1 MV values. The BCS Version 7 software for the 155-mm uses data from both these tables, depending on what you have in your data base.

To understand the discrepancies between R-1 and AN-1, first we must look at how you should use the R-1 correction factor. Second, we need to examine which data the BCS uses in different situations and the errors that result. Third, we'll see how the BCS can produce three different sets of firing data from the same input, depending on what form that input is in the data base.

How to Use the R-1 Correction Factor

The following is an example of how you should use the R-1 correction factor. If HE MVV for charge 4 green bag is given as –2.0 meters per second (M/S), the expected MV for HE is determined as follows:

Standard	+	MVV*	=	HE MV
316	+	(-2.0)	=	314 M/S

**MVV = Muzzle Velocity Variance*

The data from R-1 is now added to the HE MV to determine DPICM MV:

		Correction		Expected
HE MV	+	*from R-1*	=	DPICM MV
314	+	(-18)	=	296 M/S

The R-1 tells us that if we now fire DPICM with this howitzer, we should achieve an MV of 296 M/S, which is 18 M/S less than HE.

BCS Computation with AN-1 and R-1

Since R-1 derived 296 M/S is the best estimate of expected MV, we'd expect the BCS to use that value in its computations. However, the computer will use the AN-1 value, *unless* there's an HE registration correction on file for that charge, angle of fire and propellant lot. The AN-1 MV charge 4 green bag value is 305 M/S—a difference of +9 M/S. Figure 1 compares the R-1 and the AN-1 derived data for green bag and white bag and shows the discrepancy.

The comparison in Figure 1 assumes the howitzer achieves standard HE MV when firing HE. In other words, the howitzer has an MVV of 0.0 M/S for HE. The last column shows the number of meters the DPICM round would fall short of the target if the BCS uses AN-1 value *and* an HE registration is not on file.

We can use Figure 1 to see how the BCS handles our example of charge 4 green bag. If a howitzer actually achieves 316 M/S for charge 4 green bag when firing HE, then according to the R-1, it'll achieve 298 M/S when firing DPICM. We also should expect this to agree with the AN-1 standard MV for DPICM since the weapon that fires standard for HE should *generally* fire standard for DPICM.

As you can see, however, the two values differ by 7.0 M/S. If the BCS uses the AN-1 value of 305 M/S, the computer will expect the projectile to travel 7 meters per second faster than it actually will. The result is a round short on the gun target line.

Correcting BCS MVs

How then do we get the computer to use the correct MVs? There are two methods.

The first option is to register with HE. If HE registration corrections are on file, the computer will "flag" the R-1 corrections instead of the AN-1 data. Our doctrine discourages the use of registrations because they expose the battery and waste time and ammunition. (Because of software limitations, it's not possible to adjust or register with DPICM SR in BCS Version 7.)

Another option exists. We can measure MVs for DPICM during live firing. In training, this is prohibitively expensive. Even if we could measure MVs with DPICM, we're still faced with inaccuracies when transferring MVVs across charges within the same propellant lot.

Charge	Standard HE MV	HE MVV	+ R-1 =	Best Expected DPICM MV	AN-1	Error	Approximate Effect on Achieved Range, Low Angle at 5,100 m*
Green Bag							
3	276	0.0	– 15	261	263.2	+ 2.2	– 78 m
4	316	0.0	– 18	298	305.0	+ 7.0	– 203 m
5	376	0.0	– 22	354	359.4	+ 5.4	– 91 m
White Bag							
3	297	0.0	– 9	288	294.9	+ 6.9	– 215 m
4	337	0.0	– 12	325	334.8	+ 9.8	– 204 m
5	397	0.0	– 16	381	385.9	+ 4.9	– 77 m
6	474	0.0	– 21	453	461.6	+ 8.6	– 139 m
7	568	0.0	– 26	542	546.8	+ 4.8	– 73 m

*The numbers in this column were derived from TFT AN-1, Table F, Column 10. Errors generally are more pronounced as range increases.

Figure 1: Comparison of Firing Data BCS Derives Using R – 1 and AN – 1 for Green Bag and White Bag. (For M119 charges, the DPICM MVs in the computer are correct.)

Charge	HE Standard MVV	HE MVV	R – 1	DPICM Best Expected	AN – 1	DPICM MVV	DPICM MV BCS Uses	Error (M/S)
3	276	0.0	– 15	261	263.2	– 7.0	256.2	– 4.8
4	316	0.0	– 18	298	305.0	– 7.0	298.0	0.0
5	376	0.0	– 22	354	359.4	– 7.0	352.4	– 1.6

Figure 2: Flawed Transfer of DPICM MVVs Across Charges in BCS and BUCS

Charge	Measured MV	+	R-1	=	MV Used by BCS	Error
4	298	+	(– 18)		280	– 18

Figure 3: Incorrect BCS Application of R-1 Correction to DPICM MVV. The computer will expect an MV of 280 M/S rather than the true MV of 298. This causes the projectile to impact approximately 300 meters beyond the aim point.

Calibration techniques with the HE projectile family show we need only measure MVVs for one preferred charge within a charge group. Thus, for a lot of green bag, we could calibrate with charges 3, 4 or 5 because they're all preferred. For white bag, we could use charges 5, 6 or 7. BCS Version 7 software will only store one MVV per projectile family and propellant model combination.

Let's see what this means in practice. For HE, if we measure an MVV for charge 4 green bag of -2.0 M/S, then the BCS will apply that -2.0 M/S to the standard MV for each charge.

Charge	Standard HE MV	MVV	Expected HE MV
1	208	–2.0	206
2	236	–2.0	234
3	276	–2.0	274
4	316	–2.0	314
5	376	–2.0	374

This application is based on the proven assumption that all charges in a propellant lot will have about the same DPICM HE MVV (±1.5 M/S) as that determined with a preferred charge. This relationship breaks down, however, when we try to apply it to DPICM. Assume we measure an MVV of –7.0 M/S for charge 4 green bag with DPICM. According to HE calibration procedures, we should be able to apply that –7.0 M/S to the standard MV for both charges 3 and 5, but Figure 2 shows this will result in a significant error.

Notice the computer solution in Figure 2 matches the R-1 solution for charge 4 but is in error for charges 3 and 5. This is because the AN-1 standard MVs in the computer are in error, thus the MVV determined for one charge of DPICM is not transferrable to another charge in that charge group when using BCS or BUCS.

To illustrate this dilemma, assume a unit calibrates with DPICM charge 4 green bag and measures an MV of 298.0 M/S (the standard DPICM MV for this charge.) The computer will use an MVV of –7.0 M/S for all green bag charges. When the unit fires charge 4 green bag at 5,100 meters, there's no error in achieved range. If they switch to charge 3 green bag, BCS computes a trajectory based on an expected MV of DPICM 256.2 M/S (263.2 –7.0), but the projectile actually achieves 261 M/S. The resulting error on the ground is a round that hits beyond the intended aim point by 155 meters.

The effect of this error is, that for all practical purposes, there are no preferred charges when calibrating DPICM for use in BCS or BUCS. Since the computer only can take one MVV per projectile family and propellant model combination, the operator must either (1) fire only one charge (calibrated charge), or (2) measure MVs for all charges and change them in the computer before computing data for *any* different charge.

As we continue, the problem is exacerbated. If both HE registration corrections and DPICM MVVs are in the BCS data base, the computer incorrectly applies the R-1 correction factor to the DPICM MVVs rather than the HE MVVs. Let's look again at our example of charge 4 green bag DPICM. The unit measured 298.0 M/S muzzle velocity, which BCS stores as a DPICM MVV of –7.0. If the unit also has an HE charge 4 registration on file, BCS will compute the firing data so the DPICM round impacts 300 meters beyond the aim-point. (See Figure 3).

Firing Data Discrepancies

The BCS can produce three different sets of firing data for the same target, depending on what information is in the data base. In the initial fire for effect, a 155-mm M109A3 battery firing at a target 5,100 meters away using standard meteorological data and an HE/M3A1 MVV of –2.0 can get the following three sets of firing data.

1. No Workaround

Conditions: No valid HE registration on file and no DPICM MVVs.

Firing Data: Charge 4 Green Bag, FZ Ti, Time 18.6, DF 3207, QE 378.

Results: Round impacts 189 meters short of the target.

By inputting "false" registration corrections for HE, the discrepancy is eliminated, as shown by the firing data in example 2.

2. Workaround

Conditions: Same.

Action: Input "false" registration corrections for HE.

HE: Range correction 0.
Deflection correction 0.
Fuze correction 0.

Steps for the BCS (Version 7) and BUCS Workarounds for 155-mm DPICM

BCS Workaround

Steps must be taken to ensure that BCS *Version 7 software* correctly applies DPICM MVV data in the determination of firing data with the M3A1 and M4A2 propellants. To fire accurately with 155-mm DPICM, do the following:

1. *Never* store DPICM MVVs in the data base when there's an AFU:REG on file. If an HE AFU:REG is on file for the appropriate charge and the registered propellant lot is specified in the FM:RFAF, the BCS will use the correct data to determine the DPICM firing data as long as there are no DPICM MVVs on file.

2. Input DPICM MVs (corrected M90 chronograph readout average) into the MVV file *only* if there's *no* HE AFU:REG on file and the five requirements for accurate predicted fire (accurate target location, battery location, ammunition and weapons information, meteorological data and computational procedures) can be met. *This MVV should only be applied to the charge for which it was determined*.

3. If the unit is *not* able to register or has met the five requirements for accurate predicted fire with shell HE, and DPICM MVVs are *not* available, a false HE AFU:REG must be generated. During data base construction, do the following for each charge to be fired:

   (a) Input and execute a dry-fire registration with the desired charge *and*

   (b) Display an FM:SUBS format; enter the target number, an 'X' in RARP and an 'X' in EOM; and then execute the format *and*

   (c) Display the AFU:REG and ensure the range, deflection and fuze corrections are 0.

   (d) Don't generate a false HE AFU:REG when firing M119 series propellants as the programmed MVs are correct.

4. Note that BCS Version 7 *cannot* adjust DPICM SR or process DPICM registrations.

5. In BCS Version 7, a registration is applied *only* if the charge, propellant lot and angle fire in the FM:RFAF format match those in AFU:REG.

BUCS Workaround

Unlike the BCS, HE residuals on file with DPICM MVVs in the data base create no special requirements. To determine accurate firing data in all possible situations with BUCS, meet the five requirements for accurate predicted fire *or* conduct a registration for the appropriate projectile family. If you can't construct such a data base, consider the following:

1. When there are no residuals or DPICM MVVs available, BUCS won't determine accurate DPICM firing data for M3A1 and M4A2 propellants. To provide more accurate firing data, establish HE residuals with a deflection correction of L0.1, RgK of 1.0000, and a FzK of 1.000 until actual residuals from an HE registration are determined. Don't generate false residuals when firing M119 series propellants as the programmed MVs are correct. Note: HE registrations and R-1 corrections are *not* applied to any *other* projectile in the DPICM family except DPICM.

2. If measured DPICM MVs (corrected M90 chronograph readout average) are available, they must *only* be applied to the charge for which they were determined. The DPICM MVVs that the BUCS determines will be used when either there are DPICM residuals or no HE residuals on file for that particular charge. This MV is applied throughout the charge group by the BUCS but must *not* of be used to compute firing data with any charge *other* than the one calibrated. In this situation, it's recommended that MVs for charges 5 green bag and 7 white bag be determined.

3. To more accurately determine firing data for the *entire* DPICM family of munitions, you must—

   (a) Meet the five requirements for accurate predicted fire (to include DPICM MVVs) *or*

   (b) Register with DPICM, as necessary.

Firing Data: Charge 4 Green Bag, FZ Ti, Time 19.1, DF 3208, QE 396.

Results: Effects on Target.

As this example shows, the presence of registration corrections causes the quadrant to increase by 18 mils (QE 378 to QE 396). The explanation for this is that BCS now uses the R-1 correction factor when HE registration corrections are present. Since the R-1 data is the best solution under this circumstance, the second set of firing data should achieve a target hit.

Good gunnery procedures call for measuring and using MVs from previous volleys. But in this case, you *don't* enter the MVVs from the DPICM volleys in the BCS as they'll create new accuracy problems. Example 3 shows the results of such actions.

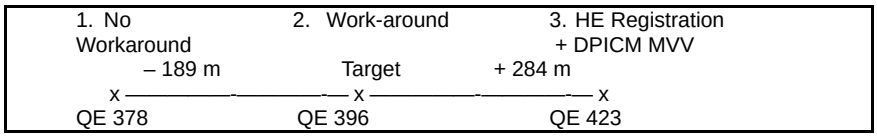

Figure 4: Comparison of Three BCS Situations, Showing Where the 155-mm DPICM will Hit in Relation to the Target.

3. Improper Application of R-1 MV Corrections

Conditions: HE registration and DPICM MVVs of –9.0 on file.

Firing Data: Charge 4 Green Bag, FZ Ti, Time 19.8, DF 3209, QE 423.

Results: Round impacts 284 meters beyond the target.

Note: the results in the three examples are based on ADD J-1, Table A, Column 4.

Now the quadrant increases by 27 mils. The reason is the BCS has misapplied the R-1 correction factor to the DPICM MVV rather than to the HE MVV. The result is a projectile impacting 284 meters beyond the target.

Figure 4 shows the probable results of firing each of the three situations. In these three examples, the BCS can generate firing data resulting in differences of up to 45 mils when aiming at the same target. Notice that all three of these sets of data are produced by the BCS operator using operating procedures based on the best available information.

BUCS Computations

With a standard data base, BUCS also generates an AN-1 solution that would result in short rounds. As with BCS, generating an HE registration enables the R-1 MV corrections. If all five requirements for accurate predicted fires are met, inputting false residuals (RgK 1.0; FzK 1.0; DfK L0.1) for the appropriate charge enables the R-1 corrections and results in accurate firing data.

BUCS, unlike BCS, *does not* apply R-1 MV corrections to DPICM MVs. Therefore, DPICM MVs and HE registrations can simultaneously coexist in the BUCS data base. An additional advantage of BUCS over BCS Version 7 software is its ability to register with DPICM SR, thus accurately determining data for the entire range of projectiles in the DPICM family. But BUCS (and BCS) *cannot* determine DPICM SR data in "area" adjust missions.

This article has been reviewed for accuracy by the Gunnery Department and Directorate of Combat Developments, Field Artillery School, Fort Sill, Oklahoma. Though BCS Version 9 software, resolves some of these problems, it still requires a DPICM workaround, which will be addressed in a future article. If units have questions about these workarounds, call the Cannon Division, Gunnery Department, at AUTOVON 639-2622/6224 or commercial (405) 351-2622/6224.

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View from the Blockhouse

FROM THE SCHOOL

TOE Update

PACs Changes

The Soldier Support Center at Fort Benjamin Harrison, Indiana, recently published guidance on the structure of Personnel Administration Centers (PACs). This structure will be incorporated into Field Artillery tables of organization and equipment (TOEs) and will be reflected in modified TOEs (MTOEs) in the near future.

The foundation of the new PAC structure consists of a PAC Supervisor, MOS 75Z; a PSNCO, MOS 75B; a Legal Clerk, MOS 71D; and a Personnel Administration Specialist, MOS 75B. The latter position is for unit support, publishing, typing, etc.

The PAC also will have an additional Personnel Administration Specialist for each 160 personnel in the unit. The soldiers filling these positions will perform standard installation/division personnel system (SIDPERS), awards, promotions and other similar functions. For a battalion of 425 soldiers, this will mean an additional three Personnel Administration Specialists.

The primary difference between the new structure and the old is the exchange of the 71L, Clerk Typist, for a 75B, Personnel Administration Specialist. This promotes cross-training among the PAC personnel.

BCS Installation Kits for Vehicles

Towed Field Artillery batteries converting from M561 1-1/4 ton trucks (Gama Goats) to high-mobility multipurpose wheeled vehicles (HMMWVs) must retain the battery computer system (BCS) installation kit MK-1831 (LIN: K46771, NSN 5895-01-134-2330) for the M561. The HMMWV installation kit isn't available at this time. Conversion kit MK-2301 (NSN 5820-01-200-9690) adapts the M561 installation kit for use in the HMMWV. Units can get them through normal supply channels at unit expense.

- Self-propelled Field Artillery batteries don't have this vehicle conversion problem. The BCS installation kit MK-1832 (LIN: K47021, NSN 5975-01-134-2328) mounts BCS in the M577 command post carrier.
- Field Artillery batteries in the Arctic need BCS installation kit MK-2554 (NSN 5820-01-246-1794) to mount BCS in the small-unit support vehicle (SUSV).

Met Sections Get BUCs

The backup computer system (BUCS) special basis-of-issue plan (BOIP) has been amended to include one per meteorology section. This change will appear in the 9010 consolidated TOE update (CTU) BOIP tapes. BUCS will provide the artillery meteorology sections the ability to produce a computer meteorological message from visually obtained data for input into the tactical fire direction (TACFIRE) and BCS systems.

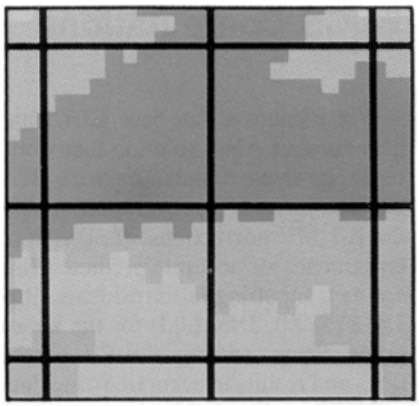
Intelligence Analyst Re-Added

An Intelligence Analyst E5, 96B, has been added to the intelligence section of all heavy division direct-support artillery battalions. This position was inadvertently deleted during a previous CTU. The addition of this individual will help the battalion perform its intelligence mission.

Questions?

Units with questions about this information or any others about TOEs and MTOEs should contact the Organization and Personnel Division (ATSF-COD), Directorate of Combat Developments, Field Artillery School, Fort Sill, Oklahoma 73503-5600, at commercial (405) 351-2726/5879 or AUTOVON 639-2726/5879.

Fire Support in Computer-Simulated Joint Exercises in Europe



Simulation Series

by Major Mark J. Lowery

The past 10 to 12 years have brought sweeping changes in almost every aspect of US Army operations. We changed from the 200-point officer evaluation report (OER) to the current system that has the dreaded pyramid. We lost the jeep and gained the high-mobility, multipurpose wheeled vehicle (HMMWV). New weapons systems have been introduced (the multiple launch rocket system for one) and old ones shelved (the Redeye for one). But nowhere has change been more apparent than in the area of computer simulations.

Computers have changed the way the Army trains for war. Before, we conducted a command post exercise (CPX) using a large map board with pieces moved by infantry and armor personnel. The FA commander positioned, moved and fired the artillery pieces and used a string to determine a weapon system's range. Computers kept account of the ammunition fired, gave a battle damage assessment for each volley and provided unit attrition data. Because each player was trying to shoot and move continuously, computer operators became overwhelmed, causing a two- to four-hour backlog on inputting fire missions into the system. Even with these problems, this was a vast improvement over using dice and assessment tables.

Joint Combat Simulations

We now have fully interactive computer simulations that replicate almost every aspect of war. Some simulations test the effectiveness of one weapon system against another. Others provide a means for commanders and their staffs to exercise against a "live" opponent with the combat action simulated by the computer. They allow an extension of CPXs and command field exercises (CFXs).

Currently, two computer simulations in Europe are used extensively in the CPX or CFX modes. They're the joint exercise simulation system (JESS) and the distributed war-gaming system (DWS).

JESS

The computerized battle simulation system, JESS, is designed to drive joint readiness exercises. The system supports Army staffs down to the brigade level and Air Force staffs to the Allied tactical operations center (ATOC) level. (The ATOC is a combined-forces air control center that might support several corps.)

The controllers provide a realistic interface between the training audience and the computer battle simulation. They accept orders from the trainees, enter them into the program and report the simulated battle outcomes to the trainees.

GWSM

The Warrior Preparation Center (WPC), a joint initiative of the US Air Force and Army in Europe, runs DWS. The Center provides senior NATO commanders a means to exercise army or group battle staffs at echelons above corps as if directing actual combat.

The distributed war-gaming system consists of several sub-simulations. One runs the air battle, one the sea battle, one holds the follow-on forces and one fights the ground battle. This article addresses the ground battle simulation, called the ground war simulation model or GWSM, which focuses on the use of fire support, and compares it to JESS.

Similarities

Despite their different missions, JESS and DWS are similar in their approach to fire support. For corps level and below, JESS provides better detail and ease of use while the ability of GWSM to maintain large data bases and large maps provides better echelons-above-corps training.

Similarities of both systems regarding fire support are that both—

- Have a fire mission order form listing the unit, weapon, ammunition type, number of rounds and target location.
- Can assign direct support missions where the computer automatically fires the artillery for each supported unit engaged in combat.
- Use a six-sided or hexagonal grid system, called HEX, to model the ground data. The road networks are between the centers of the HEX grids while the obstacles (rivers, mines, etc.) are along the edges of the HEXs.
- Interface players in a field location (or simulated field location) with controllers who enter the movement, fire and other orders for the units.

Advantages of Each

Even though both simulations use artillery in a similar manner, there are certain advantages each has over the other.

Advantages of JESS over GWSM are:

- JESS shows the grid system on the computer screen, while GWSM doesn't. GWSM requires cell participants to update two or more map systems constantly.

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It's harder to make units move in GWSM because it's difficult to locate the roads, bridges and obstacles for movements.

- JESS' interaction between the display and the command input is easier.
- The HEX grid system in JESS better displays roads, bridges, rivers and other obstacles on the screen. There's also a representative map of the terrain in the background.
- JESS has a shoot-and-scoot option crucial to the Field Artillery and shortens the time needed to input movement orders.
- JESS allows multiple impact points for each fire mission, thereby allowing us to attack a linear or dispersed target.
- The resolution of the JESS simulation is better than GWSM.

Advantages of GWSM over JESS are:

- GWSM allows for a greater number of participants.
- GWSM has a larger map data base and operates from numerous sites throughout the world.
- GWSM simulates deep operations and follow-on forces attack better than JESS.

Common Problems

Both simulations have certain problems that detract from the overall packages. The problems fall generally into two types. The first is over-generalizing aspects of fire support and maneuver. The second problem is errors in the computer programming that cause incorrect, improper and unexpected results. The second type of problem is generally corrected by the managers of the particular simulations. But the first set of problems impact on the fire support portion.

The resolution scale of the HEX grid system in the JESS and GWSM computer models is too large to allow standard shoot-and-scoot activities. In the JESS model, each HEX grid is three kilometers wide, and the GWSM HEX grids are 3.2 kilometers across. This doesn't allow for a jump of one to two kilometers, which a platoon or a launcher section might accomplish.

JESS doesn't play radars, and GWSM does a poor job of interjecting radar play into the simulation. Counterfire in GWSM is modeled as a fire mission percentage over a given period of time. This didn't work during a recent Allied exercise.

Neither simulation models the terrain very well. Line of sight is not considered, so it isn't an advantage to gain the high ground. The HEXs replicate either mountains, open, wooded or urban terrain, or some other movement-degrading characteristic. This punishes a small firing unit that could take tertiary roads between firing points quickly.

Another problem is reporting. Because each corps, division or battalion commander might have different emphasis, each generates different reports. Many of the required bits of information, although present in the computer simulation, are either hard to access or inaccessible to the user. For example, if the commander wants to know the number of missions and rounds fired, the operator must either track the data manually or query several reports to get the information.

A major problem plaguing both simulations is the slow response for battle damage assessments. The simulations assume a mission is "observed" if it is within one HEX of a friendly unit with observers. The observer generates a battle damage assessment at the time of the fire mission, but it doesn't reach the firing headquarters until the computer processes the mission, sometimes hours later.

Simulations' Effectiveness

With all the problems of the two simulations, one wonders if they model indirect fire accurately enough to be effective training tools for the commander. This question can only be answered when you consider the purpose of the simulations.

The purpose is to train battle staffs as if they were directing actual combat. The artillery does move, fire and attrit units and damage the enemy in battle. The purpose isn't to train the Field Artillery but to train the battle staffs of the combined-arms, multi-branch AirLand Army.

Future Improvements

In the future, simulation programmers will correct many of the existing problems. With more memory and faster computer processors, modifications to the simulations and new simulations will better model all aspects of the future battlefield. But programmers only can make changes based on constructive feedback from all participants in the computer-simulated exercises.

Fire supporters should notify the software programmers of errors and changes to be incorporated into the next version of the simulations. Commanders should remember the purpose and limitations of the simulations. Each response cell should be adequately manned with knowledgeable personnel.

Predicting computer technology for the next 10 to 20 years is impossible. Technology is changing so fast there might come a day when the large map boards of the past with small symbols representing units will be replaced with holographic map boards that allow the user to see only those units acquired in a real battle.

This is an exciting time for the Army and will prove challenging for everyone in uniform. Our future holds greater promise for increased readiness through the use of advanced computer simulations.

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