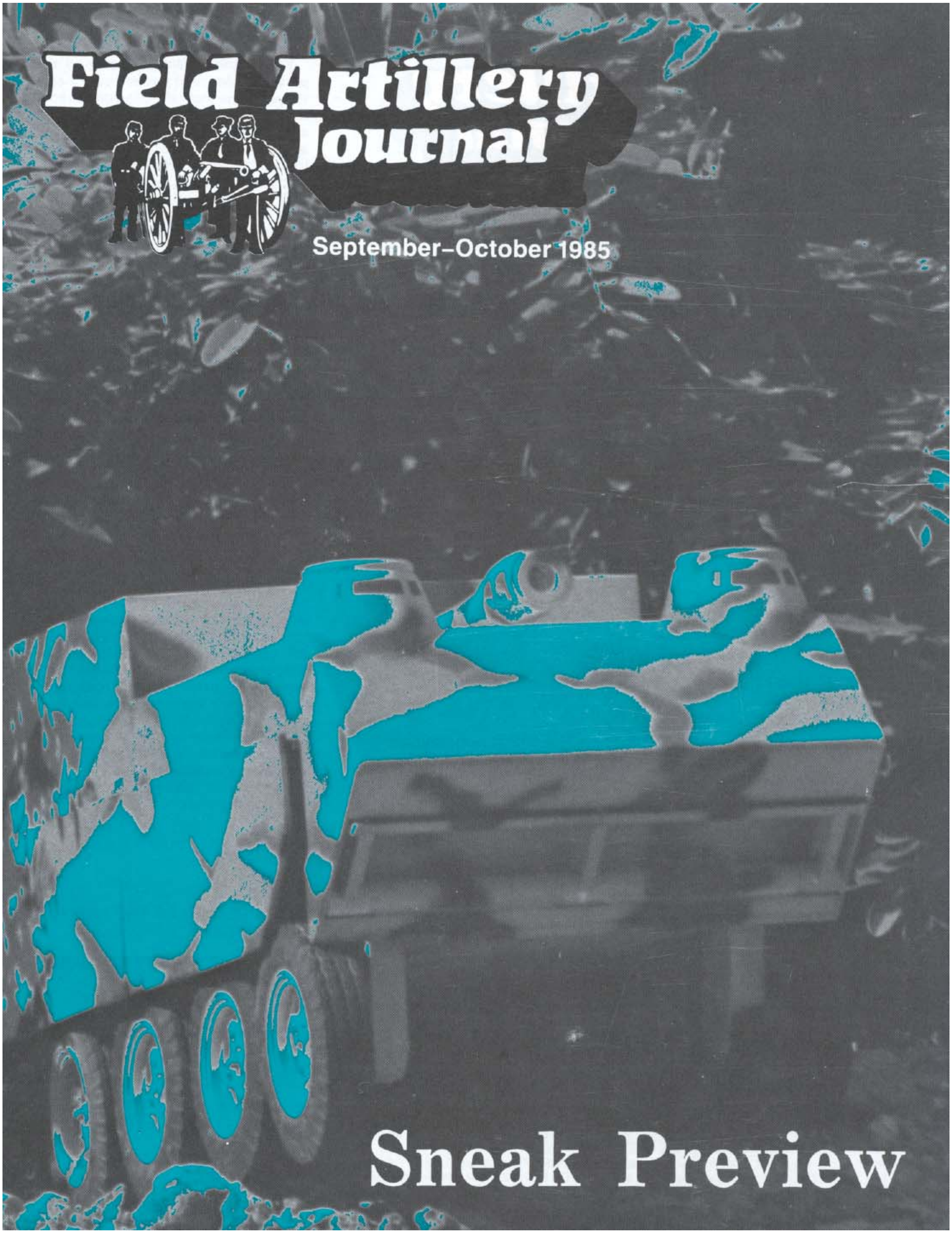
Field Artillery Journal

September–October 1985



Sneak Preview

Field Artillery Journal

Volume 53 | **September–October 1985** | **Number 5**

ARTICLES

FEATURES

Front cover photo by Sam Orr

The ***Field Artillery Journal*** (ISSN 0191-975x) is published bimonthly at the US Army Field Artillery School, Fort Sill, OK. Funds for printing are approved by Department of the Army. However, unless otherwise stated, material does not represent official policy or endorsement by any agency of the US Army.

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

SUBSCRIPTIONS: May be obtained through the US Field Artillery Association, P.O. Box 33027, Fort Sill, OK 73503-0311. Telephone numbers are AUTOVON 639-5121/6806 or commercial (405) 355-4677. Dues are $16.00 per year ($31.00 for 2 years and $46.00 for 3 years) to US and APO addresses. All other addresses should add $9.00 per subscription year for postage.

SUBMISSIONS: All letters and articles should be addressed to Editor, *Field Artillery Journal,* P.O. Box 33311, Fort Sill, OK 73503-0311. Telephone numbers are AUTOVON 639-5121/6806. Material submitted for publication is subject to edit by the *Journal* staff; footnotes and bibliographies may be deleted due to limitation of space.

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POSTMASTERS: Second-class official mail postage is paid by the Department of the Army, DOD 314, at Lawton, OK 73501. Send address changes to the *Field Artillery Journal,* P.O. Box 33311, Fort Sill, OK 73503-0311.

When Robert Walpole coined the phrase "balance of power" over 2 centuries ago he was reflecting on the strategic realities of his day. Today, his idea still has applicability but at every level of war and across the well-known spectrum of violence. National-level decision makers seek a *balanced* deterrent and war-fighting capability against a host of threats. Army force structure experts design *balanced* operational forces, and combined arms doctrine writers strive to produce tactics *balanced* with new systems. Their universal objectives are flexibility, effectiveness, and efficiency all wrapped-up in a single, yet slightly misleading word—balance. Their mission is certainly not stalemate; it is victory at the lowest possible cost in lives and materiel.

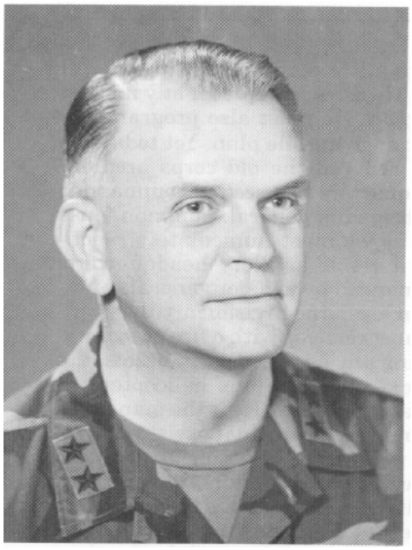
From cover-to-cover, this *Journal* focuses on the theme of achieving a desirable relationship—a good balance—between the capabilities of the Threat and our forces, between American doctrine and developments, and between fire support organizations and the maneuver units they support. It deals with the esoteric and exoteric; it seeks both conceptual and practical answers to thorny questions.

This issue challenges each of the *Journal's* quarter of a million readers to sit on the perch of judgment and weigh the factors that affect our balance. By using this issue to its full potential, fire support mentors have an extraordinary opportunity to train their charges about how our Army seeks through *balanced* concepts, doctrine, and developments to meet the challenges of highly disparate threats. This *Journal* gives Redlegs around the world a chance to come to grips with today's multifaceted "balance of power."

EDITOR

On the Move

MG EUGENE S. KORPAL



Every Redleg leader must understand and nurture AirLand Battle as both a concept and a doctrine.

Doctrine and developments are inextricably tied in a number of ways. Doctrinal principles describe how to employ newly-fielded combat systems on a contemporary battlefield. Emerging technologies trigger innovations in doctrine. But the essential tie that binds doctrine and developments is the Army's operational concept. Doctrine as well as training, organizational, and materiel developments evolve from core concepts—ideas which all Redlegs must understand and nurture. In fact, the operational concept can be likened to the seed from which the plant of doctrine and developments grows. Paradoxically, our current operational concept and the doctrine it has cultivated bear the same title—AirLand Battle. Every Redleg leader must understand and nurture AirLand Battle as both a concept *and* a doctrine.

This issue of the *Field Artillery Journal* focuses on the theme of doctrine and development. It invites professionals to "enter the net" and to pass along their thoughts on the shape of fire support on future battlefields. What follows is an outline of important points which artillerymen should keep in mind as they reflect and comment on the evolution of our branch.

As a general rule the need for an operational concept—a set of new guiding notions about how to fight future battles—derives from the recognition of a problem or mission for which no doctrine exists or from the emergence of a new, previously unexploited technology. For example, AirLand Battle as a concept is largely a response to Soviet echelonment and expanding Warsaw Pact capabilities. Army 21, our emerging operational concept, seeks to take advantage of technologies as we consciously work to meet the challenges that we may face in the early twenty-first century.

Ours is not the only nation that recognizes the utility of a concepts based system. The Soviets also have an operational concept. They believe that numbers win and place unflagging faith in the notions of mass, momentum, and continuous land combat. They too understand that concepts are the logical first products of any development process. They fully appreciate that concepts must be dynamic—changing as perceptions and circumstances alter.

Unlike concepts which are dynamic and unfettered by unit designs and existing materiel, doctrine generally describes how the Army fights with its available organizations and weaponry. Doctrine encompasses specific tactics, techniques, and procedures. It defines how weapon systems are integrated; how command and control and combat service support are provided; and how forces are mobilized, trained, deployed, and employed.

FM 100-5, *Operations,* 20 August 1982, is not only the embodiment of AirLand Battle as doctrine but also the explanation of the Army's current operational concept. AirLand Battle is doctrinal in the sense that it defines how today's Army will fight. It remains conceptual in the sense that it is guiding the Army from its present state through a transition which will yield new training, new combat systems, and new organizational structures.

FM 6-20, *Fire Support in Combined Arms Operations,* is the keystone doctrinal manual for the Fire Support Community. But unlike FM 100-5, FM 6-20 is not a statement of an operational concept as well. This is as it should be. Concepts look into the future, not merely at the present. They may contain innovative tactical or procedural ideas which are not executable with current organizations or materiel. For example, the "deep battle" is an integral component of the AirLand Battle concept outlined in FM 100-5. At present we lack the complete wherewithal to execute all aspects of this dimension of the AirLand Battle concept. Nevertheless we can still achieve significant deep battle results on any contemporary battlefield by using existing weapon systems. In fact, the current FM 6-20 describes how we can execute several aspects of the deep battle concept, and its future editions will provide new doctrinal precepts as more advanced systems become available.

The challenge for all professionals in the Fire Support Community is threefold:

- First, to execute AirLand Battle doctrine with precision and elan.
- Second, to create sound doctrine concurrently with the fielding of new organizations, materiel, and training.
- Third, to continue contributing to the development of imaginative operational concepts of fire support.

Only in this way can we be ready today and be confident in our ability to conduct an orderly transition of fire support to maneuver as our current AirLand Battle concept evolves to Army 21.

Incoming

LETTERS TO THE EDITOR

Doctrine and Development

An Army Out of Balance

On April 16, 1945, Marshals Zhukov and Konev launched the Soviet offensive against the main strength of the German Army on the eastern European front. It was supported by over 42,000 artillery pieces. The attack rolled on without interruption to Berlin. The leaders of the Soviet High Command viewed fire support as the primary requisite for a successful attack. That was World War II. What has happened since?

There has been a technological revolution since World War II in the development of firepower, giving it a new dimension and potency on the battlefield. The development of various missiles, guidance systems, target acquisition sensors, and "smart" submunitions has created what might be termed "The Age of the Guided Missile." The Soviets have fully implemented these advances into their materiel assets, doctrine, and command structure. The US Army has failed to keep in step with this Soviet progress.

Assets

The Soviets have developed and deployed a series of tactical missiles in Europe. In range, they blanket the North Atlantic Treaty Organization. They are capable of being armed with various warheads—conventional, nuclear, and chemical. Various guidance systems are employed. Our most recent effort consists of the multiple launch rocket system with a range of 30 kilometers—suitable for support of troops in contact only.

We must build a credible conventional deterrent and thus raise the nuclear threshold. A missile series capable of reaching the most distant Warsaw Pact air bases and supply installations is, in part, required. We have the technology to accomplish this, employing various guidance systems. Programs to produce the emerging multispectral sensors for target acquisition, as well as the various smart submunitions, now "on the shelf," must accompany this effort.

Also lacking at present is a modern "field piece" for the new light divisions. Forty years after World War II neither the Army's artillery nor the Marine's have come up with anything. Fort Sill is talking of improving the 105-mm howitzer. It *should* be put in a museum! We need an air-droppable, amphibious, high velocity, high rate of fire, lightly armored, *modern* field piece. We only talk of light division personnel problems. We have yet to produce a single light armored weapon carrier for this task.

The Soviets, by contrast, have developed a series of assault guns and could drop a complete light armored corps in the Middle East tomorrow if called for.

Doctrine

Soviet doctrine states that "strategic and tactical missile forces are the basis of the firepower of the land forces for defeating their enemy." The primary element of any Soviet plan for either attack or defense is the provision of adequate fire support. A study of Soviet World War II operations will show this most convincingly.

We have emphasized recently our new AirLand Battle doctrine which focuses on soldiers and not just the systems they use. This is certainly a fine personnel motivator. Lacking, however, is equal emphasis on the radical developments in those systems they use and the importance of their proper employment for their survival.

In our service schools, the primary importance of fire support and fire plans in all operations must receive increased emphasis. How often during World War II did we hear the G3 say, "Artillery, here's the draft of the attack order, please give us your paragraph"? Artillery, many times, was taken for granted in the *initial planning*.

Command Structure

Warfare can be reduced to two words—"fire" and "movement." The two most important positions in any ground command are the maneuver commander and his fire support commander.

The Soviets follow this logically by always ranking their "Chief of Rocket Troops and Artillery" as they term him, next in seniority to the maneuver commander.

The US Army has a different approach. Let's take corps headquarters. Here the artillery commander must create a fire plan integrating the air plan. He is responsible for any nuclear fire plan. He must also program any long range missile plan. Yet today, we have reduced the old corps artillery headquarters to a *section* commanded by a brigadier general. Common sense tells us we must immediately reactivate a viable artillery headquarters, commanded by a major general. At division level, the division artillery officer must come up with a fire plan, integrating any assigned corps assets, the tactical air plan, plus helicopters in the same air space. He is the maneuver commander's principal assistant. Yet, here we find two "floating" brigadiers while the artillery effort is the responsibility of a colonel. This is absurd!

The Soviet Army is *power-minded*. We have over-emphasized the development of our maneuver components. In view of the sensational technical advances in firepower, our Army must be brought into balance by a vital strengthening of our *fire support components*.

R. P. Shugg
BG (Ret) USA
Oakland, CA

Cost-Per-Tank-Kill Comparison

In December 1983, I was assigned to the Army Materiel Systems Analysis Agency (AMSAA) as a research and development coordinator. One of the projects I worked on was a "cost-per-tank-kill" comparison for various Army and Air Force conventional and smart munitions systems.

I learned that there is a relatively simple methodology for determining the total cost to kill threat tanks. The accompanying figure depicts the algorithm developed for the analysis. The total materiel cost-per-tank-kill is the sum of the munition cost to kill (number of shots per kill times cost per munition) plus a prorated share of the launch platform replacement cost. This prorated share is merely the platform replacement cost divided by the expected number of tank kills during platform's pre-attrition lifetime.

The forms of the algorithm shown express this methodology in units reflecting available data. Results can be determined parametrically in the absence of some data points. Note that the prorated share of platform cost is a function of the expected number of munitions (shots) available per day and, of course, the corresponding kills per day achieved by those munitions. Therefore, a system with a relatively low ammunition availability or expenditure rate is more severely penalized (in terms of prorated platform cost) than is a similarly survivable and effective system which can expend more ammunition per day.

Much has been said and written in recent months regarding the cost effectiveness and relative merits of engaging enemy tanks and units with various weapon platform and munitions combinations (particularly multiple launch rocket, joint tactical missile, and Air Force systems). It must be remembered, however, that the victor on future battlefields will be the combatant who best employs all assets available. The cost-per-tank-kill comparison clearly indicates that *some* Air Force systems are indeed more cost effective than *some* of the field artillery systems examined. However, will those Air Force assets be available when and where needed? Can we achieve the level of air superiority necessary for employment of those tactical air assets?

For a brigade or battalion commander involved in close combat along the forward line of own troops, the most important and indeed most responsive weapons at his disposal are his direct fire systems, mortars, and direct support artillery. Of the indirect fire weapons, mortars appear to be more cost effective than direct support artillery. This is due primarily to the characteristics of the smart mortar round analyzed and the significantly lower launch platform and munition cost. However, mortars cannot achieve the range of field artillery. Other firepower systems available to the division commander to influence the battle are attack helicopters, field artillery (cannon and multiple launch rocket systems), and allocated tactical air sorties. Not only can these systems immediately influence the main battle, but they can also attrite and shape enemy second-echelon regiments and divisions. It is not possible to state conclusively which of these division-level systems is the most cost effective because of the variability of engagement ranges and combat conditions. Field artillery weapons, however, are usually the most responsive.

$$\left[\text{TOTAL COST-PER-TANK-KILL}\right] = \left[\text{MUNITION COST-PER-TANK-KILL}\right] + \frac{\left[\text{PLATFORM REPLACEMENT COST}\right]\left[\text{PROBABILITY PLATFORM IS ATTRITED PER DAY*/SORTIE**}\right]}{\left[\text{EXPECTED NUMBER OF TANK KILLS PER DAY*/SORTIE**}\right]}$$

$$= \left[\text{EXPECTED NUMBER OF SHOTS PER TANK KILL}\right]\left\{\left[\text{MUNITION COST}\right] + \left[\text{PLATFORM REPLACEMENT COST}\right]\frac{\left[\text{PROBABILITY PLATFORM IS ATTRITED PER DAY*/SORTIE*}\right]}{\left[\text{EXPECTED NUMBER OF SHOTS PER DAY* SORTIE*}\right]}\right\}$$

*Per day for ground-based weapons.
**Per sortie for aircraft weapons.

A weapon's total materiel cost-per-tank-kill.

At corps level, tactical air assets and joint tactical missile systems can be used to interdict (destroy, neutralize, or attrite) units of enemy second-echelon armies. Degradation of the enemy's capability to sustain combat operations by attacking certain high payoff targets in either the first, second, or third echelons with appropriate weapon systems is imperative for successful defensive operations. Simultaneously, US forces will be provided opportunities for offensive operations.

Decisions on the battlefield regarding which assets will be used will be made by the tactical commander. Our mission as responsible artillerymen (particularly those Redlegs in the materiel development community) is to ensure that the best possible weapon systems are available to the commander to provide him the firepower and flexibility necessary for success in combat. Although some difficulty exists in obtaining data (primarily system cost and munition effectiveness estimates) on which all factions can agree, the cost-per-tank-kill methodology is an accurate means of making such system comparisons.

Billy R. Cooper
MAJ, FA
Aberdeen Proving Ground, MD

Redleg Circa 2050

If today's artilleryman were suddenly transported a relatively short span of time into the 21st century, he would not recognize his assigned duties. He would probably exclaim, "Star Wars technology is for real!"

Since the early 1970s, the United States has been conceptualizing the application of advanced technologies such as artificial intelligence to future artillery systems. Included in these investigations has been the potential for introducing autonomous operations, particularly for self-propelled howitzers. Through an evolutionary process, technologists have progressively increased the levels of sophistication of military systems. They have steadfastly stuck to the axiom, however, that any complexity that is introduced must remain transparent to the soldier who must use the system. In other words, the user or operator must be helped, not hindered; and supported, not frustrated.

Why autonomy? Why artificial intelligence? What's the payoff? Here are some of the benefits:

- Reduced crew size.
- Intermittent crewing.
- Executive control from a remote position.
- 24-hour full performance capability.
- Operational capability in a nuclear, biological, and chemical (NBC) environment.
- Enhanced survivability.
- Higher rate of fire.

Autonomy not only promises to relieve the manpower intensiveness

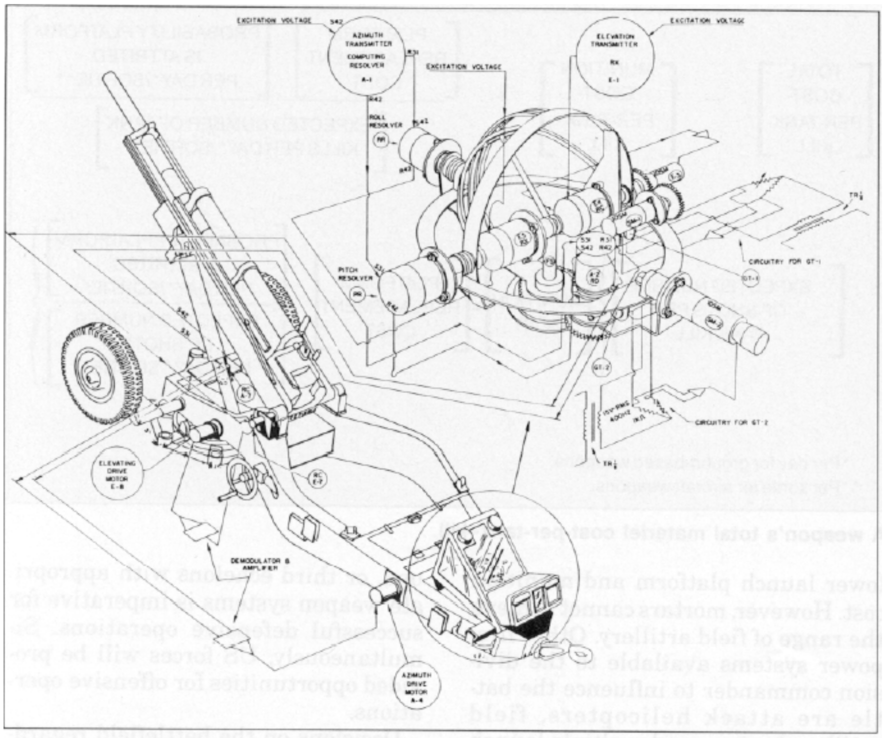


Figure 1. The automated aiming of field artillery control systems can be executed automatically without crew involvement.

that now exists but also to provide a more responsive weapon system. The ultimate goal is to put the human operator into a position where he is most efficient, where his time and energy expenditures are limited to making the decisions that help him achieve his mission, and where the burden of intermediate and routine decisions and tasks can be executed automatically without crew involvement unless there is a conscious decision that it is absolutely necessary for the crew to intervene.

Figure 1 depicts the first meager attempt toward reaching this goal. The components shown here are the adaptation of a rather unsophisticated servo-mechanism to compensate for weapon cant. This simple idea was enhanced in a series of test-bed demonstrators. Howitzer Test Bed I (HTB I) contained digital readouts that gave the operator visual information for manually laying azimuth and elevation. This led, in HTB III, to a capability to lay the weapon automatically using on-board navigation to obtain position location. In 1982 at Fort Sill, Oklahoma, HTB III demonstrated the potential for significant improvement in fire mission response. This test bed proved that a howitzer crew could receive a fire mission during a road march, pull into an unprepared firing position, and have an accurate first round downrange in about 30 seconds. The only action required by the crew was to monitor the system and load the ammunition. The weapon was automatically laid to the proper coordinates after the technical fire control computations were performed on board through microprocessor technology.

Figure 2. The chief-of-section display console of the test-bed weapon allows the howitzer to work directly with the forward observer.

Figure 2 is a photograph of the chief-of-section display console of the test-bed weapon. The on-board computer system allowed the howitzer to work directly with the forward observer through a digital communications link whenever tactical considerations made it appropriate. This is a significant time saver in fire mission scenarios.

The next generation test bed, now being developed, will take the concept of autonomy one step further by introducing robotics into the artillery combat scenario. Figure 3 is an artist's concept of the robotic demonstrator. The computer-controlled robotic arm will select the required projectile and propelling charge from storage racks within the howitzer and place them on the cannon's loading tray. The robot's software will be fully integrated with the weapon control system. This will permit charge adjustments or changes in projectile type that may be required to respond to the needs of the supported units. These adjustments will be handled automatically between the forward observer and the howitzer. In most cases, the howitzer crew will only oversee the operation. Such robotic hardware is scheduled to go through its paces in a laboratory environment during the first half of fiscal year 1986, and plans call for an operating test bed later in the fiscal year.

But what about this time-transplanted Redleg as he winds his way forward to 2050? Today he sees humans performing most functions manually. In the mid-term the crew has various aids for doing the job. And, finally the machine works virtually autonomously.

These technological advances will permit future gunners to exercise their prerogatives of oversight in the roles of tacticians, managers, and monitors. The humans will provide general mission-oriented goals, and machines with cognitive capability will analyze the immediate environment based on appropriate sensor input and make noncritical decisions without requiring further human intervention. The artillery system, learning to respond to its environment, will take necessary actions based on the prime directives developed and imparted by its manager.

This autonomous system will also possess the capability to execute self-maintenance procedures during noncritical down time. It will be knowledgeable of normal mean-times-between-failure for its components and subsystems and will be able to initiate its own preventive maintenance program to ensure a significant increase in availability. The system will routinely perform self-testing and will alert the human monitor to anticipated problems in those subsystems or components that must be serviced or replaced by the person in charge.

In summary, the artilleryman of the future will have the tools to do his job in a highly efficient and effective manner. Technology will be sufficiently mature so that routine tasks can be performed by an "intelligent" autonomous system. The human operator is left to do what he does best—develop the strategy and tactics to execute the mission and win. Today's time-transported artilleryman would not recognize his job in the year 2050 and beyond, but he would realize immediately that his changed role permits him to perform his job easier and with more efficiency. The technological capability to achieve such advancement is on the horizon.

R. L. Wrenn
Dover, NJ

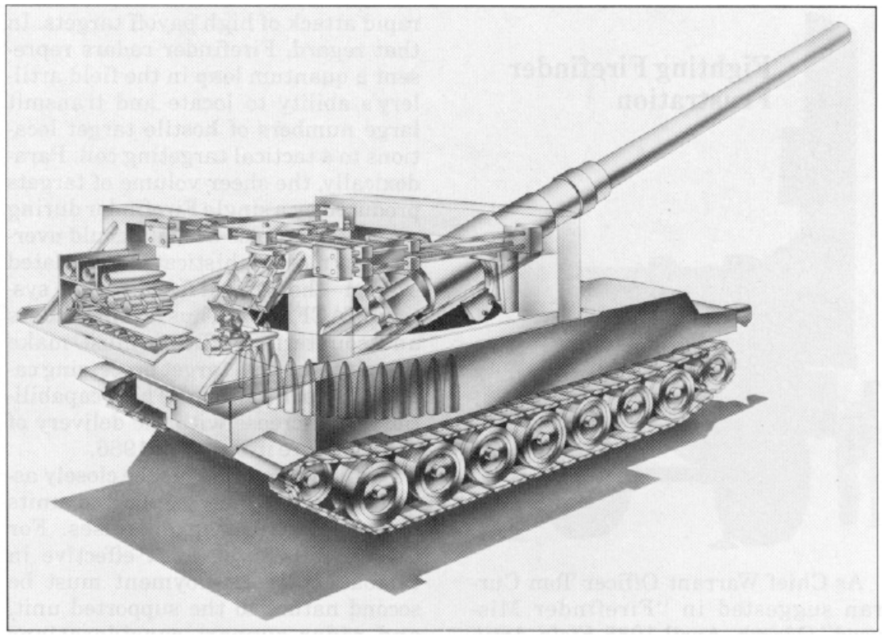


Figure 3. An artist's concept of the robotic demonstrator.

Target Aquisition

Fixing an Achilles Heel

The article "Doing Cueing" by Captains House and Hogue in the September-October 1984 *Field Artillery Journal* was most interesting.

As the writers point out, "Firefinder weapon locating radars are awesome" in their capabilities. Yet, we should not allow enthusiasm for such a sophisticated system to obscure the total picture. As the article points out, like any target acquisition system, Firefinder has its own peculiar limitations; or in this case, its Achilles heel.

Because "time on the air" from any position is closely limited by enemy electronic warfare capabilities in any reasonably active sector, moves will be frequent. Considering knockdown and setup plus travel times, any particular set will be out of action a large portion of the time. Moving large vehicles in the combat area, day or night, has its own hazards and delays. Also, depending on terrain and troop concentration, suitable sites may be limited or already occupied.

All of this is not to detract from Firefinder, but merely to emphasize that it is necessary to complement Firefinder for balanced coverage. More effort needs to be put into improving our *passive* counterfire location capability. This effort should not only provide specific targets, but it should also give some indication of the enemy pattern of operation.

There is no longer a capability of visual flash ranging. We have neither the personnel, appropriate equipment, nor adequate training for this operation. And even if we did, with modern flashless powders, a visual flash-ranging unit would hardly be "cost effective." The key word here is *visual*.

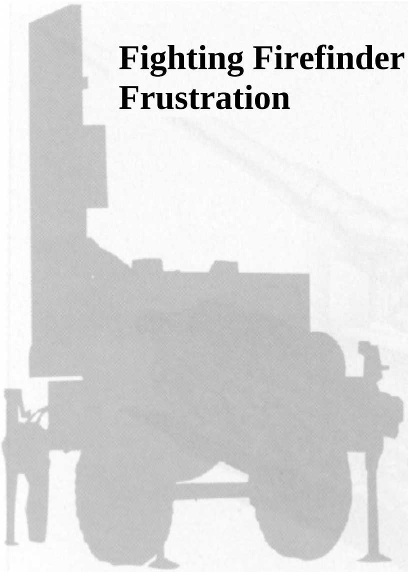
Although tests of infrared flash-ranging systems did not work out 30 years ago, it should now be possible to develop an effective system which would be nearly as automatic as Firefinder.

At present, sound ranging is the only passive counterfire system available. It has been suggested as a means of cueing Firefinder. For technical reasons this is a poor solution. Furthermore, if a sound record can be taken, we already have a location and there is no point in calling in Firefinder. Sound can usually get the first and sometimes only volley. But if the sound-ranging system is momentarily saturated, Firefinder would be an appropriate backup. In such a bombardment, a special cueing system hardly seems necessary.

Unfortunately, the development of sound ranging has been badly served in the past. This is not to say that there have not been numerous expensive research projects on the subject; but generally they have been poorly conceived. They were usually "sold," based on some computer model. Each system in turn was heralded as the final breakthrough until it came to field testing. After some disillusionment the experiment was abandoned, and we are now left with sound-ranging equipment and methods 40 years out of date. This is natural when research and development is not directed by men with field experience *and* technical qualifications. Although present concepts provide the basis for a workable system, there is much room for improvement in the associated recording and data processing equipment. (This does *not* imply "taking the man completely out of the loop.")

In summary, high priority needs to be given to research and development of *passive* means for counterfire locations to complement Firefinder. The present basic system of sound ranging should be modernized without wasting resources on reinventing square wheels. Infrared flash ranging should be reconsidered in light of more recent technology, but visual flash ranging should be entirely deleted.

Arthur R. Hercz
COL(Ret), FA
Ann Arbor, MI



Fighting Firefinder Frustration

As Chief Warrant Officer Tom Curran suggested in "Firefinder Misused" (March-April 1985 *Field Artillery Journal*), we *must* ensure the rapid attack of high payoff targets. In that regard, Firefinder radars represent a quantum leap in the field artillery's ability to locate and transmit large numbers of hostile target locations to a tactical targeting cell. Paradoxically, the sheer volume of targets produced by a single Firefinder during periods of intense activity could overload our most sophisticated automated system—the tactical fire direction system (TACFIRE). Thus, commanders and counterfire officers must make use of the tactical target processing capabilities of Firefinder. These capabilities will increase with the delivery of new software in January 1986.

Firefinder radars must be closely associated with their supported units during all training exercises. For these radars to be most effective in combat, their employment must be second nature to the supported unit, and radar support considerations must be integrated into the supported unit's standard operating procedures. Radar crews must be required to practice their combat mission of hostile fire target location. Commanders should not slip into the syndrome of simulating radar usage during field training exercises and employing the radars solely for administratively observing the impact for Army Training and Evaluation Program grading or inclement weather safety purposes. Certainly, Firefinder needs to perform these valuable administrative missions. In combat, however, less than five percent of the radar's time will be used on friendly fire missions.

Firefinder crews need to train as much as possible as a part of an integrated fire support system to perfect their target locating skills. They need to train as they will fight.

Rex H. Hampton
MAJ, FA
Fort Sill, OK

New Thoughts on Old Issues

Artillery History Well Handled

Captain John C. Whatley's article, "Artillery Well Handled" (May–June 1985 *Field Artillery Journal*), raises the question of the utility of history. Captain Whatley provides a vicarious experience for the reader as he explains how the Confederate and Union armies performed at Spotsylvania in May 1864. Is this important for the soldiers of the 1980s? I believe so!

As the Army moves further in time from the Vietnam War, it finds that many company grade officers who pass through the Army's service schools lack any combat exposure. Reading good books about battle may provide them the vicarious experience they lack in fact. Whatley's article is a good example of history furnishing such second-hand experiences.

Reading military history also gives the reader another important return on his investment of time and effort. The diligent reader can learn the lessons of the past. Studying history provides an excellent opportunity to learn about past mistakes and successes. For example, Europeans discounted the military experience of the American Civil War and attributed the appearance of trenches and high casualty rates to inexperienced officers. They even labeled Americans as "rank amateurs." Little did the Europeans realize that improved technology created by industrialization had led to the trenches and high casualty rates. Failing to learn the lessons of the American Civil War, the Europeans did not fully understand that tactics had to change because of improved technology. In consequence, they employed tactics that had failed in the American Civil War and bled themselves dry on the battlefields of World War I.

Studying history furnishes still other benefits. It fosters professional growth by giving the reader a better understanding of the development of current tactics, strategy, and doctrine. Moreover, it encourages critical thinking which is essential to success. Equally important, studying history teaches the reader that there are few if any absolutes. This appreciation fosters flexible thought.

Whatley's article provides the reader with a brief albeit good introduction to the uses of history, but "Artillery Well Handled" should be just the beginning. By reading history, the serious student gains valuable experiences and broader perspectives which are invaluable in today's world where specialization rules and individual horizons become narrowly focused.

Dr. Boyd L. Dastrup
Branch Historian
USAFAS, Fort Sill, OK

Doing Better Business

I was glad to see Captain Blaise X. Schmidt and Major Lawrence E. Broughton's article "We Mean Business. . . ." in the July–August 1985 *Journal*. With 56 percent of today's tube artillery in Reserve Component (RC) units, it is of the utmost importance that our reserves be trained and ready to go into combat.

Unfortunately, the Reserve Component Field Artillery Training Model (RC FATMOD) proposed by the authors is nothing new. Reserve Component units have been writing yearly and 3-year training plans for quite some time. Some of the things mentioned in the article are included in virtually every good yearly training plan while others have been tried and proven to be ineffective. Here are a few additional insights for RC planners.

• Document 350-XX, *Standards in Training Commission* (STRAC), out lines a training strategy for all units. This publication suggests that commanders conduct live fire exercises throughout the year to prevent a unit from having peaks and valleys in their training readiness. I suggest that this is more appropriate than the RC FATMOD for training a unit for combat. In fact, the STRAC training strategy has been evaluated by units and proven to work.

• TC 21-5-7 describes the battalion training management system (BTMS) approach to training and affords every commander step-by-step guidance regarding the development of a yearly training plan. BTMS is an excellent approach to training and allows a commander freedom to develop his own plans and make his own assessments.

• The amount of assistance that a Reserve Component commander has available is dependent upon many factors. These include the unit's major training objectives; whether the unit is a roundout, affiliated, or partnership unit; the quality and work load of advisors and readinesss group assistance; and the dictates of higher commands. Requests for assistance must consider all of these parameters.

• Annual training (AT) is the prime training period for Reserve Component units. This 15-day period must be used for training collective tasks. This 15-day period must be used for training collective tasks. It should not be used to train on a task such as small arms firing which could be done during inactive duty for training (IDT) at home station.

• Unit commanders are authorized additional training assemblies to plan for drills. These training assemblies enable a commander to complete the planning of a drill with his key personnel. This planning must occur several weeks prior to a scheduled weekend drill.

The authors' Field Artillery Training Model does recognize that each commander has many tools to plan his training and notes the tremendous assistance available through readiness groups. Unfortunately, it assumes that all units need the same training. It removes the commanders' flexibility, and that is a major flaw.

Johnny L. B. McWhirter
LTC, ARNG
Fort Sill, OK

Chewing on Korean Capers

I agree wholeheartedly with Major M. Thomas Davis' article, "Korean Capers: Tactics for Exploiting the Terrain" (May-June 1985 *Field Artillery Journal*), in which the author very aptly points out the pros and cons of using the Korean topography in tactical situations confronting self-propelled artillery units.

However, several other factors occurred to me regarding positioning of the M198 howitzers now in Korea. I believe these additional thoughts warrant every tactician's consideration.

• First, units in Korea have apparently discarded the use of high angle fires and reverse slope positioning to enhance survivability. Obviously, they have wrestled with the question of which is more important—living to fight another day or realizing maximum range capabilities. They have sought a compromise through the use of urban terrain.

• Second, with the fielding of the M198 in Korea, several additional problems have arisen. Because of the narrow berm-like roads, the wide wheel-based M198 has often been "high centered" on the road. The result is damage to the equipment. This limitation must be very carefully considered during route reconnaissance and position selection.

• Third, positioning within villages has significant advantages and disadvantages. The villages are normally constructed of highly combustible material. Moreover, these same villages which lend themselves to camouflaging self-propelled artillery restrict the movement of towed artillery. Invariably, they have roads no wider than paths as well as many dead-end streets. Although they conceal support vehicles well, such layouts play havoc with the M198.

I feel that Major Davis' article adequately addressed positioning considerations within Korean villages for self-propelled artillery. However, it did not fully consider the problems facing the division's M198 battalions.

One final note regarding communications problems caused by compartmented terrain—perhaps we should consider providing each direct support battalion communications platoon with a second retransmission capability. This would dramatically facilitate communications at a relatively small price in personnel and equipment.

Richard L. Holsinger
SFC, USA
Fort Sill, OK

Speak Out
The *Journal* welcomes and encourages letters from our readers. Of particular interest are opinions, ideas, and innovations pertinent to the betterment of the Field Artillery and the total force. Also welcomed are thoughts on how to improve the magazine.—*Ed*.

Command Update

NEW REDLEG COMMANDERS

COL Richard W. Tragemann
101st Airborne
Air Assault Division Artillery

COL Robert A. White
Grafenwoehr Training Area

LTC Stanley E. Griffith
4th Battalion, 3d Field Artillery

LTC Danny L. Crawford
1st Battalion, 29th Field Artillery

LTC David E. Bronner
1st Battalion, 41st Field Artillery

LTC Peter A. Eschris
570th Artillery Group

LTC Leonard Russ
3d Cannon Training Battalion

LTC Theodore R. Coberly
5th Training Battalion

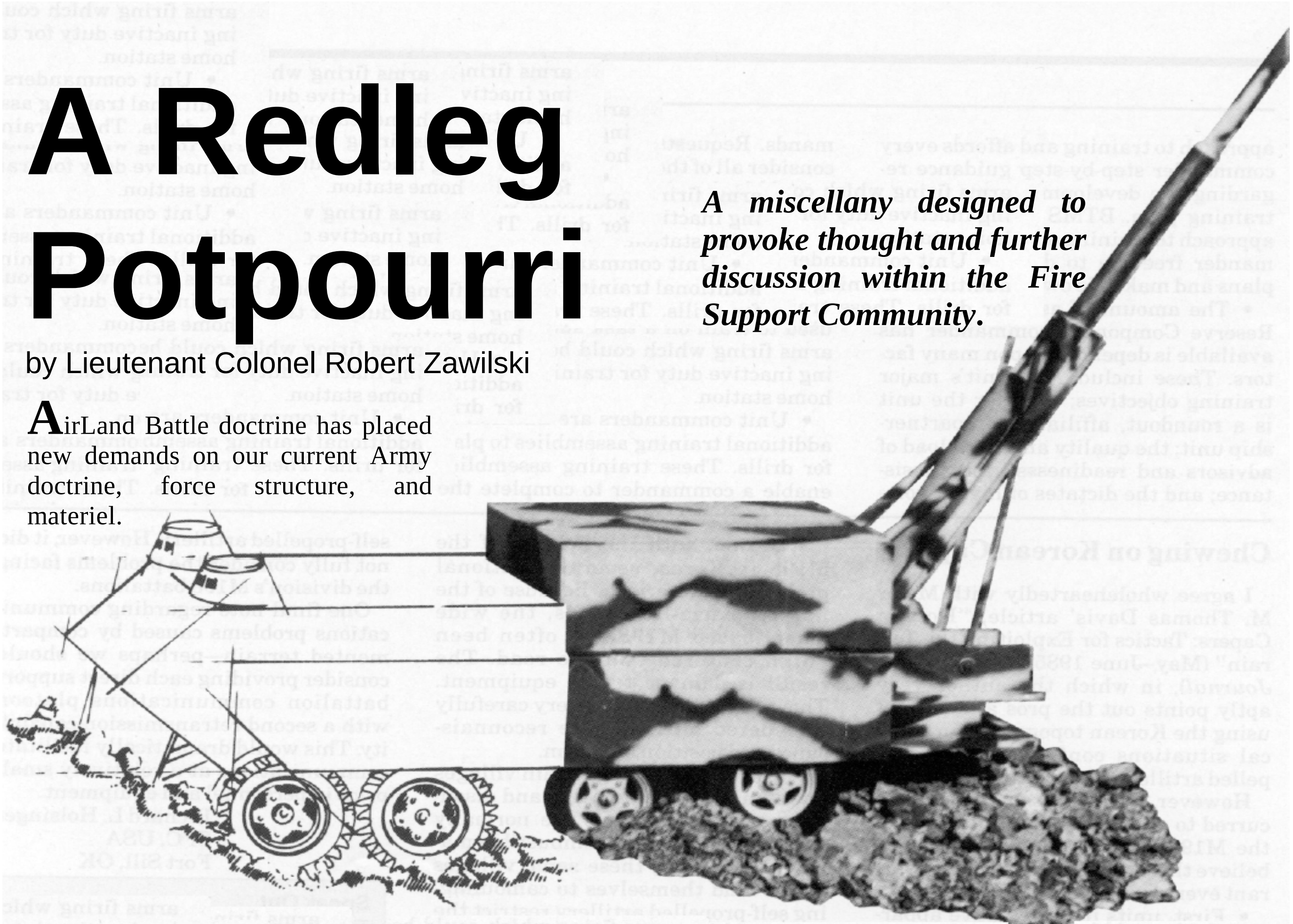
In the May-June 1985 issue of the *Journal*, the Commander of the 3d Battalion, 34th Field Artillery should have been listed as LTC Robert T. *Pavlak*.

A Redleg Potpourri

A miscellany designed to provoke thought and further discussion within the Fire Support Community.

by Lieutenant Colonel Robert Zawilski

AirLand Battle doctrine has placed new demands on our current Army doctrine, force structure, and materiel.



The purpose of this article is to present a wide range of doctrinal, force structure, and materiel concepts for consideration and discussion within the Fire Support Community. The resulting miscellany is designed to provoke thought and further discussion.

Many of these concepts stem from work done at the Army Development and Employment Agency (ADEA) in support of the development and refinement of the high technology motorized division (HTMD) concept—the evolutionary goal of the 9th Infantry Division (Motorized). Others predate the HTMD concept and have their roots in the fire support mission area analysis (FSMAA) originally published in 1980.

Fire Support's Contribution

Fire support agencies in general and the field artillery in particular experience difficulty in responding to the question: "What is your contribution to the combined arms team?" The normal answer is couched in terms of the direct effects we can produce—destruction, disruption, and so on. Because our antiarmor capabilities are increasing, such answers usually lead to heated discussions focused on the relative preeminence of fire support or maneuver. Although intellectually stimulating, such conversations regarding "turf" have little or no utility. In fact, they can harm our relationships with the rest of the combined arms team.

Another often advanced answer focuses on a different set of terms—close support, counterfire, interdiction, suppression of enemy air defense, and other fires. Using this vocabulary, the fire supporter then appears to be speaking from behind the veils of mystery. As the distinctions between types of fires fade, the mysterious vocabulary becomes highly suspect.

A better way to respond is in terms of force survivability. Fire support enhances force survivability and constitutes a risk abatement measures that commanders can use to increase their organization's chance of survival. Field artillery units simply exist to enhance the force's survivability and should be employed as such.

The survivability "payoffs" range from the immediate—suppress an antitank guided missile site—to the deferred—strategic bombing or interdiction. But the bottom line is that fire support permits the maneuver commander to take calculated risks with some of his force because he has a degree of assurance regarding the whole force's survivability. The confidence maneuver commanders have in fire support agencies relies heavily on how well the latter can command and control their delivery units. Capable, resilient, centralized control of units which can quickly respond breeds confidence.

Command and Control Concepts

Command and control (C^2) superiority is at the very heart of AirLand Battle doctrine. Nowhere is the Fire Support Community more challenged than in the development and fielding of (C^2) procedures and materiel. This is particularly true in the area of fire support control and coordination and in the subarea of field artillery command and control.

The Advanced Field Artillery Tactical Data System (AFATDS) responds to two main problems with our existing tactical fire direction system (TACFIRE) based command and control.

First, our current (C^2) procedures do not fully support AirLand Battle concepts, and second, the existing hardware is old, large, power consuming, unfriendly, and inflexible. Because of differing time perspectives, developers who look to the future see the first as the more critical fault, and soldiers concerned with day-to-day readiness focus on the second.

Our current command and control system is inadequate in supporting the AirLand Battle doctrine. One key word—targeting—makes this painfully apparent. Our processing system is initiated by the acquisition of a target. It treats each target as a various entity requiring a human decision. This situation is acceptable in an environment of limited targets and generally available fire support. However, as discernible targets increase dramatically and as fire units and munitions availability become relatively constrained, the current processing system becomes a hindrance rather than a help. We need command and control systems and procedures that organize appropriate information, identify the critical decisions and options to the decision maker, and then assist in executing the decision. To use an analogy, the current procedures force the decision maker to drink from a garden hose pumping out various targets. Continuing these procedures into the future will require an increasingly larger hose, and may well drown the drinker. The last thing the decision maker needs is a high pressure pump to force more targets through the hose, but that's what will happen if we continue our current procedures. Our objective must be to limit the focus to the most critical targets.

The AFATDS program attempts to expedite and ease decision making by first identifying the essence of what we must do to win and then fielding an appropriate automated system.

Developing such a system requires a complex effort. AFATDS will solve both the procedure and equipment problems, but by its nature the program will take time. The vast majority of that lead time is required to lay out the operational requirements. Hardware solutions are available today and better ones will be available as the procedures evolve.

The Army Development and Employment Agency has initiated a program to provide an interim hardware solution. The system, called light TACFIRE (LTACFIRE), downsizes all battalion mainframes. Figure 1 provides an illuminating example—a battalion fire direction center mounted in a high-mobility multipurpose wheeled vehicle (HMMWV). ADEA will take delivery of LTACFIRE in 1986 for use by the 9th Infantry Division (Motorized). Actions are also underway to downsize the division artillery mainframe.

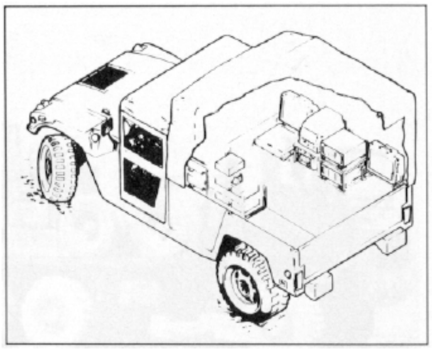


Figure 1. A battalion fire direction center.

Those involved with the development of each of these "high-tech" command and control systems often encounter skeptics who invariably recite "Murphy's Law" with reverence—assuming that anything that can go wrong *will*. The views of such dissenters warrant thoughtful consideration, but they need not spell the doom of automated command and control. We can build resiliency into our modern systems.

Degradation and Reconstitution Concepts

Today and tomorrow's field artillery command and control concepts continue to rely heavily on electronic communications. Field artillerymen give little thought to operations in an environment without electronic communications. To illustrate this point, let's go back to your beginning as an artilleryman.

The scene is Rabbit Hill on a clear summer day. This is your introduction to the "Sport of Kings." To your rear you can make out the line of metal. All is well, but then, radio communications and backup wire communications are lost. Everything stops while the focus is on reestablishing "commo." It seems odd, you can see the target and the guns, why did the whole show grind to an abrupt halt? Subtly you learn a dangerous axiom: "This system does not function without electronic communications."

Extended to a greater scale, this axiom equates electronic communications to ammunition; without it we can't contribute to the battle. Is this the case? From a doctrinal perspective it appears to be. Our tactics, techniques, and procedures fail to provide ways to deliver support below the electronic communications threshold. But is this the appropriate threshold or simply one to which we have defaulted? I think our threshold for effective support is lower than the current communications level.

I contend that the field artillery should cease to contribute to the battle only when its weapons are engaged in self-defense. Of course, you could argue that we still contribute by tying up enemy combat power. However, at that point we have no offensive power to offer the combined arms team and are, therefore, essentially negated. The point is that a gap exists in our doctrine between what we currently perceive as the threshold and what is the true threshold.

A technique to bridge the gap, when "commo is out," would be to reconfigure our supporting relationships. For example, a direct support battalion's fire units could quickly move forward to establish visual communications with a fire support team and continue to fire under its direction. Likewise, general support units could either fire targets that have been preplanned for communication loss or take direction and accept fire missions from a nearby fire support element to support the battle plan.

This proactive, aggressive perspective stems from the concept of degradation and reconstitution. I leave you to study the dictionary definitions. But if you interpret a system to mean an organized entity like your body, the telephone network, or the field artillery system, degradation is the negative effect of reality on that system. These factors could be colds or injury affecting your body, windstorms interrupting the telephone network, personnel shortfalls, and deadlined equipment constraining the fire support system. Reconstitution represents the action taken to provide a temporary fix and to initiate a permanent fix.

Why bother with such an apparently superficial abstract concept? Why don't we rely on experience? After all, given a situation, we can always come up with an *ad hoc* solution. Two reasons abide. First, because abstract prior planning forces the decision makers to back off and consider the complexity and depth of the whole system and its interrelationships. The system becomes something akin to an "onion." The core is the operational baseline and the layers are prioritized degradations; that is, the decision maker can now decide in advance procedures to reverse or reconstitute each layer. The process forces him to come to grips with some of the basic assumptions of the system, such as "This system does not function without electronic communications. Now wait a minute, maybe to some extent it can."

A second reason for some mental onion peeling is that in the command and control world we must document a concept for degradation and reconstitution to serve as a backdrop for our increasing automation of functions. Without this documentation, our system will be designed to break where the system analyst chooses; or worse, the system will continue to try to meet unachievable goals until it suffers a catastrophic failure. A failure could be over something as trivial as trying to pass "nice to have" data (such as administrative reports) that in a manual world we would have disregarded during a surge period.

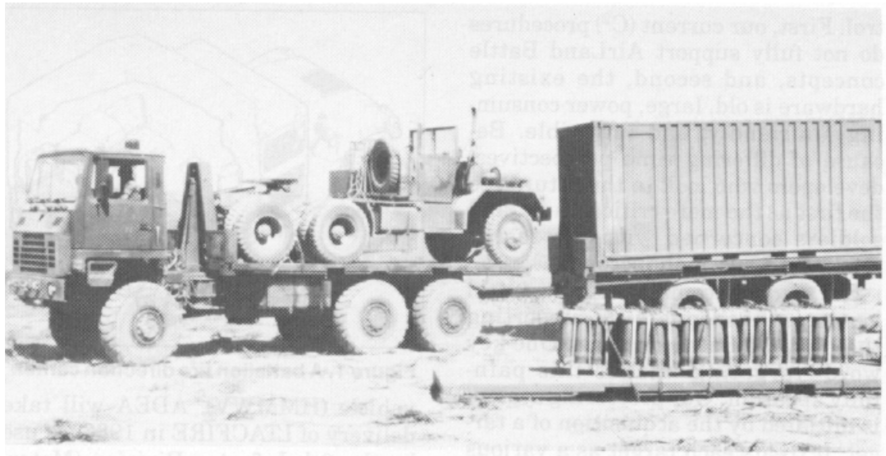


Figure 2. The British palletized load system under study by ADEA.

Communications Concepts

Army Development and Employment Agency materiel developers are working on one other significant project that offers more reliable communications through redundancy and command post survivability. The mechanism is remoting the transmission signature through the use of a tactical command, control, and communications vehicle (TC^3V). This HMMWV-based vehicle contains improved high frequency, single channel ground and airborne radio subsystem (SINCGARS) FM, and tactical satellite radios. The system also has a low-power, directional radio to "remote" the TC^3V to the actual command post. The TC^3V is totally self-contained and can operate on the move. In consequence, it presents a continually changing picture to direction finders. The TC^3V can operate as much as 8 kilometers from the command post. The 9th Infantry Division (Motorized) objective force structure includes one TC^3V for each field artillery battalion as well as one at division artillery headquarters. Unfortunately, innovativeness in the development of command, control, and communications concepts and systems has not been mirrored in the Fire Support Community's light howitzer initiative.

Light Howitzer Concepts

We have not been very bold in our approach to light howitzer concepts. Our need is generally stated as an all or nothing approach. For example, "The howitzer must be UH-60 liftable and fire at least 18 kilometers." This highly generalized statement leads developers to try to achieve both standards, and when they can't, the tradeoff occurs in either range or liftability.

A better approach is to tell the developers what our requirements are for various phases of combat operations and the allowable transition time between the phases. Various possibilities then become available in the near term.

One such option is to use a ballasted howitzer. That is, a howitzer that is capable of airlift and firing at reduced ranges—say 8 kilometers—but, with the addition of ballast (water or sand) to tanks on the recoiling parts, can achieve the desired range when in position. To prepare for an air move you simply drain the tanks. This ballast would have an additional benefit of mitigating the gun tube thermal signature.

Another possibility is to build a howitzer along the lines of the Lance zero length launcher (ZLL) concept. The howitzer could then be fired at maximum range when in place on its parent wheeled vehicle. But, when required for air assault missions the ZLL-equivalent portion of the howitzer could be airlifted and operate under the restrictions of limited ground mobility and range.

In whatever configuration our future delivery systems are, they will require enhanced logistical support to be effective on the AirLand Battlefield.

Logistics Concepts

One particularly impressive support concept is the palletized load system (PLS), a system being examined by the British under the name demountable rack off-loading platform (DROP). ADEA has leased the British equipment shown in figure 2 to examine its capabilities. The system consists of a truck and trailer. Each can transport an 8- by 20-foot flat rack capable of carrying 15 tons of equipment or supplies. The truck has a hydraulic arm that self-loads the flat rack. The truck's arm slides a flat rack on to the trailer. All this comes from a truck that weighs essentially the same as the current United States 5-ton truck.

The primary palletized load system application for the field artillery is in Class V resupply. The system will accommodate up to 360 complete 155-mm rounds per truck and trailer combination compared to 80 complete rounds for a current 5-ton truck and trailer. Trailer. Every truck in an ammunition convoy could upload preconfigured flat racks at an ammunition transfer point (ATP) in less than 15 minutes. This contrasts quite favorably to 4 hours now required to load a 10-truck convoy of 5-ton trucks at an ATP which requires considerable material handling equipment. The palletized load system truck can also evacuate damaged equipment as back-haul, thus eliminating the penalty of evacuating a damaged vehicle with an operational vehicle.

The palletized load system concept also has the potential to revolutionize our tactical shelter program. This system is dimensioned to haul the MILVAN and "Sea Land" containers used to bring supplies into theater. This gives us the opportunity to "recycle" the containers into shelters through the use of interior and exterior applique kits. An M198 crew, for example, could use the containers as a section shelter. The applique for this shelter would include exterior armor and overhead protection for the firing crew, as well as interior seats and ammunition lock downs. Other Army applications could include command posts, field hospitals, and maintenance facilities.

The second vehicle concept being investigated by ADEA is the trailing arm drive (TAD) vehicle. This seemingly simple vehicle concept uses a common undercarriage with a specially configured payload to suit the needs of the user. Figure 3 shows an AN/TPQ-36 system placed on a TAD chassis the size of a HMMWV or commercial utility cargo vehicle. This results in a significant change in support requirement from the current AN/TPQ-36 system which consists of two 2½-ton trucks and trailers. Moreover, such integration actually increases the operational capabilities of the AN/TPQ-36 in terms of air and ground mobility, reduced shock to the electronics, faster emplacement and displacement, and improved system survivability.

The flexibility of the chassis which became apparent during testing is illustrated at figure 4. Here the chassis provides the base for a motorized version of the M198. This concept gives up the marginal capability for CH-47D air mobility, but it provides superior agility, mobility, and survivability. A single statistical assertion underscores the remarkable agility of the TAD concept: The contractor estimates a total elapsed time of 6 to 10 minutes for the system to emplace, fire 4 rounds, displace 1 mile, emplace, and be prepared to fire. This is in contrast to 23 to 30 minutes required for the current 5-ton truck and M198 combination.

ADEA has not confined itself to strictly material developments. It has also tackled challenging force structure and doctrinal issues.

Ground Laser Locator Designator Tactical Concepts

ADEA and the 9th Infantry Division's (Motorized) examination of tactical employment of ground laser locator designators (GLLD) offers a case in point. Most previous studies have focused on the technical rather than tactical aspects of the GLLDs. The 9th Infantry Division (Motorized) objective force design has 47 field artillery combat observation lasing teams (COLT) and 27 infantry COLTs. These are broken down within the nine maneuver battalions as follows—one COLT per field artillery fire support team and two field artillery COLTs under the control of the battalion fire support officer as well as three infantry COLTs for the precision guided antitank missile system (PGATM) in each maneuver battalion. The remaining two COLTs are distributed to the ground cavalry troops.

Each COLT consists of two men with the GLLD mounted in a fast attack vehicle (FAV). This vehicle gives the team the agility and mobility to maneuver

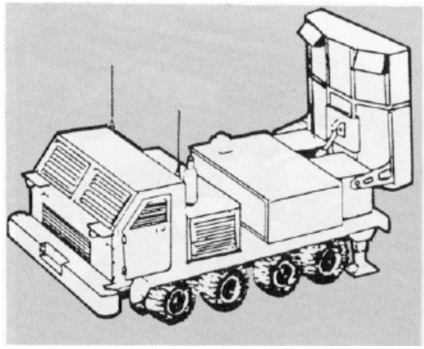


Figure 3. The AN/TPQ-36 system mounted on a trailing arm drive vehicle.

into good observation positions and keep up with the supported force.

Paradoxically, the COLTs provide their best support to a maneuver company by remaining physically separated from it. That is, the COLTs operate best using bounding overwatch. Such tactics permit the team to be in position and to support during the critical transitions of the maneuvering force—occupation, engagement, and displacement. Moreover, the tactics provide early warning, engagement, and fires in support of breaking contact.

The limited 1,500 to 3,500 meters range of the COLTs effective, survivable envelope and the underlying speed of the supported maneuver forces encourage the COLTs to operate in leap-frogging pairs for mutual and continuous support. For example, a COLT can hand off a mission in progress to its partner and then displace to a new survivable and effective position.

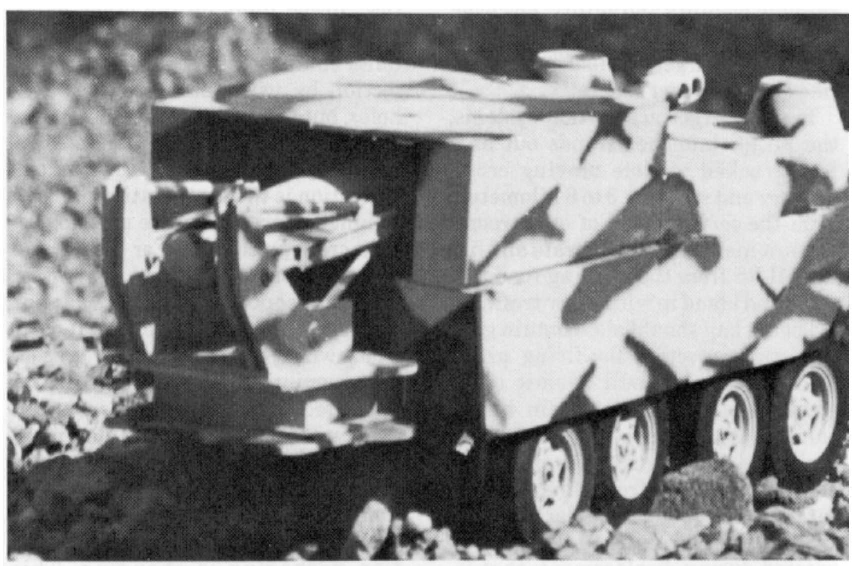
From the Field Artillery perspective, the speed of the maneuver force, the points of vulnerability on enemy vehicles, and the geometries associated with laser guided munitions like Copperhead all have an effect on how to position observers and firing units. The practice of positioning observers with the maneuver force and the firing units along the primary maneuver axis coupled with the geometry of Copperhead lobby heavily for positioning COLTs in areas of fastest movement and change. This translates into reduced shots per position and decreased survivability because the COLT is in the enemy's "eye." A better tactic is to position the delivery unit to give the COLTs the maximum advantage. This can be done physically or through an agile command and control system by firing from adjacent units.

Survivability Concepts

The single conceptual thread that binds all the areas considered thus far is survivability. Of course, survivability means many things to many people. To put different perceptions in perspective the following taxonomy is offered for survivability.

Survivability consists of those active and passive steps taken to ensure system performance at minimally degraded capabilities. Survivability consists of three main aspects. First, counter– or "hit" avoidance measures are those steps taken to avoid enemy actions that could degrade system performance. Second, hit abatement measures consist of those prior efforts taken to negate or minimize the degradation caused by enemy actions to which the system is actually exposed. Third, system reconstitution involves those actions taken to counter degradation and bring the system back up to optimal performance.

Each category of countermeasures is



Tony Muralha

Figure 4. The flexible trailing arm drive provides mobility on the roughest terrain.

Figure 5. The small emplacement excavator (SEE).

Figure 6. The ammunition module holds 40 complete 155-mm rounds.

critical to field artillery for two reasons: first, field artillery units are among the highest priority targets of the Soviets. Second, field artillery must be stationary to deliver support; and when firing they emit signatures which are not easily negated—ballistic trajectories, acoustic pulses, thermal signatures, and unique digital pulses on the electromagnetic spectrum. The point is not that we have an insurmountable signature problem, but that field artillery commanders need a diverse, well-stocked kit bag of procedures, tactics, and equipment to counter the threat as it manifests itself.

The contents of this kit bag would include techniques designed to negate signatures and to withstand attacks when they occur. For example, current multiple launch rocket system (MLRS) tactics negate most signatures through mobility and agility; however, we need to consider countermeasures to stand-off target acquisition system-like moving target radars.

To such target acquisition systems, the MLRS launcher stands out as a lone tracked vehicle moving cross-country and stopping 3 to 6 kilometers from the forward line of own troops. Thus, it may be best to operate and fire the MLRS from the existing road network and blend in with other traffic.

The kit bag should also contain good ballistic protection for firing units. Such hardening will permit us to weather attacks and remain in the same location, particularly if the enemy's fires are not driven by our emissions, but rather from "map sheet" targeting. This is particularly important because we are effectively suppressed during displacement; that is, the displacing unit cannot shoot.

Two requirements that would enhance cannon battery survivability are to move dirt and to provide for effective overhead cover. The 9th Infantry Division (Motorized) division artillery design accommodates the latter by giving the small emplacement excavator (SEE) shown in figure 5, to each firing battery. Additional enhancements include a host of hydraulically powered tools including an impact wrench, arc welder, generator, and chain saw. Another innovation being developed is removable forks to convert the scoop loader into a fork lift for ammunition movement.

Overhead protection is perhaps the most difficult ballistic problem to solve. The ideal solution is continuous, effective overhead protection with no operational degradation on the unit. Given sufficient armor, self-propelled units have most of these characteristics. Towed units on the other hand, lack all of these characteristics. Towed units can obtain some overhead protection by using earth covered foxholes, but this does not provide *continuous* protection.

The key to achieving this continuous protection is the proliferation of lightweight armor that can be used to provide crew protection. For towed systems the palletized load system or MILVAN concept discussed earlier might allow the extension of an overhead awning over the howitzer breech. This awning would provide continuous, effective overhead cover without dramatically affecting emplacement and displacement times.

The answer to where we get the lightweight armor may be in ammunition packaging. Our 155-mm ammunition packaging is changing. This change is being driven by both the advent of the field artillery ammunition support vehicle (FAASV) and changes in the logistics system. The Army Development and Employment Agency is looking at a logistic improvement to create a resupply module compatible with the palletized load system that is configured internally for different type supplies. The ammunition module shown in figure 6 holds 40 complete 155-mm rounds. This module can also provide a recurring source of survivability materiels. The top can be used, either as a whole or cut into two triangular sections, as a fox hole cover. The base can be laminated with lightweight armor such as Kevlar for strength. This armor can then be cut with the SEE chain saw and either placed in preconfigured fixtures or glued into place. The main benefit of the concept is that it provides a replenishable source of survivability materiel for both heavy and light forces at little additional cost to the logistic system.

One last thought on survivability—if visual signatures necessitate a camouflage system, we need to simplify that current camouflage system. One way to do this is with a buggy bow support system pivoted at the rear of the vehicle with the camouflage system permanently affixed so that emplacement and displacement requires only deploying the buggy bow and staking down the edges of the camouflage net. In any case, the current net system is not compatible with the speed of AirLand Battle.

Obviously, ADEA is exploring a wide variety of significant concepts, proposals, and equipment as it seeks to find new directions for the Army. This potpourri of ideas regarding the field artillery—its command, control, and communications; its tactics; its logistics; and its survivability—may kindle still others which will help Redlegs confront the challenges of warfare on the AirLand Battlefield.

Lieutenant Colonel Robert Zawilski, FA, is assigned to the US Army War College's Center for Land Warfare. He was the US Army Field Artillery School Liaison Officer to ADEA when this article was written.

A Look at LARS

by Lieutenant Colonel Dietmar Hoffman, German Army Liaison Officer, USAFAS

The Bundeswehr introduced its light artillery rocket system (LARS) in 1968. The system has an effective range between 6 and 14 kilometers and is fielded in batteries of the rocket battalion assigned at the division level. Each battery consists of eight launchers organized in two platoons and is mainly employed against area targets. A battery can deliver a tremendous volume of fire. In fact it can saturate an area of 1,000 by 1,000 meters with 110-mm rockets.

German maneuver commanders envision using the LARS to establish a main effort of fire within their areas of influence. In doing so, they seek to:

- Block specific sectors of the terrain for a limited period of time.
- Interdict armored vehicles.
- Destroy or neutralize light forces.
- Blind enemy forces in critical phases.

The weapon system has two traversable tube packages, each with 18 rifled launching tubes. These packages, along with a traversing mechanism, elevating gear, and pointer-type sighting gear, are mounted on a 7-ton truck. The vehicle commander uses a rocket test, control, and firing device to fire all 36 rockets from within the driver's cabin. The rockets are ignited electrically at half-second intervals, so that within 18 seconds 36 rockets (one launcher series) leave their tubes. The solid-fuel propellant rocket with its warhead is 2.26 meters long and weighs 26 kilograms. After launching, the spinning rocket is stabilized by fins. The firing data for the LARS is computed by the Fieldguard Computer.

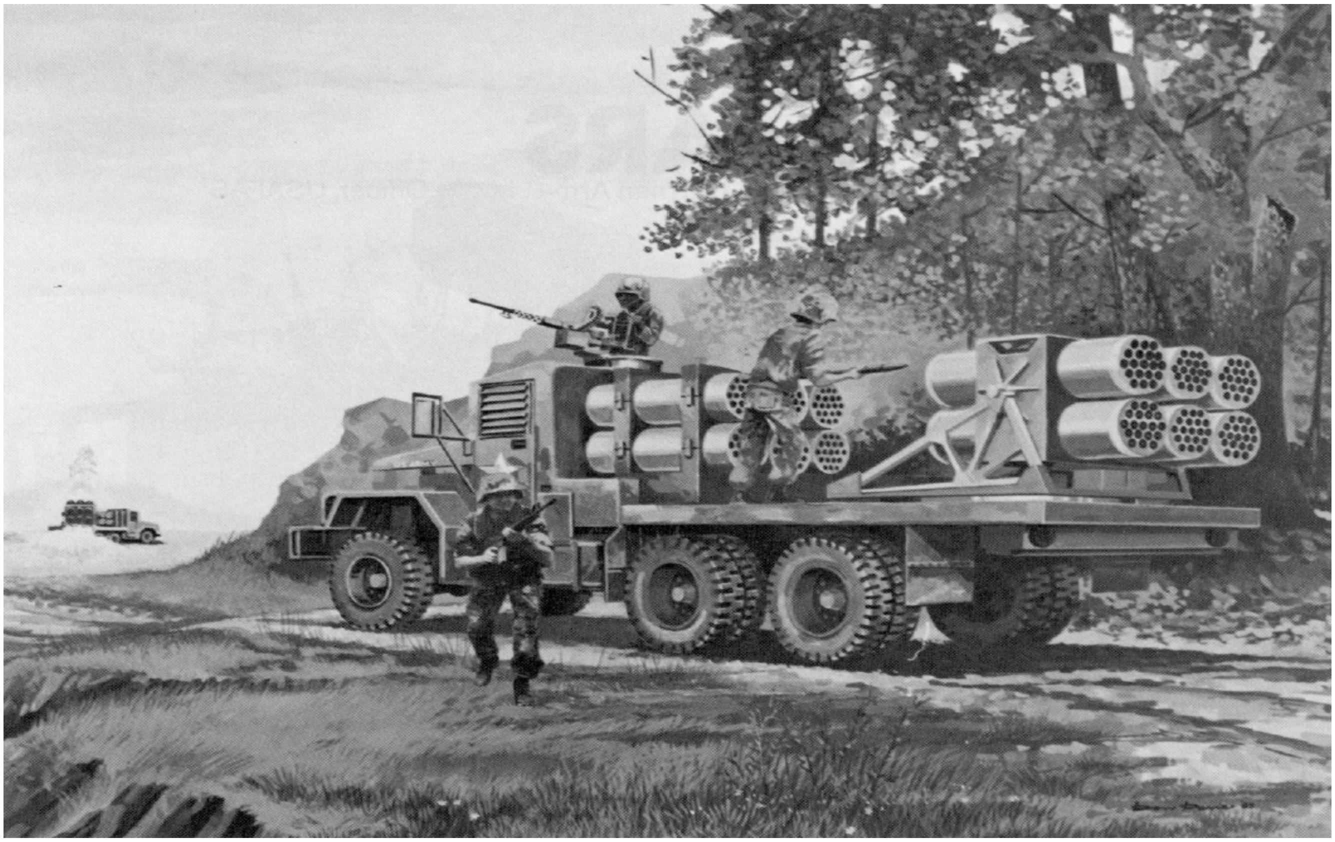
LARS has a variety of warheads tailored to different targets types.

- The AT2 consists of five antitank mines which are ejected by an electrical time fuze about 500 to 700 meters above the target. The mines are effective for a programed period of time and have antitampering devices. This warhead is used against wheeled and armored vehicles.
- The fragmentation-antipersonnel warhead is employed against soft targets or light forces. It consists of 5,000 to 6,000 steel bullets which are spread out after the variable time fuze is activated about 20 meters over the target.
- The smoke warhead contains 336 wedges of smoking substance. It allows for obscuration for approximately 20 minutes. One battery volley will screen an area of 4,000 meters wide.

LARS' high rate of fire makes it an important part of fire support in the German Army. LARS batteries are normally employed in general support and are part of the division artillery. However, they may provide direct support to a maneuver brigade conducting a main attack.

After fielding of the multiple launch rocket system (MLRS), the rocket battalion at division level will be a composite unit consisting of two batteries of LARS and two batteries of MLRS. This organization will provide the commander an important tool to attack area targets throughout the full depth of the battlefield.

Lieutenant Colonel Dietmar Hoffman, FRG, is the German Army Liaison Officer at the US Army Field Artillery School, Fort Sill, Oklahoma. He received his commission from the German Artillery School and is a graduate of the German Command and Staff College. Lieutenant Colonel Hoffman's past assignments include commander of the 11th Field Artillery Battalion, communications officer, commander of both 105- and 155-millimeter batteries, instructor in gunnery and tactics at the German Artillery School, and second in command of an M109 direct support battalion.



Don Davis

A System That Could Make a Difference

by Captain Charles B. Brenner

"As a result of a rocket volley, only 12 persons remained alive in our company out of the 120 it had formerly," recalled Wehrmacht Private Hart after he became a prisoner of war near Stalingrad. Veterans of many other campaigns have told of the awesome terror and destruction inflicted by Soviet multiple rocket launchers (MRL). Several years ago, Angola was overrun by thundering Cuban troops marching under "Stalin's organs." In the 1973 Arab-Israeli conflict, Syrian antiaircraft fire destroyed a number of Israeli close air support aircraft until rocket artillery neutralized many Arab air defense systems. Even though multiple rocket launchers, with their unguided, free-flight rockets have been described by some as primitive, they can do wonders. In fact, the US needs such weaponry now! We are still behind in the competition for parity in artillery; a rapidly deployable light MRL, fielded relatively soon, would substantially even the odds.

Our ability to deliver massed firepower has steadily eroded. No longer will we be able to count on the luxury of massive B52 strikes and a surplus of close air support sorties as we did in Vietnam. A European battle will be a target-rich and plane-poor environment. The Warsaw Pact's indirect fire support capability is not only numerically superior to that of the US but also possesses greater range and higher rates of fire. And the same air defense threat that played a critical role in the Arab-Israeli war will confront us both in European and contingency areas.

Part of the reason for the firepower disparity between US and Soviet forces results from differences in firepower philosophies. The Russians have always believed that massed fire works. And it does! According to Martin Caiden in *The Tigers are Burning,* Marshal Zhukov, an acknowledged master of the art of massed warfare, was "not simply excessive with his use of massed artillery fire; he believed in the dense, shattering effect of firepower overkill." When Zhukov prepared for a decisive move, he lined his guns up hub-to-hub; supplemented them with all the mortars, rockets, and tactical air he could muster; and turned them loose all at once. During WW II the Soviets repeatedly proved that gun densities exceeding one weapon per 10 feet of front work! We proved the value of massed fires at Khe Sanh, An Loc, and Hanoi with scores of bombers, fighter bombers, and concentrated artillery when we had it. Israeli artillerymen discovered in 1973 that they could stop battalion-sized tank attacks with concentrations of 36 155-mm howitzers firing 10 rounds fire-for-effect as fast as possible.

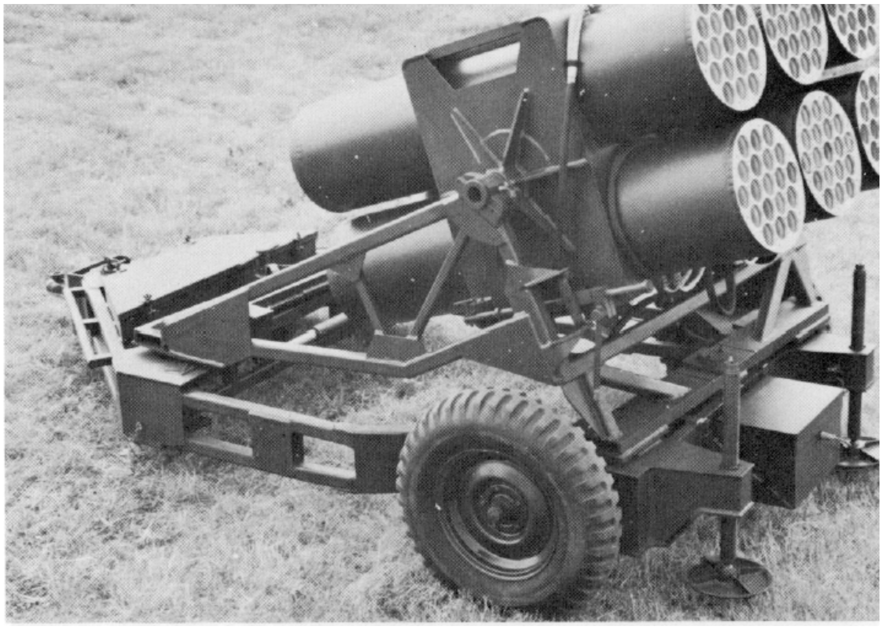
By contrast, the US has developed its firepower using a more sophisticated, high technology approach with precision guided weapons used to achieve one-shot kills. There is nothing wrong with this scheme as long as the limited number of delivery systems dispensing the sophisticated weapons survive on the battlefield. However, if they do not survive, the firepower gap will widen. Unfortunately, even if they do survive and achieve excellent results against our adversary, the Russian's weaponry will in all likelihood still outnumber ours.

The resulting disparity in firepower generates a very real and very urgent need for a light multiple rocket launcher beyond the multiple launch rocket system (MLRS) now reaching heavy units in the field. The MLRS consists of a highly mobile, tracked launch vehicle with two sealed launch pods containing six rockets each. It can fire rockets singly or in a ripple of two to twelve rockets in less than a minute at targets up to 30 kilometers away. The system has been under development since the mid-1970s and represents the only multiple rocket launcher to enter the US Army's inventory since the Korean War. The multiple rocket launchers used in World War II are no longer in service, and the one developed during the Korean War to deliver chemical agents has long since been declared obsolete. The MLRS is typical of sophisticated US weaponry. Its rockets are large, but they are easy to maintain. And it requires hydraulic power for reloading. Its performance is superb; but perhaps it is too little, too late.

What is required to supplement our capabilities is a light MRL that can be fielded quickly. The expensive MLRS will serve as a long-range, general support system, while a cheap medium range light MRL system could serve in a direct support role.

The advantages of a medium-range, light multiple rocket launcher are abundant. Comparisons between multiple rocket launchers and tube artillery favor rocket systems in terms of firepower, range, weapon weight, and support costs. In terms of fire power, one rocket launcher generally equates to a howitzer battery, or a rocket battery to a howitzer battalion. Multiple rocket launchers are capable of achieving longer ranges than cannon without a significant weight penalty. Relative firepower maintenance costs for rocket systems are less than those for self-propelled cannon weapons, and support costs for the crew are less due to smaller manpower requirements. Per round costs will vary from the expensive multiple launch rocket system to the cheap light multiple rocket launcher. Both, however, may be considered cheaper in life-cycle costs for the level of firepower delivered.

A review of MRL characteristics underscores its potential.



The Slammer VI is a prototype multiple rocket launcher. This display is mounted on a chemical rocket launcher chassis and is towable by an M151 ¼-ton truck and an M113 armored personnel carrier.

• ***Rate and Volume of Fire.*** The standard Soviet MRL is the BM-21. It can fire 40 122-mm rockets with a 40-pound warhead 20.5 kilometers. One six-launcher battery can fire 240 rockets in 20 seconds. In terminal effect, such a launching approximates a one-round volley delivered by 40 cannon batteries. Concentration and surprise magnify the effect of 9,600 pounds of a high explosive arriving at its destination.

• ***Dispersion.*** When friendly troops are not too close and individual targets can't be pinpointed, the shotgun-like patterns of MRL fires are particularly effective against targets vulnerable to fragmentation. Such targets include all surface-to-air missiles, artillery crews, antitank crews, and support elements.

• ***Security and Survivability.*** The multiple rocket launcher completes its mission within 20 seconds or less and drives to another firing point. A cannon unit would have to stand fast and face the counterfire threat while firing an equivalent number of rounds.

• ***Mobility.*** Multiple rocket launchers are easily transported by air, and they move more quickly on roads than self-propelled artillery. Their mobility would permit a very rapid buildup of reinforcing firepower. The light MRL could be especially effective with rapid deployment forces to provide massive fire support for those light infantry, airmobile, or airborne divisions.

• ***Rocket Launch Stresses.*** A rocket sustains less than a 100-G force during launch. Cannon shells experience as much as 9,000 Gs when fired. Consequently, rocket warheads can be designed with lighter warheads than cannon projectiles. This situation results in less stringent design criteria and cost savings.

• ***Simplicity.*** Compared to cannon, rocket launchers are simple and inexpensive to manufacture.

• ***Accuracy.*** Past multiple rocket launchers have mistakenly received a bad reputation in this department. The fact is that modern MRLs can achieve accuracies better than cannons. Their range error actually decreases as the range increases due to the higher angles of shot fall.

• ***Immunity to Electronic Countermeasures.*** Light MRLs have no electronic components or powered guidance systems other than the electric squib used to initiate them. The squib is not connected until just prior to firing. Threat forces cannot jam guidance systems or disable electronic components of a system that does not have any.

• ***Counterfire and Illumination.*** Missions which require a unit to remain in place for extended periods of time making them subject to acquisition as targets could be handled by remoted multiple launchers. If acquired and destroyed, the crew would be saved to operate a spare launcher.

• ***Fire Suppression.*** Multiple rocket launchers may not be tank killers, but they can suppress enemy artillery and air defense so our air and ground tank killers can do their jobs.

• ***Terminal Effects.*** All the improved and special-purpose submunitions

Developed in 1976, the Slammer can place a high volume of fire on targets.

available in cannon weapons can be loaded in the multiple launchers.

All these advantages appear promising, but that promise loses its appeal if it takes another 10 years to develop and field a light multiple rocket launcher! Fortunately, it does not have to. A modern light MRL is available from our North Atlantic Treaty Organization (NATO) partner—West Germany. It is a 110-mm light artillery rocket system (LARS). The LARS can launch 36 rockets with 38-pound warheads in 18 seconds to a maximum range of 14 kilometers. It was developed, tested, and fielded by Germany as an interim measure while they awaited the US-produced multiple launch rocket system. The Germans will retain LARS to complement the MLRS. Since Germany will be procuring the MLRS from the US or producing their own version, our purchase and integration of LARS into our own artillery assets would serve to promote NATO standardization as well as relations. If this idea is unacceptable, a prototype light MRL known as the "Slammer" may provide an alternative. Developed in 1976, Slammer proved capable as an area fire weapon. In field tests it placed a high volume of fire on targets with acceptable accuracy.

Regardless of the political and economic considerations, three military facts are clear.

- The United States is not on an equal footing with the Soviet Union in terms of firepower.
- United States firepower requires augmentation.
- An MRL system can fulfill this need and do so quickly.

We do not have to match the Soviets gun-for-gun, but we must at least have sufficient firepower to increase our political and military confidence and demonstrate to the Soviets that a surprise conventional attack could not hope to succeed. The light multiple rocket launcher may not be a cure-all, but it is certainly a quick and cheap means to increase our firepower. And that increase might just make the difference.

Captain Charles B. Brenner, FA, is the commander of Service Battery, 1-17th Field Artillery, at Fort Sill, Oklahoma. He was commissioned through ROTC at South Dakota State University and is a graduate of the Ordnance and Field Artillery Officer Advanced Courses. Among his assignments, Captain Brenner has served as an engineer with the Research and Development Applications Branch at Edgewood Arsenal, operations officer with the 636th Ordnance Company (EOD), and commander of the 144th Ordnance Company (Ammunition/Direct Support).

View from the Blockhouse

FROM THE SCHOOL

Updating Doctrine

Production of quality doctrinal literature takes time and effort. Traditionally, doctrinal literature development, like equipment development, has been characterized by methodical planning and extensive testing. The rapid pace of today's technological change and the demands for complete state-of-the-art systems has necessitated the condensation of the planning and testing procedures used to produce selected doctrinal publications.

The reduced time available to develop doctrinal literature presents many challenges to the staffs and faculties of the various proponent schools. To produce a sound publication the subject matter expert (SME), who is a teacher as well as a writer, needs the help of soldiers in the field. By carefully reviewing and commenting on outlines and circulars, doctrinal users around the world can often offset the negative aspects of condensing the doctrinal literature development cycle.

One example of efficiency in condensing the cycle is the production of doctrine for the backup computer system (BUCS). With the help of Redlegs in the field, Fort Sill subject matter experts put together two first-rate circulars on BUCS in a remarkably brief 3 months. Sufficient quantities of these circulars were mailed to the depot distributing the new system so that each BUCS will be accompanied by an appropriate field circular. Furthermore, the Field Artillery School produced enough additional copies of the circulars to send them out under the normal distribution scheme for manuals. This dual distribution of the products listed below will ensure that units will be able to integrate this exciting new system into their organizations more efficiently and expeditiously.

- FC 6-40-31, *Backup Computer System Job Aids-Cannon Application,* 30 April, 1985.
- FC 6-40-33, *Field Artillery Survey Operation and Use of Backup Computer System,* 30 April, 1985.

The Lance missile gunnery BUCS has been delayed because of software development problems. Action officers at Fort Sill are carefully monitoring the situation and will distribute advanced publications to Lance battalions as the situation dictates.

Each of the field circulars on BUCS has a preface statement which opens a direct communications link between the Field Artillery School and the BUCS user. The preface begins with a request to review the circular and return appropriate comments to each action agency. Recommendations from units receiving these new publications will be used when BUCS procedures are incorporated into a final field manual.

Comments, suggestions, or questions regarding other doctrinal literature should be directed to the Field Artillery School, Directorate of Training and Doctrine, Doctrine Management Office, by calling AUTOVON 639-4225/4240 or by writing to Department of the Army, Commandant, US Army Field Artillery School, ATTN: ATSF-DD, Fort Sill, OK 73503-5600.

Looking for a Light Gun

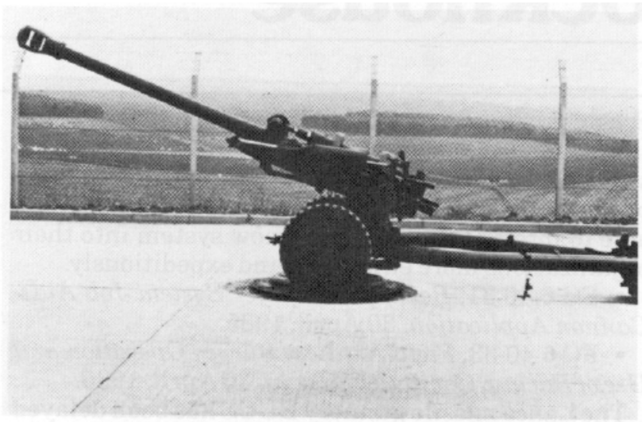
Until recently, the US Army's force structure has tended to concentrate on heavy mechanized and armored forces as part of a broad pattern of mechanization in modern armies. However, the emerging strategic reality is that the United States needs light forces with great flexibility and firepower to respond to more prevalent low- to mid-intensity conflicts. The resulting challenge for the field artillery is the selection and fielding of a weapon system that will provide fire support for these light forces. Such a system must include a lightweight, long-range howitzer; improved munitions; and a high mobility prime mover.

Field Artillery School experts made preliminary studies to determine available options. They considered 105-mm, 155-mm, and 5-inch systems. Based upon wargaming at the Combined Arms Center and the US Army's Field Artillery School (USAFAS), the 105-mm howitzer and ammunition system emerged as the near-term weapon of choice. This was primarily due to the technological inability to obtain 155-mm effectiveness from a strategically and tactically mobile weapon. Fiscal constraints also prevented the establishment of a new 5-inch ammunition line despite the advantages offered in effectiveness.

The US Army Armament Research and Development Command (ARDC) conducted a market analysis of 18 US and Allied 105-mm howitzers. They eventually narrowed the field to four finalists: the M204 howitzer (the soft-recoil weapon developed and type classified in the 1970s but never produced), a modified M102 howitzer, and the L118 and L119 British Light Guns. Key parameters in the comparison and contrast of these four options were:

- Compatibility with developmental dual-purpose improved conventional munitions (DPICM) and high explosive rocket assisted (HERA) projectiles.
- Growth potential for increased range.
- Availability and associated program risk.
- Tactical and strategic mobility.
- Cost.

Based upon the results of the analysis, USAFAS and ARDC recommended further evaluation of the L119, and the US Army Chief of Staff approved the recommendation in May 1984. Of the four competitors, the L119 has the longest range with the current stockpile of US ammunition, is eminently available at low risk, has significant growth potential, and does not significantly



The 105-mm British Light Gun is electrically fired.

exceed the price of the least costly alternative.

The 105-mm British Light Guns are manufactured by the Royal Ordnance Factory, Nottingham, England. The L118 model was developed to fire the British Abbott ammunition which is electrically fired and has a maximum range of 17.2 kilometers. It was this model which saw extensive action in the British Army during the 1982 Falklands Campaign in the 29th Commando and 4th Field Regiments. The L119 is identical to the L118 except for the cannon assembly which includes a percussion firing mechanism in the breech, a shorter barrel, and a different muzzle brake. It is compatible with US M1 ammunition. The British manufacture the L119 to allow their units to fire M1 ammunition during training. The L118 can be converted to the L119 by merely changing the ordnance. This modification takes a well-trained crew about 30 minutes.

Following the decision to evaluate the L119, the weapon was redesignated the XM119 howitzer, towed, 105-millimeter. Testing began in October 1984 at Aberdeen Proving Grounds to validate compatibility with the M760 high explosive round. This cartridge is composed of the standard M1 high explosive/TNT projectile and the M200 propelling charge (developed and type classified with the M204 howitzer). A "zone 8" charge will provide the XM119 with an increased range of approximately 14.3 kilometers with the M760 and XM915 DPICM projectiles and over 19 kilometers with the XM913 HERA round. Although more M200 tests are pending, test results indicate no significant safety or compatibility problems associated with the XM119. Other evaluations of the British Light Gun include a concept evaluation conducted by the Field Artillery Board in 1977; a field evaluation by the 82d Airborne Division Artillery in 1982; cold regions testing at Fort Greely, Alaska, conducted January through March 1985; and a culminating operational evaluation using two batteries from the 9th Infantry Division (Motorized) from June through August of this year. The operational evaluation will include the integration of the high-mobility multipurpose wheeled vehicle (HMMWV) as the prime mover for the howitzer. If these evaluations prove the XM119 system to be effective and supportable, then all M102 and M101A1 howitzers currently organic to US Army units could be replaced by the light gun. (CPT Richard Kamakaris)

Automated Fire Direction Instruction at USAFAS

The field artillery continues to be a leader in applying new electronic and electro-optical technologies on the battlefield. Nearly 2 decades of research have produced an assortment of new devices to make artillery firepower more timely and accurate. The position and azimuth determining system (PADS) has helped to eliminate firing position errors, and range-finding lasers now assist observers in locating targets with precision. The meteorological data system and the M90 chronograph have taken the guesswork out of measuring external variables which govern the flight of an artillery projectile.

Technical fire direction was the first artillery function to be automated. In the early 1960s, the Field Artillery Digital Automatic Computer (FADAC) replaced manual computation methods. The advent of the tactical fire direction system (TACFIRE) a decade later automated both technical and tactical fire direction at the battalion level and brought the branch into the era of digital automation. However, without a digital interface between FADAC and TACFIRE, the system remained fragmented. Battery and battalion fire direction functions were not fully integrated. With the advent of the battery computer system (BCS) as a part of the TACFIRE system, this shortcoming has been corrected. The field artillery now has a complete top-to-bottom automated technical fire direction system.

The battery computer system is now the primary means of performing technical fire direction for the active forces. Fielding to the Active Army will be completed by March 1987 and will continue through 1993 for the Reserve Components. In less than 30 seconds the battery computer system can compute 12 individual sets of firing data based on individual piece locations, individual piece aimpoints, and individual piece muzzle velocity variations. Such speed and flexibility of BCS allows the field artillery to support the AirLand Battle in a more responsive manner.

Until recently, battery fire direction center personnel had to return to the age of charts and firing tables in case of BCS failure. A brand new system, the backup computer system (BUCS), gives the fire direction center another digital alternative. Despite its small size, BUCS has virtually the same computational capability as BCS. In those units currently without BCS, BUCS will serve as the primary means of computing technical fire direction. All Active and Reserve cannon units will receive BUCS before the end of this year.

Technical fire direction instruction at the Field Artillery School will be keyed to BCS and BUCS. The manual procedures for the computation of basic firing data will continue to be taught but at a reduced level.

In order to teach automated systems, the Gunnery Department has redesigned its programs of instruction.

The updated courses will be implemented to coincide with the fielding of BUCS. These new programs address all aspects of solving the gunnery problem as well as the pure mechanics of operating the BCS and BUCS. Every program of instruction adheres to the following format:

- **Principles and Theory—**An understanding of gunnery principles and procedures is essential to the delivery of accurate predicted fire. Instruction is designed to ensure students understand the gunnery solution and are not merely "button pushers."
- **Battery Computer System—**Students learn this primary system—its capabilities, limitations, and work-arounds.
- **Backup Computer System—**Students receive training on its capabilities and limitations.
- **Emergency Procedures—**Students will be taught the basic manual procedures necessary to get a round to the target in the event that all automated systems fail. These procedures will include the use of the graphic firing tables, graph site tables, and tabular firing tables. This instruction focuses on what has been called "cold stick" calculations.

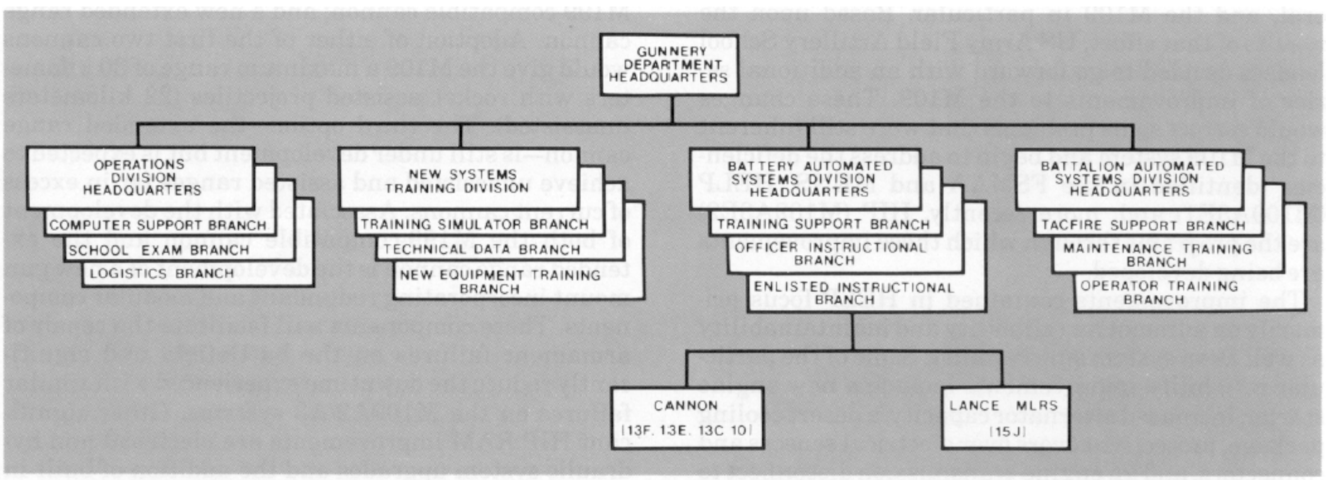
The US Army Field Artillery School began implementing these new programs of instruction in July with Officer Basic Course 10-85 and Officer Advanced Course 4-85.

Gunnery Department Reorganizes

In order to teach the tactical fire direction and battery computer systems (TACFIRE/BCS) better and to meet the needs of the field, the Field Artillery School has reorganized its Gunnery Department (see figure).

The reorganization consolidates all fire direction functions so that the TACFIRE/BCS system can be taught as a total system for all ranks. Moreover, the Gunnery Department has assumed responsibility for instruction on safety computations, cannon fire commands, as well as Lance and multiple launch rocket system fire direction from the Weapons Department.

The Battery Automated Systems Division has responsibility for the battery computer system, backup computer system, digital message device, lasers, safety, and all other aspects of technical fire direction. The Battalion Automated Systems Division is responsible for the tactical fire direction system, computer operator tactical fire direction instruction, variable format message entry device instruction supporting fire support element/tactical operation center courses, and maintenance instruction for both military occupational specialties 34Y and 34L. Requests for administrative or training support should be directed to the Operations Division. Requests for training simulation, technical data, or new equipment training support should be directed to the New Systems Training Division (NSTD).



Gunnery department reorganization.

The M109A3E1 Howitzer Extended Life Program (HELP) undergoing operational testing at Fort Sill.

Getting HELP and HIP

HELP is on the way for the M109 howitzer—it's getting HIP! The Howitzer Extended Life Program (HELP) and the Howitzer Improvement Program (HIP) are approved, ongoing programs that will soon result in the fielding of a significantly improved M109.

The M109 was first distributed in the 1960s, and over the next 20 years it underwent a series of improvements. The Department of the Army's fire support mission area analysis (FSMAA) and the Department of Defense's Mission Element Needs Statement (MENS) completed in 1980 underscored the need to field an even better howitzer to resolve a number of deficiencies in the overall fire support system. At the same time, the Field Artillery School was taking a hard look at direct support weapon systems in general, and the M109 in particular. Based upon the results of that effort, US Army Field Artillery School leaders decided to go forward with an additional series of improvements to the M109. These changes would correct some problems that were still inherent to the M109 system and begin to address the deficiencies identified in the FSMAA and MENS. HELP (M109A3E1) and, more recently, HIP (M109A3E2) are the programs through which these improvements are being developed.

The improvements contained in HELP focus primarily on automotive reliability and maintainability as well as on system survivability. Some of the particular reliability improvements include a new engine starter, increased alternator capacity, a desert cooling package, protective covers over electrical sensors and connectors, and an engine-transmission disconnect to improve cold weather starting. HELP also provides for better maintainability by allowing easier access to the engine starter and by incorporating a simplified test equipment and internal combustion engine (STE/ICE) system similar to that found on the field artillery ammunition support vehicle. Among the improvements in system survivability are an automatic halon fire suppression system, a driver's night vision device, and a number of features designed to enhance protection in a nuclear, biological, and chemical (NBC)-contaminated environment. Other significant features will include a ventilated face piece system, remote powered travel lock and spades, and the automatic gun positioning system (AGPS).

AGPS is perhaps the most significant of all the changes brought about by HELP. It is designed to provide the howitzer with a total on-carriage vehicle position location and gun tube orientation capability. AGPS will also reduce crew exposure to an NBC-contaminated environment. Moreover, because dependency upon line of sight with the M2 aiming circle to lay the howitzer has been eliminated, it will increase system survivability against counterfire by allowing individual howitzers to spread out and occupy masked terrain positions. The AN/PRC-68 small unit radio is another planned feature of HELP.

The Army contracted with Norden Industries for HELP development in September 1981, and HELP Operational Test II (OT II) began at Fort Sill on 25 March 1985 under the supervision of the Field Artillery Board. OT II and other HELP test results should be examined by a Department of the Army review committee during the third quarter of fiscal year 1986. The result of this review will be a production decision with an expected initial operating capability (IOC) objective of the fourth quarter of fiscal year 1988.

The second phase of the M109 Howitzer Modernization Program is HIP. HIP focuses on the areas of armament reliability, availability, and maintainability (RAM); weapon responsiveness and effectiveness; and survivability. Fort Sill action officers are considering three cannon configurations—a modified M185 cannon designed to shoot the M203 propelling charge; an M199-compatible cannon; and a new extended range cannon. Adoption of either of the first two cannons would give the M109 a maximum range of 30 kilometers with rocket assisted projectiles (22 kilometers unassisted). The third option—the extended range cannon—is still under development but is expected to achieve unassisted and assisted ranges far in excess of current cannons. Associated with the development of both the M199-compatible cannon and the extended range cannon is the development of a new gun mount incorporating redundant and modular components. These components will facilitate the repair of armament failures on the battlefield and significantly reduce the downtime experienced with similar failures on the M109A2/A3 systems. Other significant HIP RAM improvements are electrical and hydraulic system upgrades and the addition of built-in test equipment and a prognostic set of maintenance tests contained in a simplified test equipment-expandable (STE-X) system.

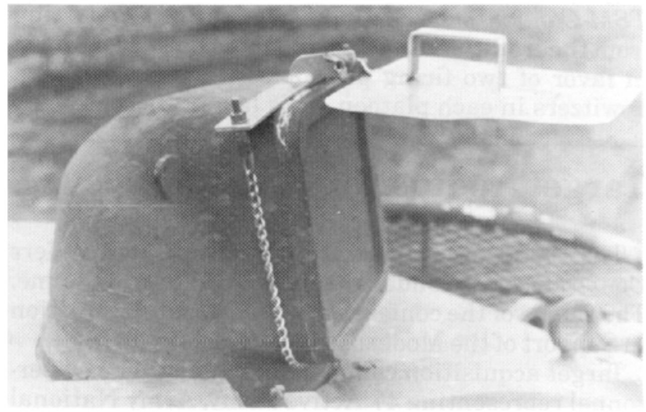
In the areas of weapon responsiveness and effectiveness, the AGPS will be modified and expanded to an automatic fire control system (AFCS) which will perform ballistic computations on-board. The AFCS will interface with both a gun drive servo system for automatic adjustment of the tube for deflection and quadrant and an on-board single channel ground and airborne radio subsystem (in lieu of HELP's PRC-68) with digital and voice capability. To increase crew performance in an NBC or heat stress environment, an air vest microclimate conditioning system will be integrated with the ventilated face piece system. The HIP program will also involve the development and fielding of training devices for use at both the institutional level and in the unit.

HIP is a much more recent program development than HELP. The Vice Chief of Staff of the Army made the go-ahead decision on the program on 1 November 1984. The current acquisition strategy calls for development of HIP improvements on an accelerated schedule to produce an initial operating capability in the fourth quarter of fiscal year 1988, the same time frame as HELP's initial operating capability. The intent in doing this is to roll the HELP improvements into the HIP to achieve the objective of a single initial operating capability in 1988. The responsibility for coordinating this effort on behalf of the field artillery has been assigned to the US Army Training and Doctrine Command (TRADOC) Systems Manager—Cannon (TSM-Cannon) at Fort Sill. TSM-Cannon coordinates the management of both programs within TRADOC by acting as the user's representative in the materiel development and acquisition process. The development and acquisition of HELP and HIP are managed by the Project Manager for Cannon Artillery Weapon Systems (PM-CAWS) at the Armament Research and Development Center at Dover, New Jersey.

The fielding of the modernized M109 howitzer with the improvements described above will produce an artillery system that is vastly improved in areas critical to providing fire support. By enhancing system reliability and maintainability as well as crew survivability, the HELP and HIP improvements will result in a howitzer that, when compared to the M109A2/A3, will be capable of operating longer between breakdowns, can be fixed more quickly and further forward on the battlefield, and will provide much greater crew protection in an NBC-contaminated environment. The increased range possible with the alternative armament packages will enable the M109 howitzer unit to add new depth to the battlefield. The addition of the on-board position location, ballistic computation, and communications equipment gives the field artillery capabilities that were never before possible. The net result of these changes will be a fire support system that will enable the field artillery to provide the fire support required by the maneuver forces on the battlefield of the 1990s. (CPT James F. Janda, TSM-Cannon, USAFAS)

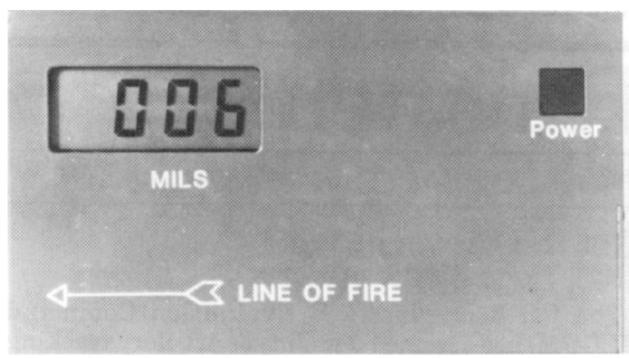
BATTLEKING Projects

• *BK 18-84, Ballistic Shield M109A2/A3 SPH (Source: 4th Division Artillery).* Moisture on the ballistic glass and glare from the sun make laying the howitzer difficult. BATTLEKING evaluated several methods of correcting this problem. The most feasible method was the fabrication of a sunshield that could be positioned to reduce glare and moisture. Test results will be published soon.



The ballistic sunshield reduces glare and moisture intrusion.

• *BK 46-84, Micro-Levels (Source: Sperry Corporation).* The micro-level is an angle measuring device which can be used to set quadrant elevation on towed and self-propelled howitzers. Two devices are being evaluated; both are graduated in mils. One has a bar attached with feet spaced for use as a gunner's quadrant, and the other is the standard unit which lacks the feet. The operating range is from -85 mils to + 1,445 mils.



The Sperry digital gunner's quadrant can be used to set elevations on towed and self-propelled howitzers.

The devices have the potential to be the primary gunner's quadrant for towed howitzers and as backup devices for M109 and M110 self-propelled howitzers. The micro-level is compatible (digital to digital) with the battery computer system gunner's assemblies. On the M109 and the M110A2 crew ballistic shelter (CBS), the M15 quadrant will be removed to allow installation of the automatic gun positioning system (AGPS). If the AGPS goes down, the only backup would be a one man-one sight system. The level also appears to be a good digital replacement for the M1A1 gunner's quadrant. Moreover, this instrument has many more possible uses than quadrant elevation in howitzers. The micro-level can be used in future iterations of Firefinder, the meteorological data system, and the elevated target acquisition system.

• *BK 50-84, Follow-On Evaluation (FOE) of the M109A3E2 Howitzer Improvement Program (HIP) Organization and Operation (O&O) Plan (Source: TSM-Cannon)*. The HIP O&O Plan calls for departing from the traditional 400 by 200 fixed battery position in favor of two firing platoons with four dispersed howitzers in each platoon. This layout increases the likelihood of survivability during periods of intense counterfire. The M109A3E2s would be positioned so that each howitzer would occupy a 1-kilometer circle, a concept known as semiautonomous operations (SAO). This dispersion increases the number of tasks for which the chief of section (a staff sergeant) is responsible. The chief will now have to select and supervise the occupation of howitzer and ammunition vehicle positions for the section from one location to another; manage section logistics (ammunition, fuel, and food); operate and maintain the systems on board the M109A3E2 (ballistic computer, servo drive, navigation system, radio capability for both voice and digital communications); and prepare and submit reports to the operations center.

Target Acquisition Conference

The 1985 Target Acquisition Battery Commanders Conference was conducted at Fort Sill from 4-7 June. The theme of the conference was "Target Acquisition in Support of the Modern Battlefield."

Target acquisition commanders and other key personnel representing 47 Active Army, Army National Guard, US Army Reserve, US Marine Corps, and US Marine Corps Reserve units attended the conference. The US Army Field Artillery School sent 40 Target Acquisition Department personnel. Geographic areas represented included the Continental United States, Korea, Alaska, Europe, Hawaii, and Okinawa.

The conference served as an open forum for the discussion and exchange of ideas, concepts, and developments. It also assisted in finding solutions to pressing targeting and target acquisition problems. The ideas advanced at the conference will be used by School agencies to improve target acquisition doctrine and training.

The Target Acquisition Department extends special thanks to those commanders and other soldiers who attended the conference and solicits their suggestions for improving future conferences of this nature.

Fire Support Conference

The US Army Field Artillery School will hold the Fire Support Conference from 5-7 November for Active and Reserve Component operations officers or representatives from the S3 section of corps and division artilleries, field artillery brigades and groups; and action officers from Department of the Army, US Army Training and Doctrine Command service schools, ROTC regions, and selected Army and Marine Corps commands. Points of contact at Fort Sill are Captain John Shelver or Mr. Louis Bedoka at AUTOVON 639-2064/5004 or commercial (405) 351-2064/5004.

Fragments

FROM COMRADES IN ARMS

Get the Picture!

The US Army Test and Evaluation Command (TECOM) has accepted a prototype artillery tracking instrumentation radar system that is expected to save the Army more than 18 million dollars during the next 10 years.

TECOM recently accepted the Application of Radar to Ballistic Acceptance Testing of Ammunition (ARBAT) Radar, from the Army's Armament, Munitions and Chemical Command (AMCCOM), which developed the system with prime contractor ITT Gilfillan.

"ARBAT is a self-contained, autonomous system which performs the functions of projectile-in-flight acquisition, tracking, event detection, impact prediction, and associated data reduction," said Joseph Secko, a project engineer with the Product Assurance Directorate, AMCCOM. "It also provides near-real time data without the need for outside facilities or assistance."

ARBAT is expected to save the Army at least 1 million dollars per system annually.

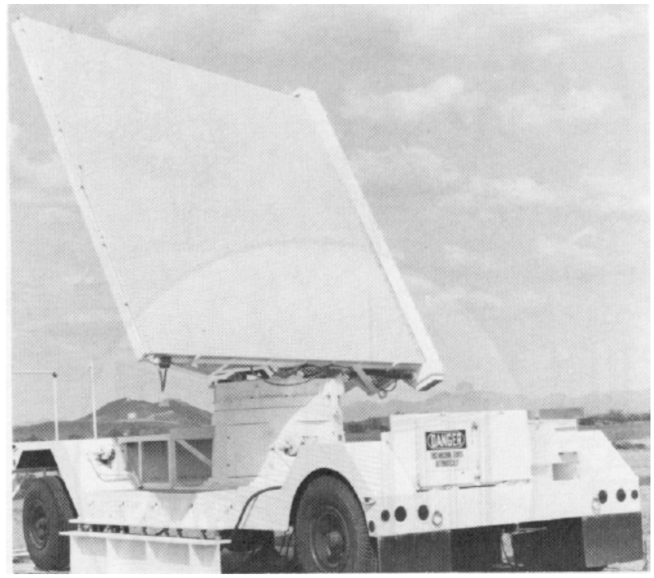
The system can track a variety of ammunition from 40-mm to 16-inch projectiles, including new sophisticated ammunition such as extended range rounds, improved conventional munitions, and high accuracy rounds.

ARBAT also can monitor from the same location the sequential firing of several gun positions. The system is adaptable, so its software capabilities can keep up with advances in weapons technology.

"By providing near-real time trajectory data, ARBAT will help us to spot failures early in production testing," said Grover H. Shelton, Chief of TECOM's Methodology Division. "Its ability to support several firing sites concurrently will result in savings in manpower and dollars."

"ARBAT now provides the Army with unique capabilities in ballistic acceptance testing with a minimum of personnel," Secko said. "Besides measuring all critical flight ballistic parameters of a projectile's flight from launch to impact, ARBAT can identify projectile malfunctions such as early ignition, rocket separation, early or late fuze function, and tumbling."

Of equal importance to the Testing Community is ARBAT’s ability to provide real-time data feedback. "Current radar systems that provide only partial information and translation of this data to meaningful information takes several days or even weeks," Secko said. "The realization of ARBAT's benefits in terms of cost savings, availability of data, and the intangible benefits from real-time data on projectile malfunction analysis, make the system superior to any ballistic acceptance radar currently used."



The ARBAT system is autonomous as well as cost effective. It is expected to save the Army at least 1 million dollars per system annually.

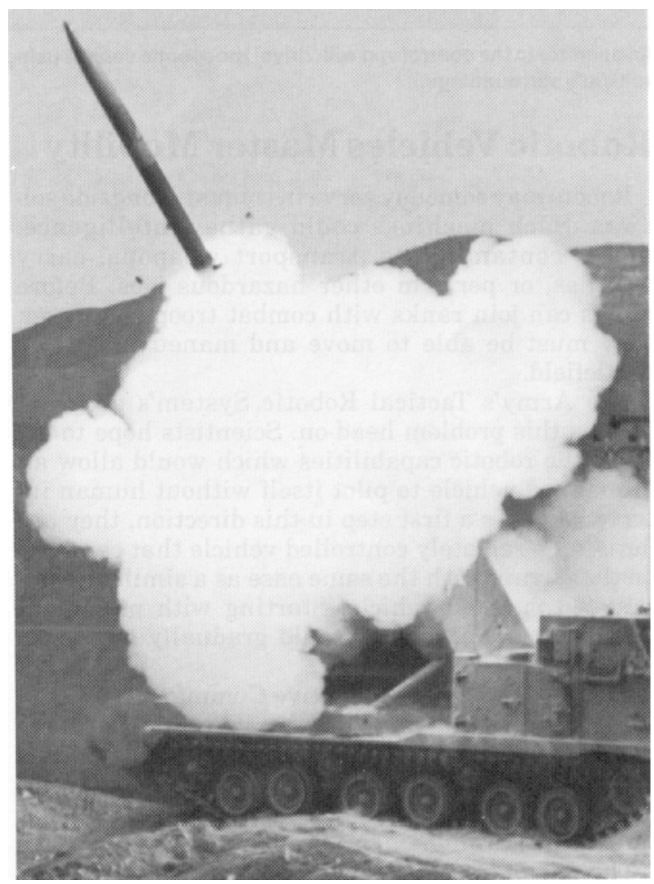
Designs on Safety

Preventive medicine may seem out of place in the soldier's work environment, but the US Army Environmental Hygiene Agency (AEHA) is using this concept to protect soldiers from the everyday hazards they may encounter.

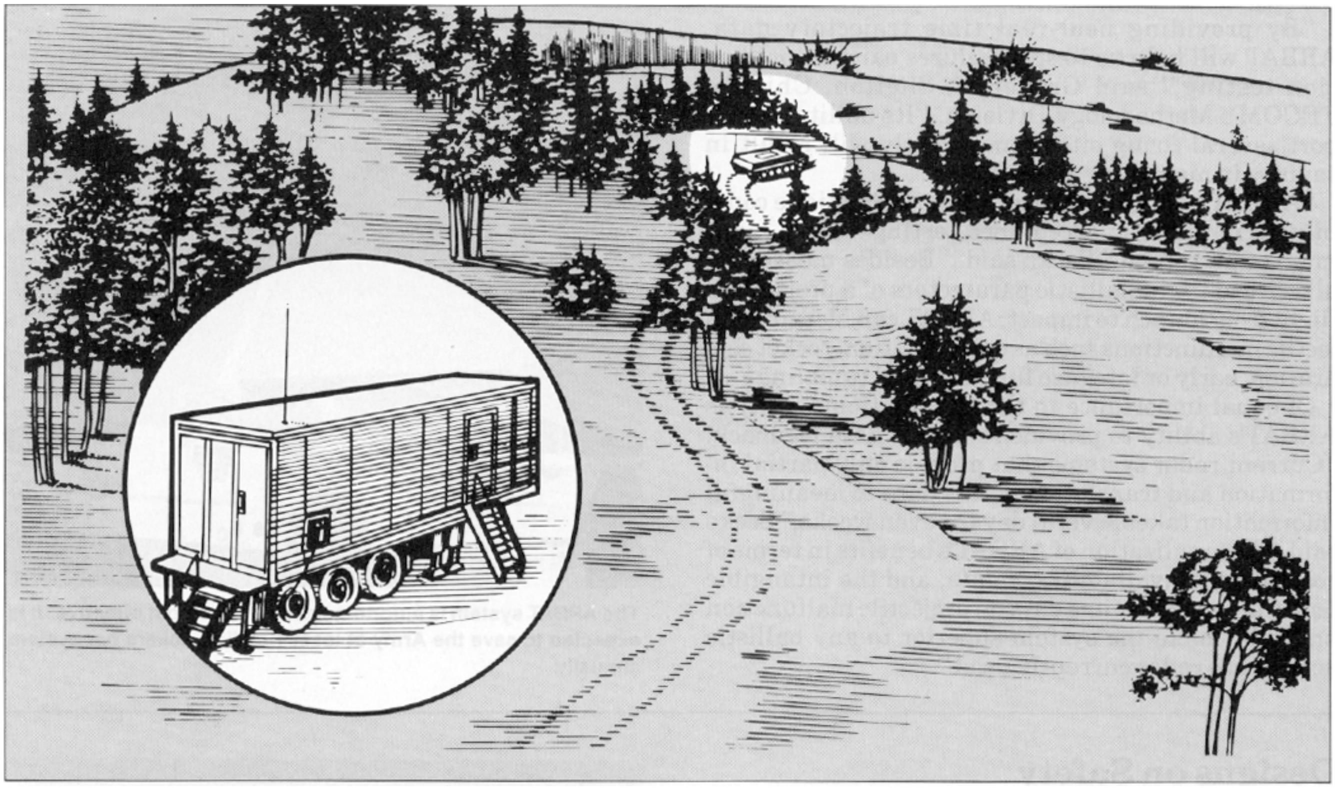
One of the better ways to reduce hazards is by having trained occupational health specialists involved in the development and acquisition of new weapons, materiel systems, clothing, and equipment. The Army-wide Health Hazard Assessment Program, based at Aberdeen Proving Ground, Maryland, was created in 1983 to identify, eliminate, or control potential health hazards early in the development of new items.

Because field conditions and combat requirements make it impossible to ensure a soldier's safety, the AEHA works instead with the equipment and systems a soldier uses to reduce potential dangers. By becoming involved early enough in the development phase, problems can be "designed-out," and hazards can be averted.

Ensuring soldier safety is no easy process, but Army Regulation 40-10 spells out requirements for health hazard assessments from concept exploration through full development, acquisition, and deployment of a system. Health Hazard Assessment Reports provide recommendations to improve new systems, personal protective equipment, and administrative controls.



A cloud of hydrogen chloride is released during the firing of the multiple launch rocket system. As a result of an AEHA Health Hazard Assessment Report, the door seals on the cab have been improved. This "designed-in" precaution better protects the soldiers inside. (US Army)



Bobby Hill

An operator in the control van will 'drive' the robotic vehicle using navigation display screens which provide a real-time view of the vehicle's surroundings.

Robotic Vehicles Master Mobility

Robots may someday serve in combat alongside soldiers. Such machines could gather intelligence, detect contaminants, transport weapons, carry supplies, or perform other hazardous jobs. Before robots can join ranks with combat troops, however, they must be able to move and maneuver on the battlefield.

The Army's Tactical Robotic System's program tackles this problem head-on. Scientists hope to develop the robotic capabilities which would allow an unmanned vehicle to pilot itself without human intervention. As a first step in this direction, they are building a remotely controlled vehicle that can take on the terrain with the same ease as a similarly constructed manned vehicle. Starting with maximum mobility, such a vehicle would gradually evolve toward increased autonomy.

The Army's Tank-Automotive Command (TACOM) is heading up the effort to assemble this near-term demonstrator. Researchers are using digital terrain data bases, image processing techniques, and computer technology to design the demonstrator's allimportant terrain navigation subsystem.

The demonstrator itself consists of an unmanned platform and a control van. A non-line-of-sight communications link will keep the two components in constant contact.

Project officials plan to use an existing tracked vehicle as the "body" of the robotic platform. In place of a driver, this vehicle will carry remote control actuators, mobility sensors (including stereo TV cameras and thermal devices), a position and navigation unit, and communications equipment. It will transmit color TV pictures of its surroundings back to the operators in the control van along with complete information on its position, attitude, direction, and speed.

The control van will contain the computers and equipment needed to plan the vehicle's route and pilot it across the "battlefield." People will play a part in each of these operations, but they will receive as much machine assistance as possible.

When the operator selects a destination, for example, he will consult an automatic route planner to map out the best path for the vehicle to follow. The system's interactive route planning software will draw upon the information stored in a geographic data base to make course recommendations. This data base will contain detailed information on such terrain features as slope, surface and configuration, soils, hydrology, and vegetation. Planning a route on the battlefield, however, involves more than just getting from one point to another. The operator in the control van will set specific parameters for route selection depending on the particular mission requirements or circumstances. He could opt for a route that minimizes distance, fuel consumption, and traveling time; choose one that offers maximum concealment and survivability; or request one that combines certain of these factors.

The soldier who "drives" the vehicle will follow the route selected, using the information relayed from the platform to keep track of where it is and where it is going. Navigation display screens in the control van will provide a real-time view of the vehicle's surroundings. A digital map display shows the preplanned route; a blinking cursor pinpoints the vehicle's location and heading with respect to this route.

The driver will also have access to special computer graphics such as shaded relief and perspective views. These aids will give him a better view of the terrain at points along the route where adjustments might be needed. The driver selects the best possible route based on available information and uses the real-time information transmitted from the vehicle to detect and avoid obstacles. He must decide whether a route can be adjusted to accommodate the real world (that is, steering around a ditch) or whether a new route must be mapped out (such as when a destroyed bridge cannot be crossed).

Although the Army's near-term demonstrator provides a unique capability for "over the hill" control, it relies on existing technologies. The current state of the art makes a man in the control loop a must. Project officials, however, believe that they can gradually transfer the functions performed by the operators in the control van to the platform itself with vehicle autonomy as their ultimate goal.

It's a Snap!

At Fort Monmouth's Electronic Warfare Laboratory (EWL), they call it the "little black box," but it's much more than that.

The steerable null antenna processor (SNAP), which recently entered production, is an electronic counter-countermeasure (ECCM) device that has proven so effective it heads a growing family of similar devices.

While SNAP I protects a vehicular-mounted field radio from unwanted signals, an improved frequency hopping version is now in the concept demonstration phase. Also in exploratory development are a multichannel SNAP for use with multichannel tactical radios and a high frequency SNAP used with tactical high frequency radios. Still another version of SNAP which operates in the ultra high frequency bands is in engineering development for use in the position location reporting system (PLRS).

The Electronic Warfare Laboratory has pushed hard to develop ECCM devices for the full spectrum of radios in the field. Most of these radios have no antijamming features, but they will remain in the Army's inventory for the foreseeable future.

SNAP I makes it possible to differentiate between desired and interfering signals and, if they are separated in azimuth, to steer the nulls of the antenna pattern to the direction of the interference. SNAP I does this all automatically.

In concept the operation of the device is quite simple. The antenna receives the jamming signal; then the SNAP processes that signal to eliminate the jammer. In effect, it acts like a filter. But this is done after the signal reaches the antenna and before it gets into the receiver. One of the attractive features of SNAP I is that the enemy can't detect that it is being used.

Vehicular-mounted field radios are protected by SNAP I from unwanted signal jamming.

Any enemy who is direction-finding will not know that a SNAP I device is attached to the radio because it provides no distinctive signature. The enemy operator sees only the normal signature of the radio.

Another highly favorable feature of this device is that no alteration to the radio is necessary. Moreover, a system equipped with SNAP is interoperable with nonequipped radios. (Wanda Walters, Electronic Warfare Laboratory)

Pass the Ammunition!

Keeping the Army supplied is no easy task, especially when it comes to keeping it supplied with ammunition. In fact, about 70 percent of the Army's resupply efforts are focused on ammunition.

The ammunition logistics supply chain is long and complex. At one end there is the logistic user who requires movement of ammunition in bulk, and at the other end is the combat user who requires a "clean round." The Army must have a total ammunition logistics system that will satisfy both users' needs: ammunition in containers that is easy to ship and handle safely and at the same time provide the combat user with faster rearm times, ease in use, and less debris.

While in existence for only a short time, the 15-person Project Management Office for Ammunition Logistics has already begun to make major improvements in the Army's ammunition logistics system.

"Working closely with our laboratory counterparts we are developing a total system from designer to shooter. The soldier in the field is our uppermost concern, and as the laboratory and industry develop new ideas we will have to implement them carefully making sure they are reliable, safe, and do the job they are intended to do," said Colonel Paul L. Greenberg, project manager of the new office. "We expect to field 32 items during fiscal years 1986 through 1988. . . . We are striving to provide that soldier the best ammunition logistics system available."

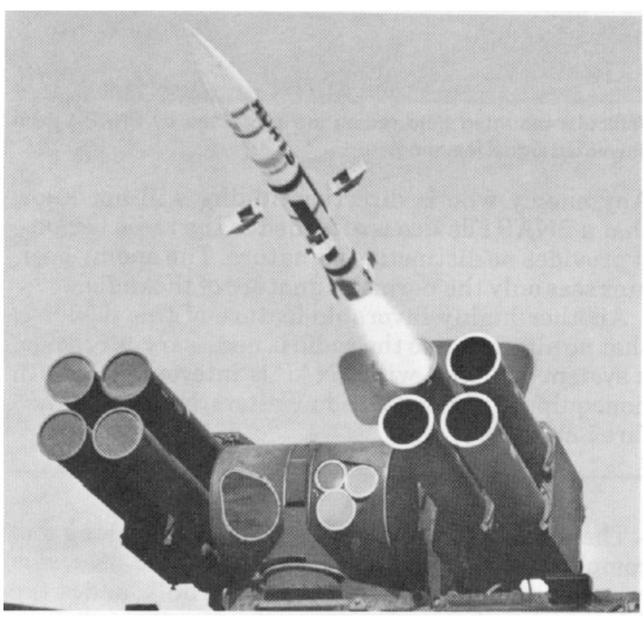
While the Army has dedicated itself to keeping pace with today's modern technology, its state-of-the-art equipment is currently dependent on World War II vintage ammunition logistics technology.

The Project Manager for Ammunition Logistics (PM AMMOLOG) was created to become a focal point for the direction and integration of the Ammunition Logistics Improvement Program. Unlike the traditional project manager whose mission follows one item from concept through production and fielding, PM AMMOLOG and the US Army Training and Doctrine Command's (TRADOC) Munitions Systems Manager will conduct a concerted program that manages a range of ammunition logistics items and their interfaces from the laboratory to the field. Packaging; materiel handling equipment; transportation; storage; battlefield resupply; command, control, and communications for ammunition management; and how well these items tie together are areas the project manager must address and improve.

While implementing these improvements, managers have many things to keep in mind. Among these, the most important is maintaining the Army's high state of readiness. For example, as the Army begins to redesign and improve its ammunition packaging system, modifications will be made on other types of Army equipment that address or are closely involved with the ammunition package. The new office will strive to influence the designers of weapon systems, transportation, and materiel handling equipment. Their goal will be to integrate ammunition logistics considerations early in the design process. At the same time, they will introduce equipment modifications and improvements into the current Army system.

The office's near term goals are to provide packaging that is safe for the handler yet able to protect a round that is ever increasing in complexity; and finally, to provide the soldier with a "clean round"—a round that is easily accessible without a large amount of packaging. Presently for tank ammunition, a ton of ammunition creates a ton of battlefield debris.

In the far term, one of the goals of ammunition logistics will be to move ammunition from the load plant forward to be inserted into the weapon system in the same package, which is an integral part of the weapon. Not only would such a system speed up ammunition resupply, but it would also decrease the down time and vulnerability of the system.



An Air Defense Antitank System missile sheds its plastic sabots as it blasts from its launcher during test firings. (Martin Marietta Aerospace)

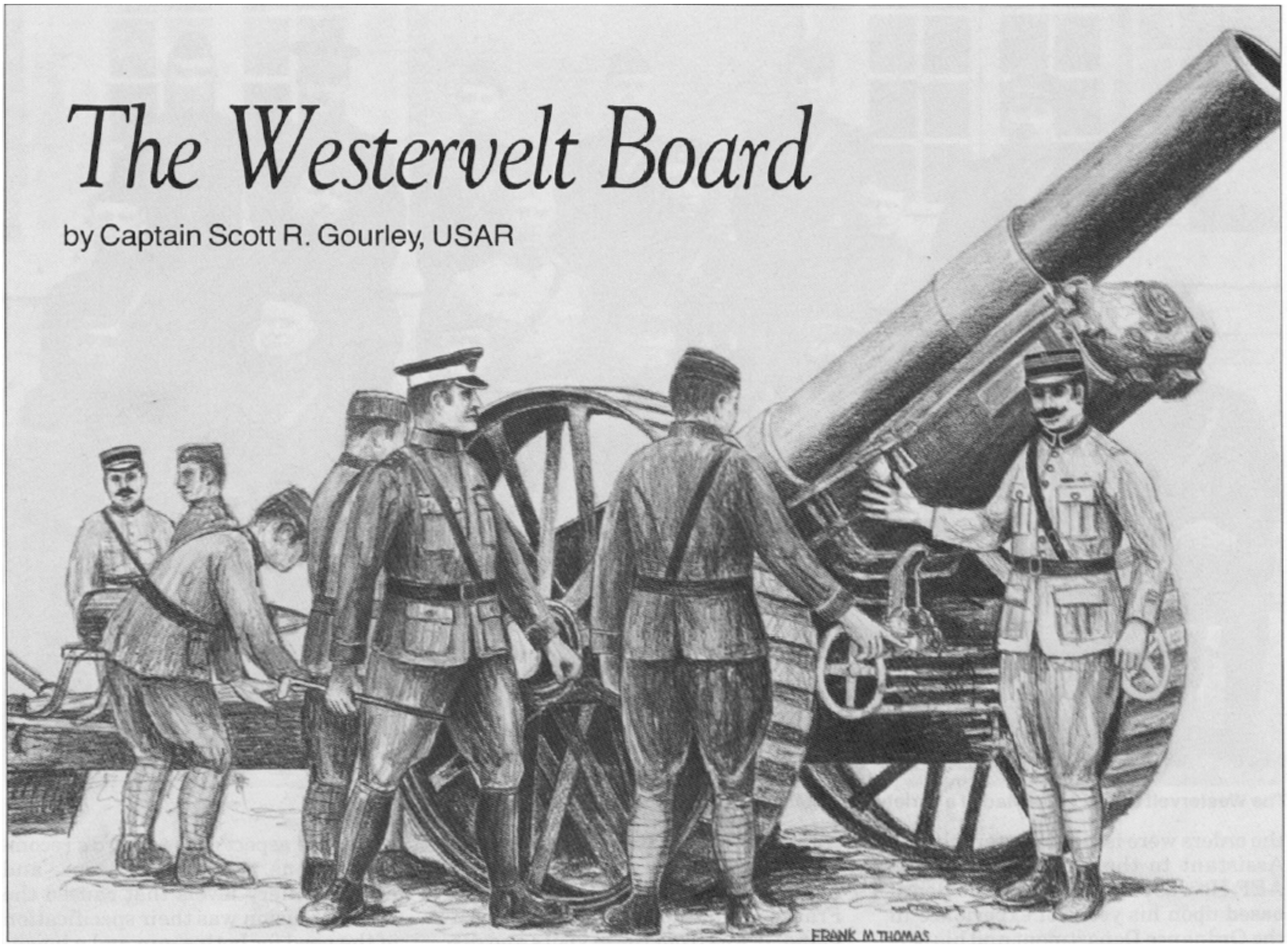
Air Defense Antitank Weapon System

The Air Defense Antitank Weapon System (ADATS) promises commanders at the forward line of own troops (FLOT) a double "whammy." Using MACH 3, dual-purpose missiles and laser-beam guidance, ADATS has successfully completed a 59-month, full-scale engineering development program. The 39-missile test schedule, which achieved an overall 85 percent success rate, included intercepts of QF-86 drone jets and direct hits on both stationary and moving tank targets.

The ADATS is a modular system that features passive forward looking infrared radar and television target detection, acquisition, and tracking for continuous operation at night, in adverse weather, and in the presence of countermeasures. Each autonomous unit is armed with eight ready-to-fire missiles and an integral radar and electro-optical fire control system. The system is contained in a single mobile unit that can be mounted on a variety of existing combat vehicles or adapted for shipboard or helicopter installation.

The Westervelt Board

by Captain Scott R. Gourley, USAR



LTC Frank M. Thomas

From December 1918 to May 1919, a group of seven American officers met to consider the future of artillery in the US Army. Perhaps their recent military experience caused them to be a little more cynical than the politicians who celebrated the completion of "the war to end all wars," but their orders were explicit. They met to:

> ". . . make a study of the armament, calibers and types of materiel, kinds and proportion of ammunition, and methods of transport of the artillery to be assigned to a Field Army."

Without the benefit of computer runs or sophisticated "threat projections," the Board made a subjective assessment of US Field Artillery during The Great War and its implications for the future. The Board's recommendations were never totally accepted or implemented. But in terms of artillery equipment, missions, and organizations, the impact of their final report is felt by the US Field Artillery today and will be felt by all members of the US Army well into the next century.

Due to the nature of their discussions, the seven men have occasionally been referred to as "The Caliber Board." However, they are usually remembered by the name of their senior member, Brigadier General William I. Westervelt. They were The Westervelt Board.

As the American Expeditionary Force (AEF) entered World War I, the US Field Artillery found itself supplied with a mixture of French and British light, medium, and heavy artillery. Almost 800 French 155-mm howitzers and over 1,800 French 75-mm guns combined with British pieces that included more than 100 8-inch howitzers to equip the American artilleryman with a relatively new and unfamiliar mix of weapons. Throughout the period of AEF involvement, these weapons provided the Americans with a diversity of combat experience.

About the time the Armistice was signed, Major General William J. Snow, Chief of Field Artillery, began searching for ways to capitalize on these combat experiences and to salvage some of the artillery lessons learned with these new systems. He was afraid that the US Army might otherwise lose this priceless information in the rush to demobilize. Consequently, he considered various plans to digest and preserve these artillery experiences.

The first option pondered by Snow involved asking General Peyton C. March, the Army's Chief of Staff, to authorize a personal fact-finding mission for the Chief of Artillery. Snow abandoned this option after a conversation with Brigadier General E. H. DeArmond, a member of his staff. DeArmond, who had considerable experience in the Office of the Chief of Artillery, AEF, suggested that a board of officers be appointed for the artillery study. General Snow liked this alternative and had General DeArmond prepare a memo to the Chief of Staff for Snow's signature.

In this memorandum of 5 December 1918, DeArmond and Snow not only recommended the issues to be considered by the proposed Board but also recommended the Board's composition. General March approved the proposal, and orders activating the Board were cut within the week.

General Westervelt was the initial member selected for the Board. When

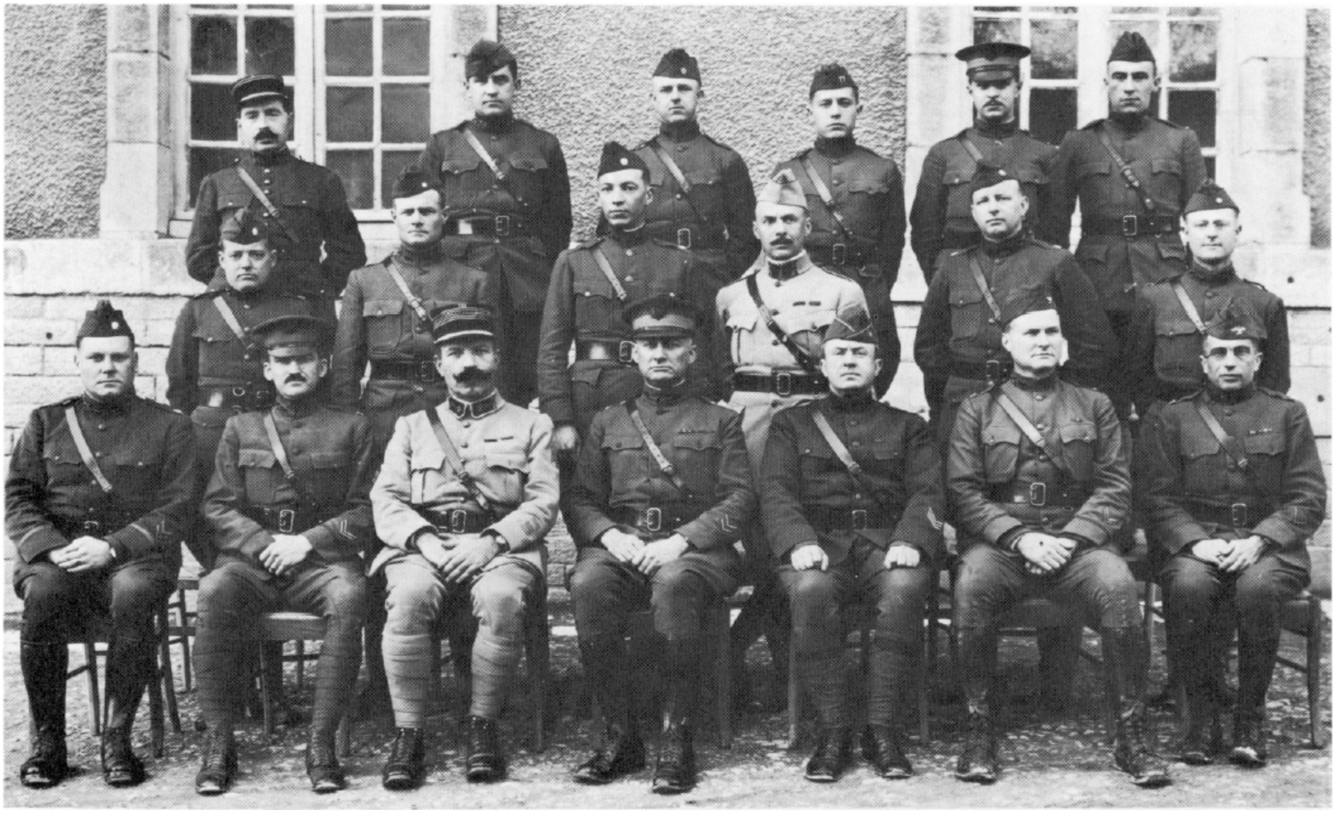


Photo courtesy National Archives

The Westervelt Board consisted of a variety of military specialists.

the orders were issued, Westervelt was Assistant to the Chief of Artillery, AEF. He was selected to lead the Board based upon his years of experience in the Ordnance Department and his personal specialization in artillery materiel.

The Board also included a number of other specialists: Brigadier General Robert E. Callan, a heavy artillery brigade commander in France and a specialist in heavy artillery materiel; Brigadier General William P. Ennis, Commander of the 13th Field Artillery Brigade at Camp Lewis, Washington, and an expert in horse and motor transport; Colonel James B. Dillard, an Ordnance Department specialist in gun and carriage design; Colonel Ralph McT. Pennell, Commander of the 34th Field Artillery at Camp McClellan, Alabama, and a former materiel specialist for the Office of the Chief of Field Artillery; Lieutenant Colonel Walter P. Boatwright, a specialist in heavy artillery materiel; and Lieutenant Colonel Webster A. Capron, an Ordnance Department motor transport specialist.

The Board members assembled at Chaumont, France, on 12 January 1919. There, they began a lengthy series of discussions with veteran French and American artillery officers and toured French manufacturing facilities. The Board also visited Italy to meet with Italian artillery officers and technical representatives. Finally, they met with the British both in France and at the War Ministry in England. It was from these visits and discussions, supplemented by their own personal combat experiences, that the Board members made their final report on 5 May 1919.

The Westervelt Board organized its final report into five major sections beginning with a general discussion of a field army's artillery and expanding the discussion to include an examination of the functions of the associated artillery organizations—division artilleries, corps artilleries, and army artilleries. The report opened with a finding that is now considered self-evident in the US Army: "Many actions of our divisions in France resulted in casualties whose numbers were a decreasing function of the number of guns with which the divisions were supported." From this cursory argument for the value of artillery support, the Board examined the divisional artillery of The Great War and concluded that "its objective must be primarily the infantry of the opposing division." The concensus of the artillery officers interviewed by the Board was that the division artillery's missions were best fulfilled "by a light field gun and a light field howitzer having a range of at least 11,000 yards."

The one aspect of the Board's recommendations at division, corps, and army artillery levels that caused the most confusion was their specification of the need for both a gun and a howitzer at each echelon. This apparent duplication of artillery is best explained in the section of the report on division artillery:

> This general type of field gun, while capable of fulfilling most of the division artillery missions, must be supplemented by a proper howitzer. There are many instances where the terrain offers such protection to infantry that the field gun cannot bring an effective fire. The howitzer has the great advantage that with a proper set of propelling charges and, therefore, a choice of trajectories for the same range, protected positions can be chosen for howitzers that guns could not use, and angles of fall on objectives obtained that the normal ammunition of guns would not give.

For a time, the Westervelt Board considered the development of a gun-howitzer. Their justification for discarding this option rested on four major points:

- It would require a heavy projectile, thus increasing tonnage of ammunition supply for the same volume of fire.

• Ammunition supply would be further complicated by the necessity for both fixed and semifixed ammunition to accomplish the double function.

• For good gun characteristics, the piece and carriage would have to be heavy which would decrease mobility.

• The gun-howitzer would not maximize the characteristics of either weapon.

As it considered the other levels of artillery organization, the Board generally applied the same gun and howitzer arguments. For example, it determined that the principal mission of the corps artillery was counterbattery work. However, the members noted that some American units had not received adequate corps artillery support in the war and, as a result, felt that the division artillery should be provided with a counterbattery weapon. The argument was further complicated by the finding that the 155-mm howitzer, which was found in the division artillery, was an ideal counterbattery weapon. These howitzers were not found in the exclusively gun-equipped corps artilleries. In the end, the Board called for both a corps gun and a howitzer, each having a range of 16,000 yards.

The officers under Westervelt envisioned the army artillery's missions as interdiction, neutralization, and destruction of targets beyond the corps' capabilities. Once again the Board called for two army weapons—a heavy gun with a range of 25,000 yards and a heavy howitzer with a range of 18,000 yards.

From its assessment of the ideal artillery capabilities and missions, the Westervelt Board proceeded to survey existing systems and munitions. In the second section of the report they discussed the types of artillery that were available during The Great War. In the third section they commented on the design and construction of artillery projectiles.

Having handled the preliminaries, Westervelt and his men tackled the meat of the issue by recommending future artillery for the US Army. The seven artillery weapon systems that they proposed included: light field guns, light field howitzers, medium field guns, medium field howitzers, heavy field guns, heavy field howitzers, and super guns and howitzers.

As it described the various systems, the Board showed a remarkable grasp of the realities of weapons acquisition by recommending both an ideal and a practical solution. For example, they described the ideal light field gun candidate as a 3-inch caliber, firing a projectile not over 20 pounds to a maximum range of 15,000 yards. Their practical solution, however, advocated arming brigades with readily available 75-mm guns—half equipped with model 1916 and half equipped with the French 75-mm guns. The ideal light field howitzer was, from the Board's perspective, a 105-mm weapon with a range of 12,000 yards. But the practical interim solution was a 155-mm Schneider, while development of the ideal 105-mm weapon was strongly pursued.

The Board also recommended medium field artillery guns and howitzers. The ideal medium gun would have a caliber between 4.7 inches and 5 inches and a maximum range of 18,000 yards with a shell weighing not more than 60 pounds. The practical solution consisted of arming the corps artillery with a mixture of the 4.7-inch model 1906 and British 5-inch guns. The ideal medium howitzer was envisioned as a 155-mm weapon which could fire a 100-pound shell capable of achieving 16,000 yards in range. The practical solution was interim arming with the 155-mm Schneider.

The Westervelt Board also recommended guns and howitzers for the heavy artillery. The ideal gun would have a 155-mm with a maximum range of 25,000 yards, while the practical solution was to arm with the on-hand 155-mm weapon. The ideal howitzer was 8 inches with a 240 pound projectile that could be fired 18,000 yards. Until that 8-inch howitzer could be developed, the British 8-inch howitzer provided a practical alternative.

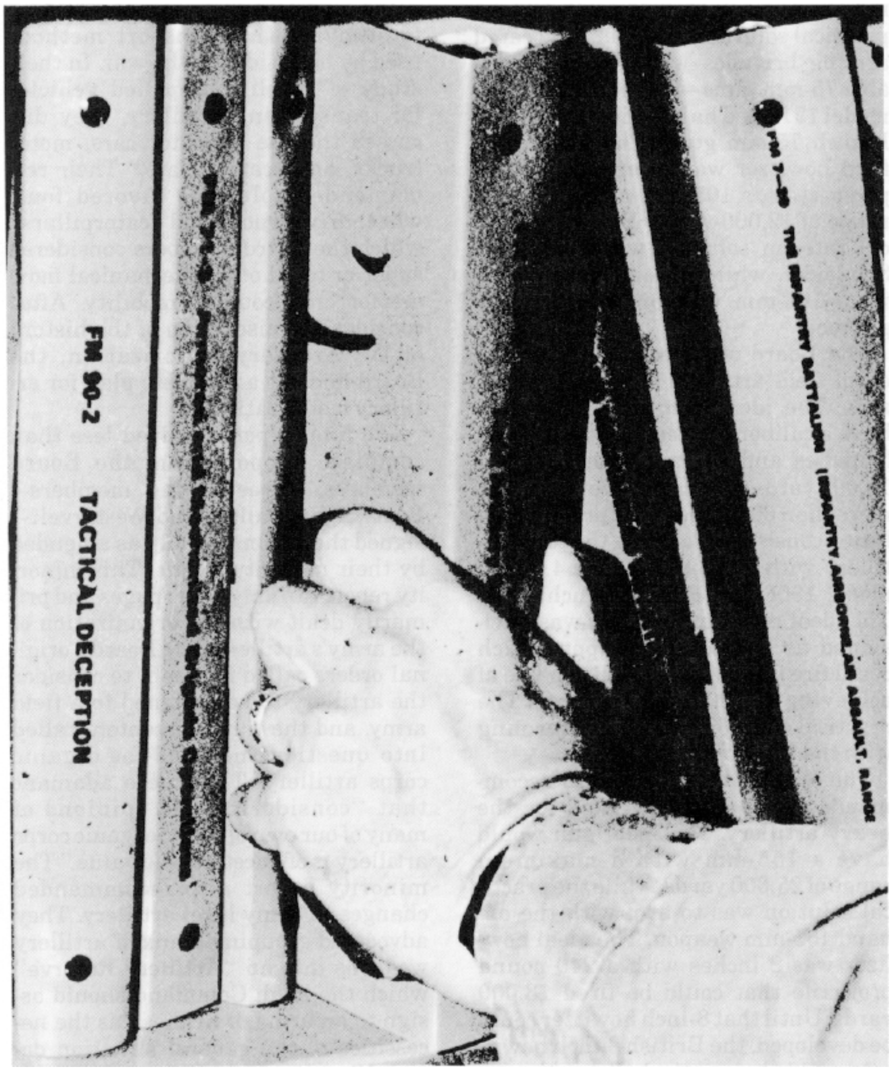
The Board concluded its artillery recommendations with a discussion of extraordinarily heavy artillery and "other artillery" weapons. The exceptionally heavy weapons included seacoast defense guns and railroad artillery. Other artillery included a miscellaneous category where the Board lumped antiaircraft, pack artillery, infantry accompanying guns, trench artillery, and antitank guns.

The final section of the Westervelt report dealt with artillery transport. The Board had convened at a critical moment in the history of mechanization. In the Board's words: "We had developed the use of man and animal power to the practical limit." There was only one possible progressive course of action: mechanical transport. In fact, the Board members devoted considerable time and attention to studying the transport methods used by both sides in the war. In their study of gasoline-propelled vehicles for transporting artillery, they discussed the use of motor cars, motor trucks, and "caterpillars." Their recommended solutions favored four-wheel drive trucks and "caterpillars" which the board members considered superior to all other mechanical movers for cross-country mobility. After considerable discussion of the history of US Artillery motorization, the Board laid out a complete plan for artillery motorization.

The final report received less than complete support from the Board members. Three of the members—Boatwright, Callan, and Westervelt—signed the document only as amended by their minority report. This minority report ran only three pages and primarily dealt with the organization of the army's artillery. The Board's original orders called for them to consider the artillery to be assigned to a field army, and the three dissenters called into question the need for organic corps artillery. They were adamant that "considering the opinions of many of our own officers, organic corps artillery is of questionable value." The minority report also recommended changes in army-level artillery. They advocated grouping a mix of artillery weapons into an "Artillery Reserve" which the High Command should assign to an army or armies "as the necessities of the general situation demand."

General March approved the final report on 23 May 1919. Over the ensuing years, US military equipment has changed dramatically. Today few people even know who or what the Westervelt Board was. Yet there is no doubt that the board members had an impact far beyond their time. Looking back at the ideal weapons recommended for light, medium, and heavy howitzers (105-mm, 155-mm, and 8-inch), one can see how the seven soldiers of the Westervelt Board helped to shape today's field artillery. In fact, when the additional discussions on motor transport and artillery missions and organization are taken into account, it's plain to see that William Westervelt and his six associates have had a monumental impact that will be felt by the US Army long into the next century.

Captain Scott R. Gourley, FA, USAR, is employed by the FMC Corporation Ordnance Division in San Jose, California. A former Threat and Target Acquisition instructor at the US Army Field Artillery School, he is the author of numerous magazine articles and is the recipient of the US Army Forces Command Fourth Estate Award for Excellence in military journalism. He is currently a member of the US Army Reserve Control Group Reinforcement.



Doctrine—
Credo or Counsel?

by Lieutenant Colonel Peter Morosoff, USMC

In combat, each situation is unique and requires a unique solution. In short, combat knows no rules. Probably the best brief discussion of this appears in the first three paragraphs of *Infantry in Battle:*

> The art of war has no traffic with rules, for the infinitely varied circumstances and conditions of combat never produce exactly the same situation twice. Mission terrain, weather, dispositions, armament, morale, supply, and comparative strength are variables whose mutations always combine to form a new tactical pattern. Thus, in battle, each situation is unique and must be solved on its own merits.
>
> It follows, then, that the leader who would become a competent tactician must first close his mind to the alluring formulae that well-meaning people offer in the name of victory. To master his difficult art he must learn to cut to the heart of a situation, recognize its decisive elements, and base his course of action on these factors. The ability to do this is not God-given, nor can it be acquired overnight; it is a process of years. He must realize that training in solving problems of all types; long practice in making clear, unequivocal decisions; the habit of concentration on the question at hand; and an elasticity of mind are indispensable requisites for the successful practice of the art of war.
>
> The leader who frantically strives to remember what someone else did in some slightly similar situation has already set his feet on a well-traveled road to ruin.

The questions, then, are these: If combat situations are not solved by rules, how does one use the material contained in field manuals, fleet marine force manuals, and naval warfare publications? Aren't these manuals doctrine, and doesn't doctrine tell you what to do? Shouldn't doctrine be obeyed? The answers to these questions are complex. But simply stated, one can confidently say that the tactical manuals contain a variety of literature on doctrine, administrative organization, tactics, techniques, and procedures. Each of these types of literature has different legitimate uses. The soldier who knows how to use each type of material possesses a tremendous advantage.

Doctrine

Joint Chiefs of Staff Publication 1 (JCS Pub 1) defines doctrine as: "Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application." *Webster's Third New International Dictionary* defines a principle as: "A general or fundamental truth."

Principles then are fundamental statements describing how the world works. The laws of physics are fundamental principles; so is the statement: "Look out for your men, and they will look out for you." Because we never perceive history perfectly, the principles we use are never totally accurate. Each generation modifies some of the fundamental principles framed by previous generations. Usually, but not always, these modified rules describe the world better than the rules they replace.

Each principle has a name as well as a description or definition. Some of these descriptions or definitions include a list of parts. For example, the definition of electronic warfare includes three parts: electronic support measures, electronic countermeasures, and electronic counter-countermeasures. Doctrine is nothing more than a collection of names and definitions which have been supplemented with explanatory statements.

Doctrine is important because it provides the intellectual framework we use to think about military operations. Someone who knows nothing of warfare sees a battle as random actions. The trained observer, however, sees patterns in a battle. He sees defenders and attackers as well as the differing application of principles which govern each. For example, the attacker may organize his forces in three echelons: the assault echelon, the fire support echelon, and the reserve echelon. The defender deploys in echelons which are arranged in-depth. Those who understand the doctrine of their area of warfare have a vocabulary they use to think about the world around them, judge that world, and then issue orders. If the doctrine used is precise and complete, the world will be seen accurately and commands will be precise. If a soldier does not know doctrine, his observations and thoughts will probably be fuzzy, and his commands will be imprecise.

Armed forces often train to fight the last war and find themselves unprepared when the next one starts. Recognizing this tendency, many leaders have doubts about the relevancy of our training. They try to see the future and train for the next war. History records that many men have seen much of the future, but no one, regardless of nationality or profession, has accurately predicted every aspect of the future. Because it seems unlikely that today's soldiers are smarter than those who have gone before us, it appears impossible to train a force that will avoid being surprised by some aspects of the next war. Rather, victory will probably go to those who can best adapt to whatever the next war brings. Understanding doctrine is a key to making those adaptations.

To most soldiers, doctrine means anything published in a field manual. To a few, doctrine includes all or much of what is in joint manuals. However, the facts are that very little of the material in these manuals *is* doctrine. Most of the matter in these manuals falls into the categories of administrative organization, tactics, techniques, and procedures. The guidance on formats for reports and operation orders, instructions on numbering pages, and organizational diagrams are not "fundamental principles." This is not to say that this material is unimportant or should not be included in the manuals. This detailed material is vital. However, doctrine, unlike the detailed matter, is universally applicable and helps us determine what needs to be done on the battlefield. But doctrine is of little use without a supporting set of tactics, techniques, and procedures to guide us.

Doctrine is important because it provides the intellectual framework we use to think about military operations.

Administrative Organization

The administrative organization of a unit is included in its table of organization and equipment (TOE). Frequently, the TOE includes the unit's mission, its structure, the number of authorized weapons, and the function the unit is expected to be able to perform. This important information suggests the strength and weaknesses of the unit, and it enables leaders to apply *our* strength against the *enemy's* weaknesses.

Tactics

Tactics is a term we frequently use and read about in military literature but rarely think about. Down through the centuries, leaders who have applied their understanding of tactics could use this vital guidance to reinforce the employment of their units much better than less learned colleagues. Just as a successful short story writer knows the characteristics of a tale, a successful military leader knows tactics.

The word "tactics" comes from the Greek word *taktikos* which means to arrange. *Taktikos* can be applied to arranging players on a football field just as appropriately as arranging soldiers on the battlefield. The official Department of Defense definition of tactics appears in JCS Pub 1. It includes:

- The employment of units in combat.
- The ordered arrangement and maneuver of units in relation to each other and/or to the enemy in order to utilize their full potentialities.

Tactics are the patterns, models, or forms for employing units. The tactics of football are the plays a team uses. A statement which describes tactics is one which describes the pattern of a unit's activities when performing a particular type of activity. The old saw used to describe the attack of a bunker is an example of such a statement. It is: "Blind them, burn them, and blast them." It was intended to prompt the following actions: First, blind the bunker's occupants, often with a smoke grenade. Second, under cover of the smoke, spray the bunker's aperture with a flame thrower. Third, while the bunker's occupants are kept away from the aperture by the results of the flame thrower attack, thrust explosives into the bunker.

While doctrine describes and classifies what happens on the battlefield in terms of fundamental principles, tactics describe the patterns a particular type of unit uses to do the various doctrinal evolutions.

While doctrine remains the same decade after decade, tactics change with the introduction of new equipment and force structures. When infantry units were issued rockets that could destroy bunkers, the tactics or pattern for employing an infantry unit to destroy a bunker changed. Now the bunker is just blasted with a rocket.

Tactics provide general, not detailed, guidance. Detailed guidance for doing particular functions is provided in procedures and techniques. Again using the example of the attack on the bunker, the tactics embodied in the statement, "Blind them, burn them, and blast them," are very general. The leader of the unit ordered to attack the bunker must be told or must figure out for himself how the bunker will be blinded. Use a smoke grenade? Call for artillery smoke? Start a brush fire?

Techniques

The Army Dictionary, AR 310-25, defines techniques as: "Methods of performance of any act, especially the detailed methods used by troops or commanders in performing assigned tasks. A technique refers to the basic methods of using equipment and personnel. The phrase 'tactics and techniques' is often used to refer to the general and detailed methods used by commanders and forces in carrying out their assignments."

An example of a technique is the movement of a unit at night and the firing of a preparation before an attack. Techniques are included in manuals to alert us to possibilities and not to direct us to do something in a specific situation. Remember, there are no iron-clad rules.

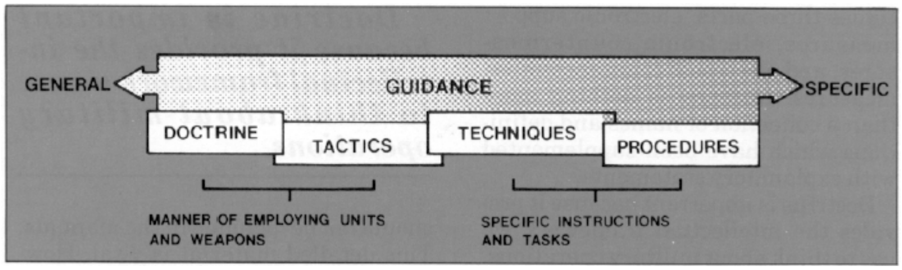
Procedures

A procedure is "a particular course or mode of action that describes how to perform a certain task." The artillery call for fire, the five-paragraph order, and the steps for clearing a machine gun are all examples of procedures. Procedures are one of the ways that the elements of a force come together. For the elements of a force to function as a team, the members of these elements must know what they are to do, and they must know what the elements adjacent to them, supporting them, and being supported by them will do. Because procedures state who will do what, they are the glue that ties the elements together into a force. Thus, forces publish standing operating procedures (SOP). It is generally agreed that any organization which does not have written or unwritten SOPs is an organization inviting great and needless confusion.

Procedures are a means for achieving that cardinal military virtue: simplicity. Complicated operations should be reduced to a succession of small, simple steps.

Only those procedures which are appropriate should be used. However, care should be taken when modifying procedures included in tactical manuals. These procedures have been designed with great care. Communications requirements, safety factors, equipment limitations, and ease of use, among other factors, have all been considered. Further, when any element of a force deviates from published procedures, it risks confusing the other elements of the force.

When categorizing the material in tactical manuals, don't lose sight of the purpose for doing this; that is, understanding the contents of the manuals so the manuals will serve as aids to solving military problems. The diagram below shows the overlapping relationship of doctrine, tactics, techniques, and procedures.



Summary

Because every situation is unique, we must selectively use the contents of tactical manuals to serve us. Manuals should never become tyrants that restrict us. The key is understanding the nature of each manual's contents. Specifically, we must understand that there are five types of material in tactical manuals:

• The fundamental principles of doctrine which give us the intellectual structure we use to observe combat, solve tactical problems, and give instructions.

• Administrative organization which helps us understand the strengths and weaknesses of our units.

• Tactics or patterns for employing forces.

• Techniques or the ways of doing things.

• Procedures or the specific steps for doing things.

A tactical manual is much like a box of tools. When we open the tool box, we see many wondrous items. Those who have not concerned themselves with the names and uses of the tools know only that each tool must be held firmly and used with conviction. Those who know the names of the tools and understand their uses will cut the boards with the saw, smooth the wood with the plane, attach the pieces with the screwdriver, sand the piece of furniture with the sandpaper, and apply the finish with the paint brush. The individual who took the simple view will have a collection of dented boards and broken tools. The individual who understands will have pieces of fine furniture.

The soldier who says that everything in the field manual is doctrine and, therefore, must be adhered to religiously will be a very busy fellow who will do much that is inappropriate to the situation. The soldier who acknowledges that one must carefully select concepts from the manuals but who cannot distinguish between the fundamental principles, tactics and techniques, may unwittingly violate the principles and slavishly follow inappropriate procedures.

The soldier who understands that doctrine includes fundamental principles and who further understands what the fundamental principles are in his area of warfare is the soldier who can choose the tactics, techniques, and procedures which suit the military situation. Further, this soldier will have the understanding needed to develop new tactics, techniques, and procedures to fit the new, unexpected situations. And possibly most important of all, this soldier will have the understanding to adjust his tactics, techniques, and procedures while making the most of his administrative organization to home in on the enemy's weaknesses.

The leader who understands what tactics are and how to express them has a valuable tool available for conveying his orders. One can teach subordinates and lead units in combat without understanding the concept of tactics. However, the individual who understands that tactics are patterns, forms, or models, will be a more effective teacher or leader. He has an aid for keeping general guidance separate from specific guidance. If the leader and his subordinates understand this, the leader need only say, "my tactics are . . ." for his subordinates to know the general guidance they are to follow, and that they are expected to flesh out this guidance by using their initiative and good judgment or by applying techniques and procedures with which they are familiar.

The leader who understands that techniques are guidelines that free him to vary his orders as the situation requires is a leader who is not restricted by the techniques described in tactical manuals.

Finally, the leader who understands that procedures help mold a collection of elements into a force and, thus, that they must be modified with great care is a leader who can avoid hobbling himself with inappropriate procedures while reaping the benefits of standardization.

And the leader who understands all of the above is the leader who can use training literature to help him solve the endless stream of unique situations he will face in combat.

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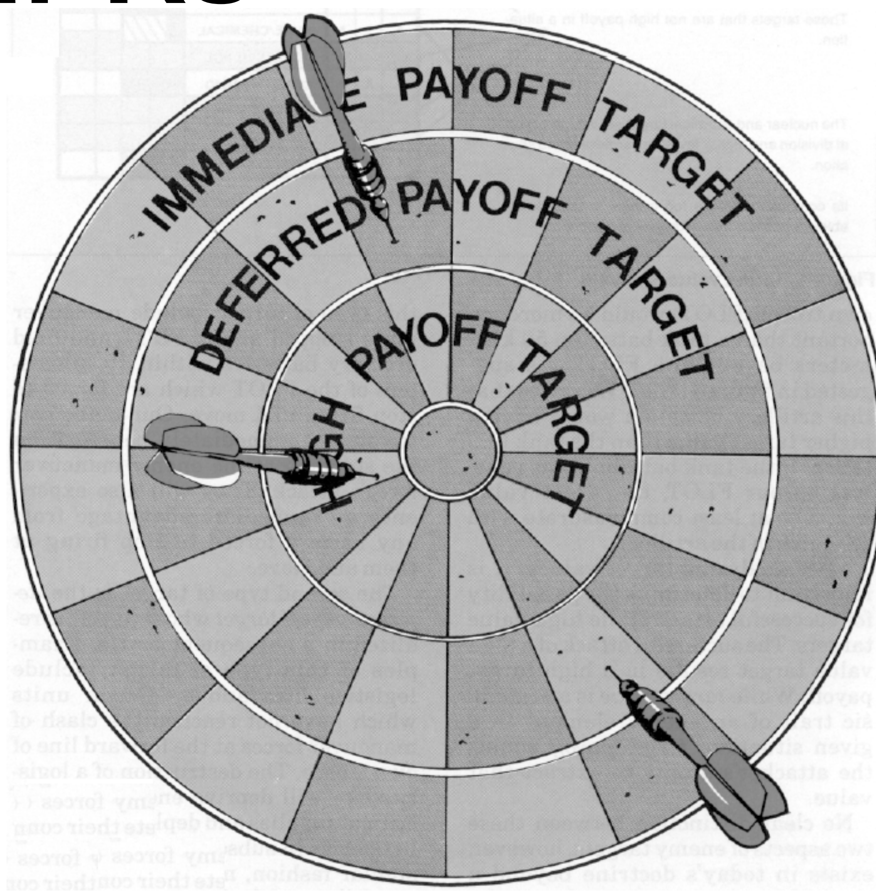
Sitting across the border is an enemy army waiting to attack into your division's sector. Looking across the wire which marks the international boundary, you quickly recount the four battalions in your division artillery and the three attached corps artillery battalions. You have 20 cannon batteries and one multiple launch rocket system (MLRS) battery available. You know that's all you can count on because you've already been told not to expect much, if any, close air support for 2 days.

When that enemy army does come across the wire—and you know it is coming very soon—you're going to have your hands full. Intelligence has already identified 500 targets in your sector alone. As you stand there straining to detect any movement across the wire, you know you can develop a priority list for those targets, but there are still nagging questions haunting you: What is the right weapon to fire, the right number of munitions, the right target, and the right time to fire? Unfortunately, our doctrine doesn't have an explicit answer to these questions. You've got a problem.

The Four Rs

by Dr. Joseph E. Halloran III



This fictitious division artillery S3 faces a crucial problem because the fire support doctrine upon which he bases his decisions has not kept pace with the changing dynamics of the battlefield. That doctrine does not provide guidelines for the best way to employ relatively scarce fire support assets against the abundance of important targets present in our potential enemy's force. Instead, the doctrine remains rooted in past battles; it takes its shape from the three major conflicts in which the US Army has participated in the last 50 years. These three wars shared two major fire support characteristics.

- Foot infantry was the principal ground target; and high explosive fragmenting artillery, mortar shells, and air delivered bombs produced the majority of the casualties caused by the fire support system.
- In each conflict our field artillery and close air support were both qualitatively and quantitatively superior to those of our opponents.

Neither characteristic remains true for contemporary US forces. American soldiers stationed in Europe and Korea or those stateside units forming contingency organizations can expect to encounter opposition from larger forces possessing more artillery than they do. Our superior numbers and the consistent nature of artillery targets in the past effectively covered our errors. They provided a comfortable cushion of forgiveness against possible doctrinal inefficiencies or tactical mistakes. A similar luxury does not exist today. As we face larger forces with equipment as sophisticated as our own, we will have little margin for error in our employment of field artillery.

In fact, our current doctrine—with its inherent close support, counterfire, and interdiction categories of fires—may prove to be our downfall. This doctrine tells us to attack all close support targets; win the counterfire battle; and begin interdiction as soon as time, weapons, and ammunition availability allow. The guidance has not gone much beyond that level of ambiguity which is satisfactory as long as US forces retain a superiority in field artillery. That vague advice is simply not sufficient. When Soviet active divisions outnumber US divisions 79 to 16, the resulting imbalance causes problems in all categories of fires. Military theorists since Jomini, battles since our Civil War, and current studies state an artillery force which is relatively weak quantitatively and which attempts to engage the opposing artillery in a counterfire duel will expend its own combat power, lose the duel, and undermine the success of the total force. A more precise method for distributing fires among the many important targets in the enemy force, therefore, must be developed.

The basis for this development already exists in the target value analysis (TVA) generated during the fire support mission area analysis (FSMAA) in 1980 and distributed Army-wide the following year. The TVA took the critical initial step of showing that a specific element of the enemy force does not always have the same value to that force. It identified the fluctuating importance of different elements of the enemy's formations. For example, a Soviet artillery battalion firing across the forward line of

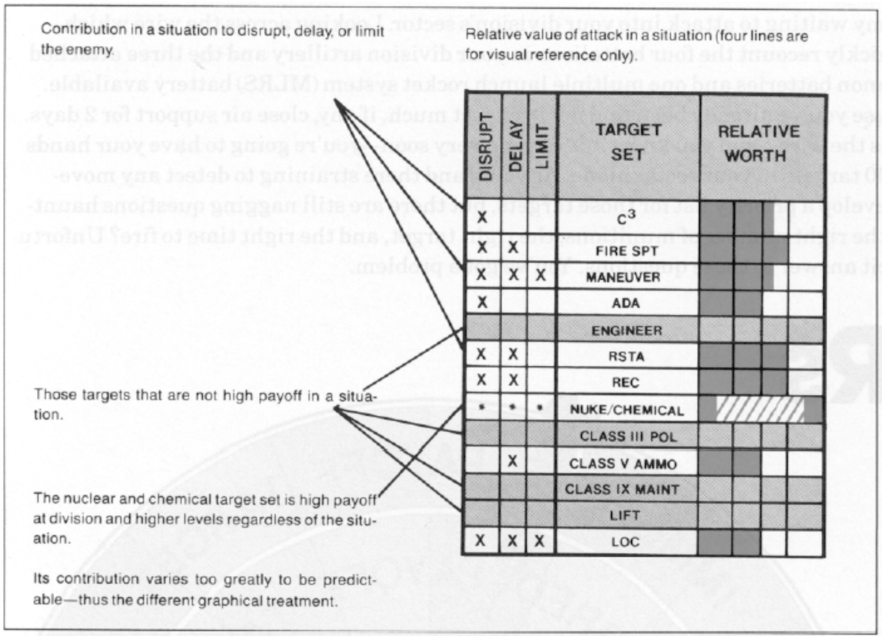


Figure 1. Target value analysis.

own troops (FLOT) would be more important than a tank battalion 50 kilometers beyond the FLOT. As suggested in figure 1, the TVA states that this artillery battalion would have a higher target value than the tank battalion. If the tank battalion was penetrating our FLOT, its target value would be at least commensurate with the value of the artillery.

After analyzing target values, it is important to determine the possibility for successful attack of the high value targets. The successful attack of a high value target results in a high target payoff. While *target value* is an intrinsic trait of an enemy element in a given situation, *target payoff* equals the attacker's ability to extract that value.

No clear distinction between these two aspects of enemy targets, however, exists in today's doctrine beyond a short discussion in target value analysis documents. The clear outline of this distinction is imperative so our fire support doctrine can provide specific guidance both to increase the total payoff from target attack and to decrease the likelihood of unproductive attacks on targets yielding little real payoff. The development of that clear distinction, which will lead to a precise method for distributing fires, rests in a further delineation of high payoff targets in the target value analysis.

Two types of high payoff targets exist based on the timing of their payoffs in combat. The first type of target is an *immediate payoff target*. Engaging such a target has payoff from successful attack within approximately 1 hour after target attack. Examples of this type of target include maneuver units stopped at the FLOT and field artillery batteries within 10 kilometers of the FLOT which are forced to stop firing and move. Our maneuver forces will immediately benefit from the stopping of the enemy maneuver force's attack. They will also experience an immediate advantage from any battery forced to stop firing at them and move.

The second type of target is the *deferred payoff target* whose payoff is realized in a subsequent battle. Examples of this type of target include logistics sites and maneuver units which have not reached the clash of maneuver forces at the forward line of own troops. The destruction of a logistics site will deprive enemy forces of critical supplies and deplete their combat power in subsequent combat. In a similar fashion, maneuver units successfully attacked before they reach our FLOT will arrive at the FLOT at a later time than planned and with a reduced strength. The payoff for this attack occurs when weakened units enter the fight.

These two types of targets are equally important; the major difference is the timing of their payoffs. This difference in timing, however, does provide the gradation within the high payoff targets. This makes the immediate payoff targets more important to the supported maneuver unit because those targets must be defeated to win the battle.

The importance of successful target defeat, of course, is the critical aspect of fire support to the maneuver unit. The 1941 edition of FM 100-5, *Operations,* states that the primary role of field artillery is to "support maneuver by fire," a philosophy which has not changed. The utility of this support is the critical measure of effectiveness for any fire distribution strategy. Recent practice has illustrated that we have been inconsistent in determining the best measure of the effectiveness of our fires. The usual focus has been on the damage inflicted on the enemy.

The concept of high payoff targets simply defines which enemy elements should receive the most damage and does not completely describe the merits of artillery fires. The important aspect of this damage is not what it does *to* the enemy but what it does *for* our supported maneuver units. This view should dominate any determination of the value of supporting fires. The successful attack of a truck motor pool may destroy that facility but may not improve the combat situation of our supported maneuver units. Even a partially successful attack on an artillery battalion supporting an attacking enemy regiment, however, will produce a beneficial effect for our supported maneuver units by reducing the fires of that enemy battalion which, in turn, will allow our units a better chance to survive and defeat that attack.

The most important and direct effect of support fires is their ability to conserve the fighting strength of our maneuver forces so that those forces can implement their commander's concept of the operation. This view of measuring the effectiveness of supporting fires focuses on the central purpose of fire support and should improve the understanding between the field artillery and the maneuver arms. These ideas of critical high payoff enemy targets and the perspective by which we should view their attack lead to a description of what should be a coherent, efficient, and effective fire distribution strategy.

The third important factor in determining such a strategy is knowing the capabilities of our combat and combat support units against the various elements of the enemy force. We know that a particular field artillery unit can achieve a specific attrition capability against a given enemy target. A 155-mm howitzer battery firing a battery of three rounds of dual-purpose improved conventional munitions (DPICM), for example, should come close to achieving the damage listed in the Joint Munitions Effectiveness Manuals when it attacks an enemy mortar position. These data then allow the fire support system to develop a list of preferred methods of attack for each

Target priority	Preferred attack system in descending order
1. Close artillery	Air, MLRS, 155 Copperhead, 155 DPICM
2. Frontline maneuver units	MLRS, 155 Copperhead, 155 DPICM, Mortars
3. Deep artillery	CSWS, Air, 155 DPICM
4. Mortars	MLRS, 155 DPICM, Air
5. Air defense	Air, MLRS, 155 Copperhead, 155 DPICM
6. Command posts	Mortars, 155 DPICM, MLRS, CSWS, Air
7. Sensors	155 DPICM, MLRS, Mortars
8. Attack helicopter bases	MLRS, Air, CSWS, 155 DPICM
9. Airfields	Air, CSWS, MLRS
10. Reserve maneuver units	155 DPICM, 155 Copperhead

LEGEND:
MLRS—multiple launch rocket system
DPICM—dual-purpose improved conventional munitions
CSWS—corps support weapon system

Figure 2. Target priority and method of attack.

of the high payoff targets, which are themselves listed in order of priority. The logic behind developing a target-attack system matrix such as the one at figure 2 is to determine the most efficient, available attack method for each priority target. An optimal strategy for the distribution of fires can be developed that:

- Fulfills our primary role of supporting maneuver units by fire which will conserve their fighting strength and enhance their fighting capability. In accomplishing this task the system will, of course, continue to respond to any particular requirements from the supported maneuver units. This includes the command decision to attack specific targets above all others regardless of those targets' expected contribution to the battle.
- Achieves the most effective attack of the high payoff targets located on the battlefield.
- Distributes the fires for that attack efficiently among the available fire support assets while adhering to any constraints imposed by supported units' requirements and preferences.
- Prefers immediate payoffs to deferred payoffs until the immediate battle is under control as determined by the maneuver commander.
- Attacks the most lucrative deferred payoff targets as soon as the supported maneuver unit can cope with the immediate battle and as soon as any fires can be shifted from a constrained optimal distribution against immediate targets.

A precise, situationally-dependent, numerically-based set of guidelines for a fire distribution strategy holds great promise for the fire support system. Such a strategy is currently being developed for the Field Artillery School. The first phase of research and development of an explicit doctrine for allocating and distributing fires focusing on lethal effects has been completed. This research, conducted jointly by the Field Artillery School and Vector Research Incorporated, produced a mathematical fire distribution algorithm which could be used in automated fire support elements or operations sections. This set of rules for solving the problem of attacking the right target with the right weapon system is summarized in figure 3. A second phase concentrating on suppressive effects and a third phase examining allocation are planned. The complete development of such a strategy would have numerous valuable uses. It could:

- Be used for real-time, short-term distribution of fires in combat.
- Assist in developing and refining the assignment of priorities to various target types over the long term.
- Form a basis for planning the allocation of fire support assets for operations because it outlines the best method by which those assets can be used to defeat targets.
- Help in the development of rules-of-thumb and guidelines for both allocation and distribution as certain parameters begin to remain constant for numerous situations.
- Assist in training fire support personnel in the most effective and efficient way to manage the fire support system.

Units possess the tools now to begin developing useful fire distribution strategies. The target value analysis can serve as the basis for developing priority lists of potential high payoff targets within each theater. It lists the high value targets for 17 tactical situations across echelons of command ranging from a Soviet or Warsaw Pact regiment to a *front*. Units can take these TVA lists and determine whether a payoff can be extracted from the high value targets based on the capabilities and limitations of their available acquisition and attack systems. An examination of the located targets, including their type, activity, and position on the battlefield, will determine whether their attack will produce an immediate or deferred payoff.

A successful fire distribution strategy adheres to the following rules:

- Its first goal is to distribute fires to maximize their effect on the enemy.
- Its second goal is to make the most efficient use of fires by minimizing cumulative necessary firing times, minimizing use of specific units, or releasing for the attack of deferred targets those units which would have the best effect on those targets.
- It only uses available units.
- It acknowledges that critical targets are those on the target list.
- It seeks to reduce the operational risk of the supported maneuver units.
- It accommodates the supported maneuver unit commander's insistence on attacking particular targets to the maximum extent possible.
- It considers effectiveness as its primary goal and efficiency as its secondary goal.

Figure 3. Fire distribution algorithm.

Data from the Joint Munition Effectiveness Manuals and similar sources will determine the potential effect which attack systems such as the multiple launch rocket system, mortars, and close air support will have on various targets leading to a preference list of specific attack systems for different targets. These procedures will allow units to develop a rudimentary fire distribution strategy which efficiently uses the available fire support weapon systems to attack effectively the numerous targets which would be present on the battlefield.

With an explicit doctrine for the distribution of fires in hand, that fictitious division artillery S3 could have solved his problem. He could have quickly picked the right weapon available to fire the right number of munitions at the right target at the right time. And he would have known precisely how to use the assets he had available to defeat the enemy facing him.

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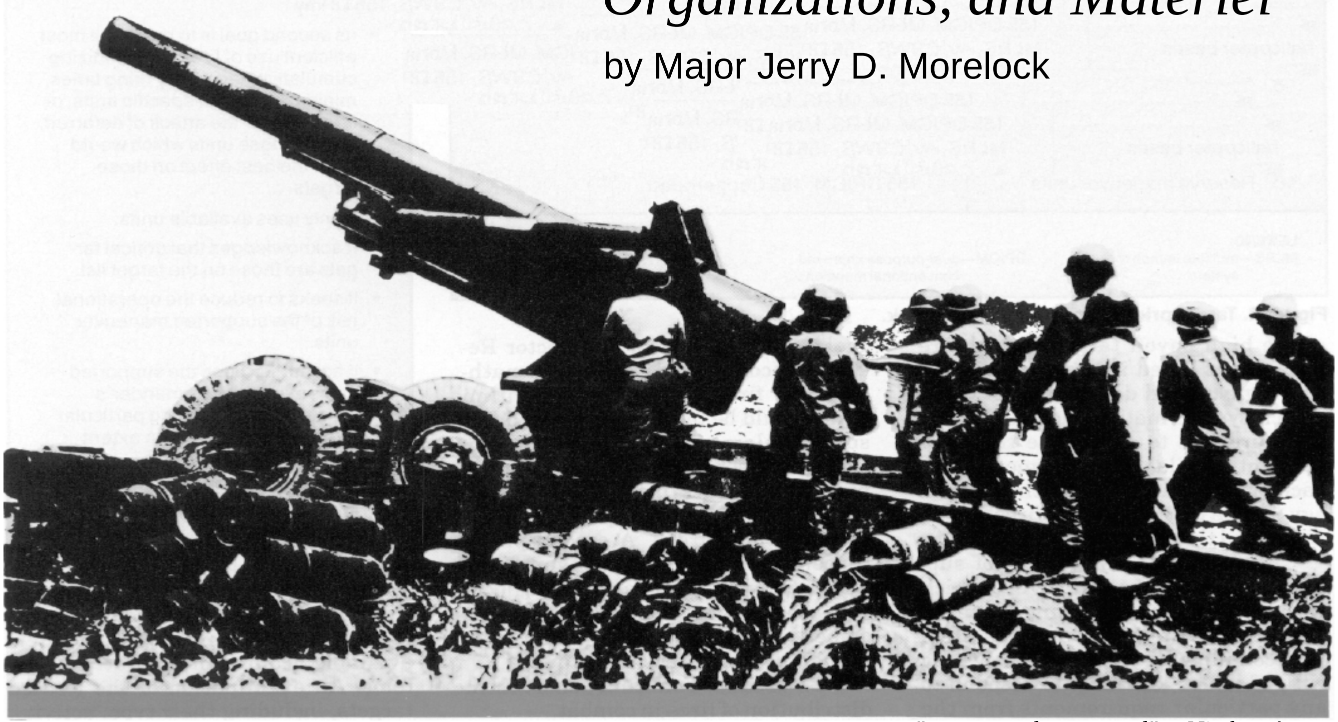
Rolling Caissons—A Legacy of Doctrine, Organizations, and Materiel

by Major Jerry D. Morelock



In the Allied drive from Normandy to the Elbe, American artillery proved to be the single greatest advantage enjoyed by the US Army. It was instrumental in providing the decisive massed firepower which infantry and armor by themselves lacked. Available in abundant supply and usually well-stocked with ammunition, US artillery weapons were linked by a superior fire control system and excellent communications equipment. The artillery forces were also generously provided with mechanized or motor transport which enabled them to once again claim the title, "King of Battle."

The Setting

By 1944, the US Army had evolved into a superbly equipped, highly mobile force of 90 divisions formed from 1,292 battalions of infantry, armor, artillery, and other combat arms. It had an aggregate strength of 2,282,000 ground combat soldiers out of the Army's total strength of 7,004,000. Although both the Germans and Russians mobilized more manpower, the American blend of industrial might and nearly complete motorization allowed this relatively lean organization to prosper. In fact, this trim fighting force proved sufficient to the task of leading the Allied drive to defeat the war-weary German forces in northwest Europe, while simultaneously tightening the noose around the Japanese empire in the Pacific.

Sixty-one divisions, organized into five armies totaling fifteen corps were eventually needed in northwest Europe. Their ranks were filled with 1,700,000 ground combat troops by V-E day.

The brunt of the fighting across France and Germany in 1944-45 was borne by General Omar Bradley's 12th Army Group which included General Courtney Hodges' "grimly intense" First Army, General George Patton's "noisy and bumptious" Third Army, and General William H. Simpson's "uncommonly normal" Ninth Army. Flanked by Field Marshal Bernard L. Montgomery's 21st Army Group to the north and General Jacob M. Devers' 6th Army Group to the south, Bradley's soldiers were able to attack across the channel into Normandy, break out of this lodgement and sweep across France, survive a violent German counterattack in the Ardennes, breach the Rhine in several places, race across central Germany to the Elbe, and link up after only 11 months with the Russians driving west.

Although far from perfect in organization, equipment, and doctrine, the American Army's accomplishments bear tribute to the remarkable resilience, industry, ingenuity, and leadership of this unique nation. One insightful observer characterized this extraordinary organization as "an excellent improvisation." Improvisation or not, the American Army of 1944-45, thanks largely to the superior organization, equipment, and doctrine of its artillery, proved to be an outstanding general purpose combat force.

US Army Organization 1940-45

From the robust but ponderous square division of World War I, the diminutive but influential artilleryman, General Lesley J. McNair, Chief of Staff of General Headquarters and later Commander of Army Ground Forces, fashioned a more mobile, leaner triangular division as the building block for the US Army of World War II. Based upon echelons of three units from the squad through regimental levels, this organization was influenced by the concepts of pooling, motorization, and standardization—all of which have had a profound effect on American artillery.

McNair's passion for leanness and flexibility led to the adoption of a basic division formation which included only those elements which would always be needed by that unit. Other resources would be maintained in a centralized "pool" to be attached to a division whenever necessary. In practice, this concept had mixed results. While it became necessary to abandon pooling and to assign almost permanently tank battalions to infantry divisions, the concept was found to work exceptionally well for artillery. Maintaining pools of cannon units in division and corps artilleries provided immediately available and, very often, overwhelming firepower with which the division and corps commanders were able to influence the action. Though the concept of pooling remained official policy, by the end of the war most of the pool consisted solely of artillery units, with the remaining tank, tank destroyer, and other combat units having in effect become permanently assigned to divisions.

More successful than pooling were the decisions to supply most formations with generous amounts of motor transport and to eliminate all horsedrawn vehicles. Although the American Army was technically only "semi-motorized," all of its heavy weapons and equipment were provided with motor transport. The abundance of tracked and wheeled vehicles in all division-sized units meant that, in practice, the entire army was completely motorized.

The advantage which motorization afforded to American units—especially the resulting ability to move artillery units quickly around the battlefield and to remain close to the rapidly advancing armored spearheads—proved to be a mobility which no other army at that time could hope to match. The German Army's incredible dependence on horsedrawn transport throughout the war proved one of its principal undoings. The inventors of the Blitzkrieg continued to rely heavily on the horse as the means for moving supplies, equipment, and especially artillery.

German resistance and morale suffered heavily when they compared their "hobbled" army to the superior mobility of the American divisions racing across France. In one striking example of this mobility, the Germans were amazed to note that, during the breakout from Normandy, one entire American corps of over 10,000 vehicles passed over a single road in 24 hours. The German Army of 1944-45 could not match this speed and efficiency.

LTG Lesley J. McNair.

The third concept, standardization, developed from McNair's conviction that a standardized, general purpose force, modified only as deemed necessary by the local theater commander, would prove a more effective, efficient, and flexible organization than an army containing any number of highly specialized and possibly wasteful units. Therefore, all formations of any given type, regardless of where they were assigned, would always be identically organized. Every light artillery battalion would be organized, trained, and equipped exactly like every other light artillery battalion of its type throughout the army. This not only allowed commanders to exercise more flexibility in mission assignment and responsiveness to the rapidly changing situation on the battlefield, but it also greatly facilitated supply, maintenance, and replacement. It allowed common doctrine and truly standardized procedures to be effected army-wide. Contrast this with the situation in the German Army where, at one time, there were seven different infantry regimental organizations alone. Standardization was a key element enabling American artillery to mass decisive firepower at the critical point on the battlefield. It was the crucial element upon which the superb American fire control system was based.

US Army Equipment 1944-45

The equipment used by the American infantryman, tanker, and artilleryman reflected both the strengths and weaknesses of an organization whose guiding principles were mobility, flexibility, and standardization. Blessed with an excellent infantry rifle and superior artillery, the US Army compensated for an inferior tank by capitalizing on mobility and a greater number of troops.

The American infantryman was issued the finest shoulder weapon of World War II, the .30 caliber, semiautomatic M1 Garand, a 9½-pound, gas-operated rifle whose 8-round magazine could be reloaded quickly enough to allow a soldier to fire 24 rounds per minute. Compared to the German rifleman's bolt-operated Mauser 98K, the M1 was superior in all respects. In other infantry weapons, however, the American soldier was not as fortunate.

The World War I designed US machine guns were embarrassingly outclassed by the German MG 34 and MG 42, and much of the M1's advantage in firepower was overcome by the liberal German issue of machine pistols. The Germans also possessed an advantage in their 120-mm mortar, although their 50-mm and 81-mm mortars were matched by the US 60-mm and 81-mm weapons. The puny US 37-mm and 57-mm antitank guns were not even in the same class with the German 75-mm and 88-mm PAK 40/43, and their 47-mm Panzerfaust and 88-mm Panzerschreck were both superior against armored targets to the 2.36-inch US "Bazooka." But the infantryman's problem was minor compared to that confronting the American tanker.

At the time of the Normandy invasion the US main battle tank, the 33-ton M4 Sherman, was clearly inferior to the German PzKw V Panther tank and the monstrous PzKw VI Tiger. While the US vehicles carried stubby, low velocity 75-mm guns, the Panther mounted a long-barrelled, high muzzle velocity 75 and the Tiger sported a deadly 88. Although the Sherman possessed

155-mm "Long Toms" fire into Germany during the Roer offensive in 1945.

a few advantages over the German tanks—principally a durable, rubber-block track, mechanical reliability, and an excellent powered traverse—the US tankers had ultimately to rely on greater numbers in most tank encounters.

The situation was frequently worsened for the US tanker when German formations were "stiffened" by 56-ton and larger PzKw VI Tigers. This resulted in the well-advertised fear among American soldiers of the 88. American tank destroyers, the M10 and M18 with high velocity 75-mm guns and later the M36 with a 90-mm gun, could defeat most German tanks with well-placed shots, but, lacking armor protection, were generally failures in their intended role of seeking out tanks and destroying them. The heavier T26 Pershing tank mounting a long-barrelled 90-mm gun did not appear in sufficient numbers to influence armored combat.

American artillery proved in nearly every aspect to be superior to its German counterpart. It more than made up for any US disadvantage in infantry or armor weapons. Historian Russell F. Weigley captured the essence of this superiority when he wrote:

> With American tanks afflicted by marked shortcomings and the tank in general moving less to supplant the infantry-artillery team than to join as a new partner with it . . . the outstanding element in the American arsenal was the artillery. To both the tank and infantry team and the marching fire advances, artillery support was essential. For this war . . . the Army had available an excellent American weapon for divisional artillery ready for mass production, the 105-mm howitzer. . . . Tests of an American 105, of a split-trail carriage for it, and of better recoil mechanisms continued through the interwar years to produce the gun that became "the workhorse of the Army" in 1941-45, a howitzer capable of firing thirteen different kinds of shells at a rate of twenty rounds a minute, with a maximum range of 12,000 yards.
>
> For heavier work, the 105 was supplemented with 155-mm guns . . . , 8-inch howitzers, 240-mm howitzers, and 8-inch guns. Increasingly, there were also self-propelled guns.

"On all fronts artillery caused more than half the casualties of World War II battles . . ."

Excellent communications equipment connected the superior fire control system which permitted a single forward observer to call for and receive the concentrated fires of all units within range of a target. The effects of the rapid and accurate massing of fires of an entire artillery battalion, or even several battalions, upon a single target was awesome to behold and devastating to endure. The Germans grew to fear and respect the American artillery, and they gave this branch much credit for Allied gains. As Professor Weigley noted, "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."

The advantages which American equipment held over German weapons in Europe in 1944-45 focused on an excellent rifle and superior artillery. In addition to these obvious technical advantages, perhaps the more decisive factor overall was the overwhelming quantity with which this equipment flooded Europe during the final year of the war. German equipment may have been superior in some notable aspects, but American industrial production, untouched and unthreatened by enemy attack, continued to pour forth a stream of rugged, serviceable equipment against which the Germans could ultimately achieve only brief, localized success.

US Army Doctrine 1944-45

US Army doctrine for conducting the campaigns in northern Europe in 1944-45 was not unlike that used in the last days of World War I. Indeed, the covering fire tactics of the final offensives of World War I provided the basis for infantry assault doctrine of World War II. The twelve-man US rifle squad was divided into a two-man scout section, a four-man fire section, and a five-man maneuver section. Doctrine called for the squad leader to locate the enemy with the scout section, fix the enemy with a high volume of fire from the fire section, then advance with the maneuver section to close with and destroy the enemy.

In actual combat, it was not uncommon for the squad leader to be pinned down with the forward elements, causing the resulting uncoordinated assault to bog down and fall apart. One remedy was the habitual assignment of tanks to any sizeable infantry formation. This tailoring allowed the tanks to take on strongpoints while the infantry dealt with antitank weapons and other infantry.

Another method of advance—the marching fire offensive—capitalized on the normally abundant supply of ammunition. Units moved forward en masse with all available weapons firing at every possible point of resistance in range. The added punch of tanks and artillery was enlisted whenever possible to demoralize and confuse the enemy and to combine the weight of their projectiles to the psychological impact of masses of infantry moving relentlessly forward.

The doctrine at division level called for the establishment of regimental combat teams in infantry divisions or combat commands in armored divisions. As the basic maneuver element of the infantry division, a regimental combat team usually consisted of an infantry regiment; an artillery battalion; a combat engineer platoon; a tank company; and other supporting organizations such as signal, medical, and ordnance units.

In theory, these regimental combat teams would be dispatched to accomplish some appropriate task in semi-autonomy. In practice, the division commander usually exercised tight control over his teams to apply the full power of the division against the enemy. The combat command of the armored division was similar in theory, but it was formed on a triumvirate of a tank battalion, a field artillery battalion, and an infantry battalion as well as supporting units.

All of these formations emphasized the doctrine of using firepower—usually artillery instead of manpower. In a deliberate attack of a position, the normal procedure was for the artillery to begin with a preparatory barrage, then shift to other priority targets. Typical targets included German artillery positions, command posts, communications centers, road junctions, and likely approach routes for enemy reinforcements. After striking these targets, artillery units would respond to calls for fire from their assigned forward observers. The 102d Infantry Division's official history describes a typical "prep" prior to an assault on a north German town:

> Beginning at H minus 10 minutes, six battalions fired five rounds per gun per minute into the western outskirts of Gereonsweiler. From H-hour to H + 15 minutes, corps artillery kept the commanding ground around the objective under constant fire. At H + 15 minutes the fire falling on the western edge of the objective lifted and the six artillery battalions rolled a barrage through the town. At 1100 hours, the ground forces moved forward.

Any enemy units located in the "western outskirts of Gereonsweiler" that day would have received approximately 500 rounds of artillery every minute for what would undoubtedly seem like an eternity for those forced to endure it. It is a small wonder that the German soldier held his opponent's artillery in such awe.

This lavish use of firepower proved to be the cornerstone of US doctrine in northern Europe. An example of such free use of ammunition can be seen in one infantry division's ammunition expenditures during a time of relative supply austerity. In less than 10 days of attack in the Rhineland, the division expended 24,000 rounds of 105-mm ammunition; 8,184 rounds of 60-mm mortar ammunition; and 1,712,550 rounds of small arms ammunition comprising a total expenditure of over 1,007 tons. This high volume of fire from a seemingly inexhaustible supply of weapons was able to make the US Army's unspectacular but sound doctrine unbeatable by the German Army of 1944-45.

Members of the 81-mm mortar crew, 3d Division, fire on German positions in southern France in 1944.

The Legacy

The organization, equipment, and doctrine of the US Army in the European Theater in 1944-45 melded perfectly to produce for that army a field artillery branch which was not only superbly suited to the warfare of the time, but crucial to the success of each campaign. The lavish application of this superior and abundant firepower effectively and dramatically made up for any deficiencies of organization, equipment, and doctrine which could have otherwise proved serious obstacles to subduing a German Army which was well past its peak of power and efficiency.

The lesson of this legacy is clear: We must continue to scrutinize the organization, equipment, and doctrine of today's Army to ensure that each element will perfectly complement the others in order to produce the most efficient, effective, and capable fighting force our constrained resources can provide. Overwhelming US fire superiority cannot be assumed on the battlefield of a future general war where the most likely enemy greatly outnumbers us in men and materiel. A blind dependence upon wonder cannons, gadget weapons, and gimmicks without regard to a reasoned development of an appropriate doctrine to employ them is as irresponsible as creating organizations which are ill-equipped for carrying out even the most flawless doctrine.

It is unlikely that today's "McNairs" will have the luxury of allowing their melding of organization, equipment, and doctrine to evolve into "an outstanding general purpose force" through battlefield improvisation. Only by creating, testing, and refining the most thoughtful, resourceful, balanced, and innovative integration of maneuver and fire support *before* the action commences will the US Army's field artillery have the opportunity to reign as "King of Battle" in a future conflict.

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Destruction by Fire: Soviet Artillery in the 1980s and Beyond

by Mr. Christopher Bellamy

'You can't describe the moral lift
When, in the middle of the fray,
You hear, above the hostile fire . . .
Your own artillery.
Shells cleave the air like wavy hair,
From a forward battery,
As Regimental cannon crack,
While, from positions further back,

Singing out, right overhead,
Crashing in discordantly,
Division's pounding joins the attack;
Mother-like, she belches shell,
Gloriously it flies, and well,
And with a thump, a wail, a cry,
A roaring furnace, giving all,
She sears a path for infantry
. . . .

Aleksandr Tvardovsky, the narrative poem Vassiliy Terkin *(1943), translated by the author.*

Such is the image which artillery, the 'God of War,' still holds for many Russians. In spite of Stalin's deification of the Soviet Army's senior arm, modern Soviet artillery officers are not demigods. They are professional, pragmatic, and cynical in appraising Soviet strengths, weaknesses, and their ability to cooperate with others to achieve desired results on the modern battlefield.

Western perceptions of Soviet artillery developments are too often conditioned by preconceptions and mirror imaging. For example, we read that the Soviets are introducing more self-propelled artillery in place of towed. From our perspective, this type of artillery is a plus for them; the fact that it is taking place very slowly is a minus. The Soviets probably do not see it that way. Whether a gun has its own engine or is pulled into position by some other means makes very little difference in either its ability to survive long enough to accomplish its mission and to the general philosophy of its employment, unless it is used as an assault gun. Soviet ideas about the employment of artillery differ profoundly from ours.

Differing Ideas

Artillery is employed more *aggressively* by the Soviets. If a good, direct fire position can be found, it will be used. Artillery and rocket forces operating cannon artillery, multiple rocket systems, and large tactical missiles are the *main fire strength* of the ground forces, not merely a "supporting arm." The Soviets are not and never have been afraid to lose a gun and its crew if it rips an arm off the enemy in the process. It is highly significant that while Westerners talk about the Fire Support Community, the Soviets talk about *fire destruction* to refer to the interlinked missions of artillery and air to guarantee the forward movement of maneuver forces.

The fact that the Soviets talk about *fire destruction* and not *fire support* does not mean, of course, that their artillery is any more effective round-for-round or battalion-for-battalion than ours. In fact, it is almost certainly less so, except when account is taken of their propensity for direct fire, which is infinitely more accurate and economical than indirect. This emphasis on *fire destruction* represents a very important difference in emphasis between the West and the East.

The Soviets deliberately retain towed artillery systems including antitank guns. This is not, as some bewildered Western analysts have assumed, a sign of backwardness. Towed systems are simpler to maintain and the loss of the tractor does not automatically mean the loss of the gun. For example, an antitank gun like the T12 pulled by the Soviet MTLB armored fighting vehicle, or a gun howitzer like the 122-mm D30 are certainly no more vulnerable than a turretless self-propelled vehicle. They are just as fast getting into action. Sure, they are slower getting out of action, almost like sitting ducks, but that is not what interests the Soviets.

The Duality of Soviet Artillery Forces

As an aid for understanding Soviet artillery command, control, and communications (C^3), visualize the Soviets as having two artillery forces. The first is decentralized. It is organic to motor rifle units and tank battalions and regiments. It is the close support, often direct fire, force. It does many of the jobs for which Western armies have to rely on the heavy weapons organic to infantry and armor units. Artillery enlisted personnel serving in motorized rifle units are distinguishable by the motor rifle, red collar patches as opposed to the normal gunner black. This tailored distinction indicates that the Soviets emphasize the different nature of such organic artillery forces.

The second force is the centralized artillery which is at the disposal of the formation (division) and higher formation (corps, army, and *front*) commanders. The Soviets have always regarded such forces as progressively more effective proportionate to the level at which they are employed.

In the West a forward observer can in theory bring down the fires of the entire divisional or corps artillery. A Soviet *divizion* (battalion) command observation post (KNP in Russian) cannot do this at this time. But, so what? A Soviet maneuver battalion or regimental commander has a very sizeable artillery force allocated to him to augment his own considerable firepower. And at the higher tactical and operational levels, the artillery is deployed and employed as part of a master plan, without requests from frightened junior officers getting in the way.

In support of this unorthodox view, the author would cite a parallel with Soviet strategic command and control. Whatever the limitations of his knowledge, the defector Viktor Suvorov was surely right when he pointed out that the

> Soviet system combines a fixed system with a flexible one. If the first system fails, the second one can come into operation. However, both systems may also be used to supplement simultaneously each other.

If this general Soviet attitude is evidenced in their approach to strategic command and control (C^2), it is also reflected in the organization of their artillery. Both systems are used simultaneously to supplement each other in the artillery C^2 net.

Further support for this theory can be gleaned from Soviet analysis of World War II operations. Figure 1 shows a Soviet presentation of the artillery support for the Belorussian campaign in mid-1944. This operation was one of the most grandiose of the war and one which has many lessons for Western soldiers today. The then Commander of Rocket Troops and Artillery, Marshal G. Ye. Peredel'skiy (replaced by Mikhalkin in 1983) was an advocate of this employment scheme. In fact, he gave it his own name. Note how the close support (*PP* in Russian) groups are very closely wedded to their infantry regiments and bear the same numbers. Also note how certain artillery units are specifically allocated to battalions, whereas others come under the regimental commander. The horizontal lines appear rigid: it seems unlikely that there was any provision for firing across boundaries.

At corps and army levels things are different. We see the term "subgroup." A force is allocated to each division as a breakthrough subgroup, while a large force is held back under the command of the corps' artillery commander. Similarly at army level, there are subgroups for each corps. However, these would appear to be under army control, and the word *subgroup* implies that they are broadly associated with a corps but not entirely under its control. By retaining control one level up, where any request for fire has to be cleared with the artillery commander of the next higher formation, the Soviets ensure that any artillery unit of the centralized artillery force can be hauled back if required.

The Soviets sometimes refer to artillery as *podchinenny* and *pridanny* (subordinate and allocated) and sometimes as *shtatny*, *pridanny*, and *podderzhiivayushichiy* (organic, allocated, and supporting). The first (organic) is regimental and below, the second (allocated) refers to the subgroups which can be withdrawn if necessary, and the third (supporting) to artillery in general support. Exactly how the two types of artillery forces interrelate in practice is not clear to the author from the sources available. It would appear that the decentralized force, like the centralized one, is controlled at the highest level possible. A recent article in the Russian *Military Herald* dealing with artillery deployed as separate batteries supporting tank companies explained that:

> When the battery [assigned to a tank company] changed position, fire in the interest of the tank company was carried out at the demand of the commanders of batteries belonging to other subunits [companies] *through the artillery battalion commander*. Its [fire] was corrected by the commanders of batteries and command platoons [groups].

In other words, *in these circumstances,* batteries are relatively independent and closely associated with other arms subunits. However, this refers to artillery in close support of tank forces in a pursuit (hence also the allocation of an artillery *battery* to a tank *company*, a one-to-one ratio). It, therefore, concerns artillery in the decentralized mode. The artillery battalion commander whose authority is invoked is the top man in the close support force. He is the artillery commander of the all-arms regiment.

Having *two* artillery forces is made possible by the sheer size of the Soviet artillery arm. In the 1920s, Vladimir Triandafillov, a key figure in Soviet military thought, did a simple calculation. Based on World War I experience, an infantry division could conduct an attack on a front of 1,500 to 2,000 meters. The same division's artillery assets, organic and allocated, could suppress targets on a front of 500 to 1,000 meters. Therefore, Triandafillov concluded that the amount of artillery

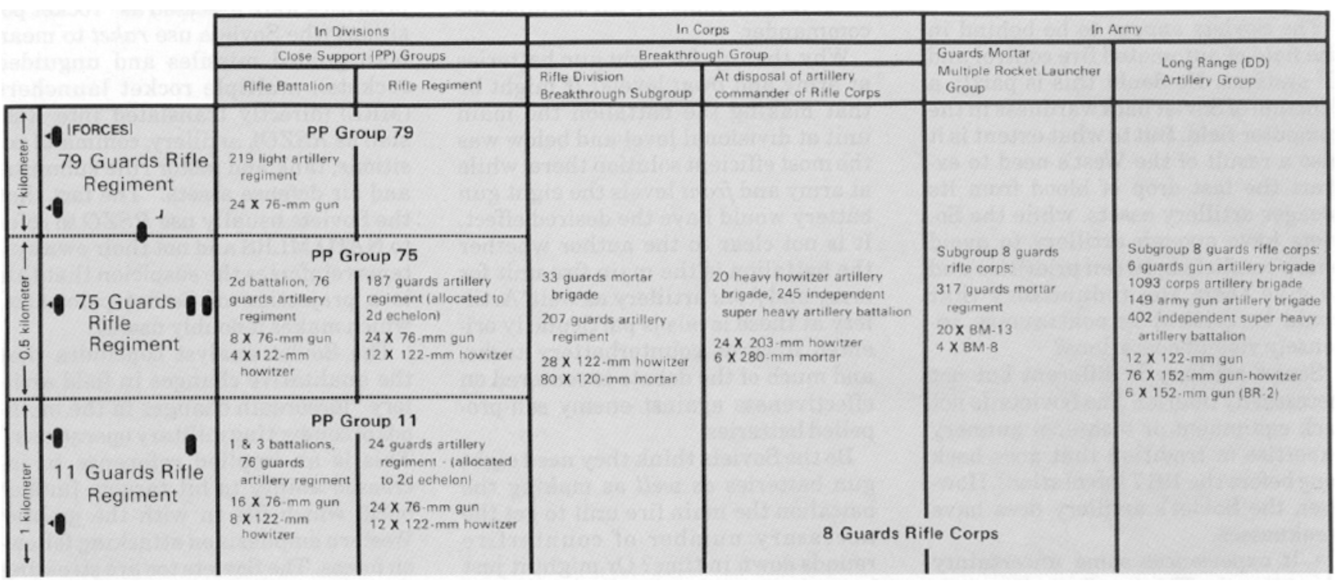


Figure 1. Segment of a Soviet presentation of artillery support for the Belorussian campaign in mid-1944.

Soviet command observation post (*KNP*). The officer on the left is a lieutenant colonel and commander of a rocket artillery battalion. Battalions are usually commanded by majors. The major on the right is the battalion chief of staff.

needed to be *doubled* relative to other arms to deliver optimum firepower. This was duly done and is one reason why the Soviet army has a higher proportion of artillery to other arms than any other. According to a recent estimate, the Group of Soviet Forces Germany (GSFG) has 28 percent of its personnel in artillery and rocket forces, compared with overall figures of 15.7 percent for the Bundeswehr and 11 percent for the US Army. Of course, GSFG's role would lead it to be artillery and armor heavy, but the overall proportion within the Soviet Army is probably still 15 to 20 percent.

Soviet Artillery Weaknesses

The Soviets appear to be behind in the field of automated fire control and C^2 systems. No doubt this is partly a function of Soviet backwardness in the computer field. But to what extent is it also a result of the West's need to extract the last drop of blood from its meager artillery assets, while the Soviets have enough artillery to avoid sharp conflicts between priorities and to give them the redundancy that could be critical in continuous, intensely violent operations?

Soviet artillery is different but not necessarily inferior. The Soviets do not lack equipment or technical gunnery expertise (a tradition that goes back long before the 1917 Revolution). However, the Soviet's artillery does have weaknesses.

• It experiences some uncertainty about its role. This is reflected in a tendency to copy the West regardless of whether such emulation is appropriate. This means that Soviet artillery officers are torn between the dictates of their own unique tradition, some of which are highlighted above, and a slavish tendency to imitate what the latest glossy Western periodicals advocate. One possible example of this tendency is the recent move to eight gun batteries at army and *front* levels. This change followed a long and detailed debate in the Soviet open military press that resulted in the decision to make the battalion the main artillery fire unit. Battalions would be fired "as one", and the battery would act alone "very rarely." It was even suggested that the battery commander should return to the gun position instead of fulfilling his traditional role as forward observer and liaison with the all-arms commander.

Why, then, go for eight gun batteries at army and *front* levels? It might be that making the battalion the main unit at divisional level and below was the most efficient solution there, while at army and *front* levels the eight gun battery would have the desired effect. It is not clear to the author whether the battalion is the main fire unit for army and *front* artillery as well. Artillery at these levels is particularly oriented towards counterbattery tasks, and much of the debate is centered on effectiveness against enemy self-propelled batteries.

Do the Soviets think they need eight gun batteries *as well* as making the battalion the main fire unit to get the necessary number of counterfire rounds down in time? Or might it just be an imitation of the West? Another explanation might focus on the ramifications of the increased material strength of the Soviet artillery (30 percent between 1978 and 1983). The Soviets might be alloting more guns per battery rather than creating more batteries with their highly-trained and scarce associated C^2 hierarchy. But then why is the change only apparent at the higher level?

• Uncertainty is also reflected in Soviet attitudes regarding modern developments such as terminally guided munitions. The quantum improvements in effectiveness attending the adoption of such weapons cannot have escaped the Soviets. Articles in Soviet open publications reproduce faithfully descriptions of the latest Western developments and the arguments in their favor. Yet the tone is skeptical:

> The widespread use of self-guiding munitions has been envisaged in plans for reconnaissance-strike complexes. However, as the foreign press has noted, they are very expensive, and their military effectiveness has not been devoid of commercialization.

The term reconnaissance-strike complex has been used to describe North Atlantic Treaty Organization (NATO) systems such as the stand-off target acquisition system (SOTAS). The tone of the articles also suggest that the Soviets are interested in developing equivalents.

The weaknesses in mirror imaging works both ways. Just as we tend to see the Soviets in our terms, they tend to see us in theirs. A recent authoritative article on the development of NATO field artillery said that NATO considered field artillery "the principal means of destroying enemy objectives on the battlefield." Target engagement priorities were assessed as "rocket positions (the Soviets use *raket* to mean both guided missiles and unguided rockets), multiple rocket launchers (MRL) (directly translated into Russian as *RSZO*), artillery, command positions, tank and motor rifle subunits, and air defense assets." The fact that the Soviets usually use *RSZO* to refer to NATO MLRS and not their own systems reinforces the suspicion that this is a projection of Soviet priorities, which makes it doubly useful.

The Soviet analyst concludes that the qualitative changes in field artillery "foreordain changes in the methods of conducting military operations." This is an implied reference to increased ability to hit targets further back, which fits in with the greater Western emphasis on attacking follow-on forces. The Soviets too are stressing the increased importance of *fire destruction* (artillery and air) of "enemy fire assets moving up from depth positions (especially antitank weapons, fire support helicopters, and artillery and mortar batteries), and also reserves and counterattacking subunits."

• The greatest and cardinal Soviet weakness revealed in recent open source literature is unquestionably the artillery's ability to make its nascent power felt on the modern battlefield. This stems both from artillery officers' lack of tactical "maturity" (the phrase is from a Soviet article on the subject), and from other arms commanders' lack of understanding of artillery and its potential. This has caused Soviet comments rising to a crescendo in the past year. It has to be seen in the context of Soviet perceptions of the nature of the future battlefield. They believe that in the early stages of a war meeting engagements will be prevalent and Soviet forces will need to break through strongly held and deeply fortified positions as well as repel (using artillery counterpreparations) strong counterattacks.

An unusually incisive anonymous article entitled, "To Utilize the Potential of Regimental and Battalion Artillery More Fully" appeared in February 1984 in the *Military Herald*. This article reflected lively correspondence on the subject. Major General of Artillery A. Yershov from GSFG blamed the poor coordination between artillery and other arms on certain all-arms battalion commanders (note how the Soviets say all-arms and not supported arms). Analysis of exercises revealed that many tank and motor rifle commanders' knowledge of artillery was only acquired "in passing."

On the other hand, it was up to artillery battery and battalion commanders to make an effort to impress the maneuver commanders with their artillery abilities. Colonel B. Mazikin, from the Northern Group of Forces in Poland, thought that artillery subunit commanders "knew little of the nature of modern all-arms combat and inaccurately appreciated the aims of all-arms subunits. Marshalling cooperation was only one part of the problem; there was more difficulty in maintaining it during combat, as the enemy would

> try with every means at his disposal to delude the opposition, use disinformation, and maneuver secretly and unexpectedly. Naturally, combat will not always proceed strictly according to plan. Therefore, both artillery and all-arms commanders must be able to ensure cooperation throughout the entire duration of combat.

The 2S3 152-mm howitzers deployed in line. The position seems fairly well chosen.

The article concluded that artillerymen should be taught more about the nature of other arms commanders' work and vice versa. This should be done, "not only in service but also in military educational establishments and staff colleges." This is a sharp reminder that unlike American or British officers, the Soviets do not receive basic training alongside cadets destined for other arms; nor, except at the highest level, do they receive higher military education with them. A young man who embarks on a career as an artillery officer receives all his military training at an artillery higher command school and is unlikely to have much professional contact with officers of other arms until he is at least a battery commander. Herein, perhaps, lies the root of much of the problem.

The theme continued in an article the following month. In this piece on artillery support of a tank offensive, the scenario was, as so often, a parallel pursuit where:

> The high tempo of the tank subunits' advance, and their maneuver with the aim of turning and enveloping the enemy makes it necessary to split battalions up into batteries to reinforce [not support] tank subunits . . . cut off from the main forces.

In these circumstances, the artillery officer has to be filled *"with the soul of the tanks."* The other side of the coin was given in a subsequent *Military Herald* article on the artillery training of the all-arms officer.

The same theme was taken up by the new commander of the Ground Forces' Artillery and Rocket Troops, Colonel General V. Mikhalkin. His article, "Giving Artillery Commanders' Training on All-Arms Emphasis" once again stressed the need for supported arm commanders to know about artillery and for artillerymen

> not only to solve problems relating to the reconnaissance and destruction of targets, but also to retain unbroken communication with the all-arms commander and to exchange information and receive target coordinates from the commanders of motor rifle and tank subunits.

This may all sound obvious, but it is a clear admission of a major weakness, penned by the head of the Soviet Army's one quarter to half million currently serving artillerymen.

If the message was not already clear enough, an article on "Cooperation in Fire Destruction" (encompassing ground systems and air) rammed it home. *"The connecting links between all-arms commanders and other arms of service are the artillery officers and representatives of aviation and special forces."* Artillerymen indeed have a great responsibility, and the price may be high. "Remember Suvorov's principle," exhorted the article, "perish yourself but get your buddy out of it." The military genius of Aleksandr Suvorov (1729-1800) is often invoked on modern leadership and morale questions.

Still more recently, Lieutenant Colonel V. Litvinov stressed the need for artillery officers to be aware of the realities of battle in the late twentieth century:

> Having saturated the training with theoretical situations we bring it to real military conditions. Commanders must be taught to show practical military skill and use ruses more often, to fight under conditions of *radio interference, massive destruction and conflagrations, in huge zones of contamination*, and to solve the problems they have been set with minimal losses, achieving victory over an enemy who may *not only be equal but even superior in numbers.*

The Soviets' New Perspectives in the Battlefield and Training

The later passage is unusual in its prediction of the nature of the future battlefield. Although such descriptions are familiar from the now dated works of Marshal Sokolovsky, Soviet artillerymen have usually described conflict in a neutral environment. In spite of the Soviets' enormous chemical and nuclear capability, they have published articles on professional artillery matters that tend to depict a straight-forward conventional fight a'la World War II. Litvinov's and other's recent articles indicate that fighting in an environment ravaged and contaminated by nuclear or chemical weapons or even massive conventional destruction is being reemphasized.

The comment about fighting an equal or superior enemy is also interesting; Litvinov may be thinking of artillery operating as part of forward detachments

A T12 antitank gun towed by an MTLB.

or operational maneuver groups (OMG) where the numerical superiority traditionally enjoyed by the Soviets might be reversed, at least temporarily and locally.

Litvinov then mentions an example oddly out of context. "Why not," he says, "build for artillerymen a special area, where a devastated area of a major city would be reproduced. After all, in the Great Patriotic War artillerymen often took part in storming cities." However, he says, one must exercise maximum economy in training. It must be remembered that the Soviet army's training, if not its equipment, is run on a shoe-string, and this undoubtedly compounds the crucial inter-arm cooperation problems.

This brings us from one fundamental issue to the circumstances in which Soviet artillerymen expect to fight. Apart from cities, there has been added emphasis recently on warfare in special conditions such as mountain regions (predictably enough given the Soviet involvement in Afghanistan), and also forests, deserts and particularly, arctic areas. In the European context much attention has been focused on the meeting engagement, when a Soviet regiment or division might expect to engage the enemy from the march at the beginning of a conflict, after effecting an OMG breakthrough, or during a pursuit. In these circumstances batteries might well be employed independently.

A recent *Military Herald* article discussed the employment of the battery in a meeting engagement. In the exercise cited, a battalion of D30 howitzers was attached to a motorized rifle battalion forming the *avangard* of an advancing force. The first battery of the battalion was told to support the forward march security element (march security is a uniquely Soviet device lying between the main body with its own *avangard* and rear guard and the outer reconnaissance patrols). The enemy was withdrawing to the southwest, leaving behind small diversionary groups and mines. The planned route of the *avangard* stretched for 120 kilometers. The battery fought a series of small actions including the capture of bridges using both indirect and direct fire. In the latter case the battery commander controlled one section of guns, and the gun position officer and second in command controlled the other.

This piece and other articles reiterated the Soviet need for artillery subunits to get on with the job at hand and not to let down the supported units who are relying on them. From the Soviet perspective, such lapses happen all too often. It appears that the Soviets are moving back somewhat from the position stated 2 years ago that artillery would be fired by batteries "very rarely," although this is still an unusual instance confined to special circumstances such as pursuit.

In addition to stress on fighting in contaminated conditions and on the likely prevalence of the meeting engagement, Soviet artillerymen are being trained to engage NATO tanks with direct fire at close range. The maximum range for engaging an American Abrams or a British Chieftain is given as 2,050 meters with APDS shell; 1,090 meters with shaped charge; and 880 meters with high explosives. This emphasis may reflect Soviet concern about the possibility of major armored counterpenetrations which would quickly break through into the artillery zone.

Moving from the tactical to the operational level, Soviet officers continue to stress the Great Patriotic War experience of massing huge quantities of artillery on narrow sectors. Do they really believe that this is likely to recur in a future major conflict? Knowing the way the Soviets use history and that senior Soviet officers are too busy to publish articles of mere historical interest, the answer must be "yes." Furthermore, in his report on the use of artillery in the great Belorussian strategic operation of 1944, which appeared in the Russian *Military Historical Journal*, Chief of Artillery and Rocket Troops Mikhalkin concluded that its "many faceted military lessons . . . also have great practical significance today."

Mikhalkin goes on to detail the organization, calculations of ammunition requirements, the duration and types of fire, and the close cooperation with aviation. As indicated in figure 2, he stresses the need for meticulous planning in order to achieve large scale maneuver of artillery units over very poor roads running through marshy, wooded terrain.

> From 29 June to 4 July a significant number of artillery units and formations of 1 Belorussian Front, including number 4 Artillery Corps (breakthrough), were gradually pulled out into reserve and concentrated in areas to the south of Bobruisk. A march over distances of 600 to 660 kilometers was accomplished from 5-13 July by a variety of means: by rail or using the artillery's own traction. Tight control over the regrouping of artillery, efficient adjustment (when things went wrong), and meeting and guiding in units and formations as they arrived all assured the secrecy of this operational maneuvering of artillery and its conclusion within a tight timescale. Individual units and formations moved from 200 to 240 kilometers in 16 hours. About 35,000 vehicles participated in the move. Thanks to this skillfully executed regrouping, the number of guns and mortars in the armies of the left wing of 1 Belorussian Front rose from 5,500 to 9,000 by 18 July.

The thought of doing this sort of thing undetected on the modern European battlefield boggles the imagination; however, the Soviets have proved themselves past masters of large scale secret concentrations as recently as the invasion of Czechoslovakia in 1968. They clearly regard this World War II experience as relevant. This move was carried out in difficult terrain and has many lessons for the possible employment of Soviet armies in places other than north-central Europe. Certainly, where movements of maneuver forces can be disguised as exercises, movements of large artillery concentrations in a period of tension would be a major and grim indicator.

Soviet gunners are, of course, as loyal to their collar badge as other artillerymen.

Nevertheless, it is clear that many of the tasks traditionally performed by artillery would now be performed by aircraft. In particular, a recurring theme in Soviet analysis of past combat is the tendency of artillery support to thin out as the attacking forces penetrate a few kilometers into the enemy defense. The increased number of self-propelled guns available to accompany advancing forces would of course help. However, it is clear that Soviet indirect fire artillery is unable to switch its fire rapidly onto opportunity targets. The Soviet preference is to engage these targets with close support helicopters. The Soviets place less emphasis than we do on registering possible targets or likely enemy locations. Soviet analysis of exercises constantly criticizes those who "stonk" hilltops and other likely threat areas:

> The main inadequacies in the organization of fire destruction were equal distribution of fire assets along the front (as opposed to their massing on the axis of the main blow), planning artillery preparation only against targets on the forward edge of the enemy deployment, and bringing fire down, not on concrete objectives, but against areas.

The Soviet reluctance to engage targets other than those confirmed as enemy positions squares with their emphasis on "reconnaissance by battle." To us, this seems wasteful in life, but the Soviets consider the sacrifice by which the enemy is forced to reveal himself worthwhile. Artillery is, therefore, used primarily against known and plotted targets; new targets are taken on by air.

The use of artillery against a NATO defense as part of a preplanned operation is extremely important in the OMG concept. A recent article on the Vistula-Oder operation of 1945 drew attention to the fact that of the 3.2 million shells and rockets fired by 1 Belorussian *Front* (Army Group), the bulk were expended in the first 3 days, "that is, in the course of the breakthrough of the tactical defensive zone and the introduction of mobile groups into the crack." In this case, history is definitely *not* bunk!

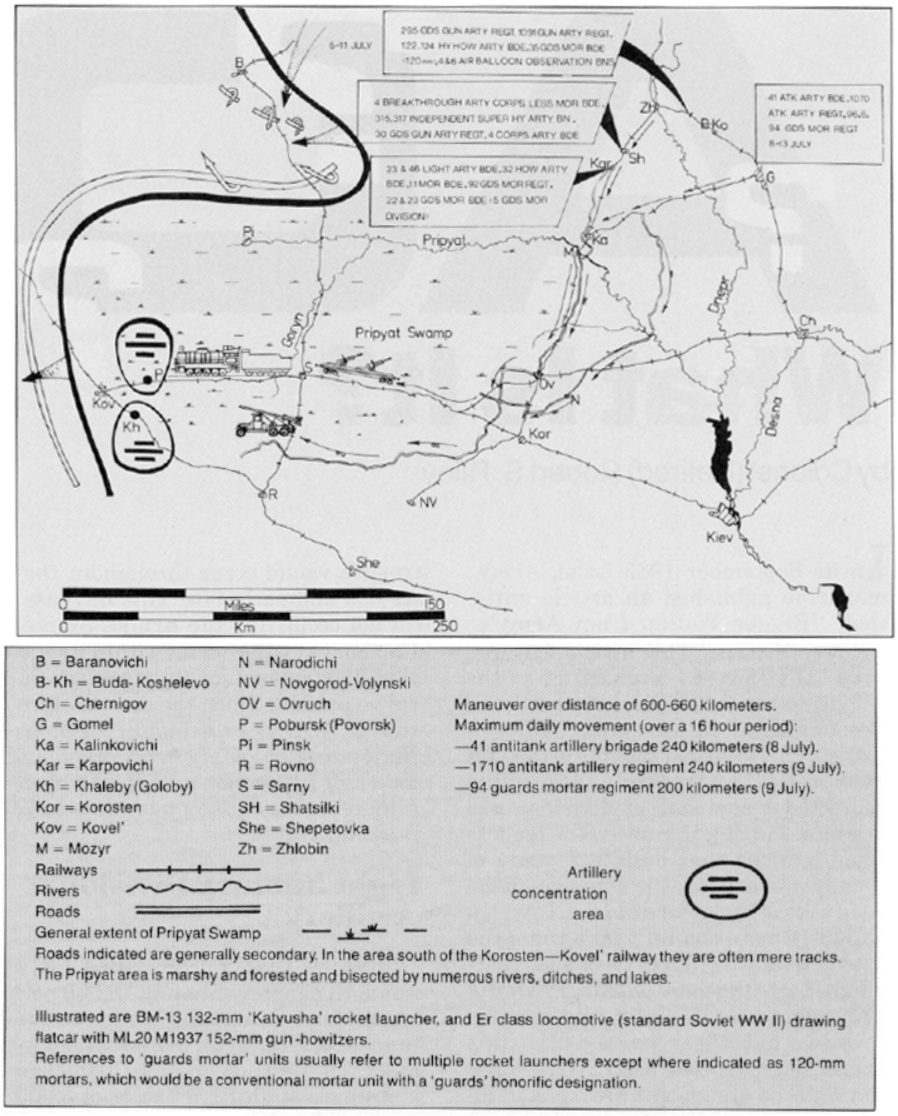


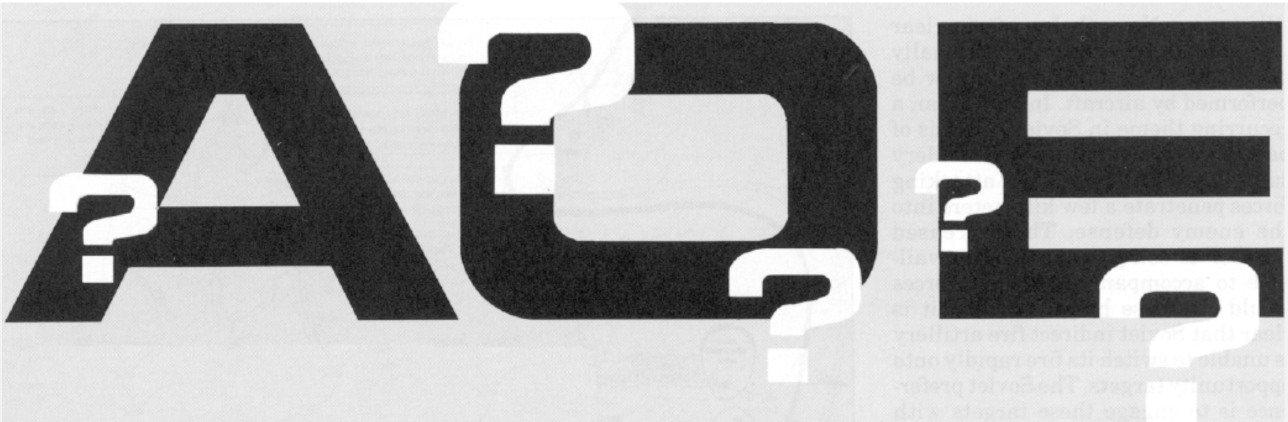
Figure 2. Operational maneuver of artillery in the Belorussian Operation, June-July, 1944.

Conclusion

It is clear from the volume of debate that the Soviet artillery is far from satisfied with their performance and that the precise role of artillery and rocket troops on the modern high-speed battlefield is uncertain. The main problem revealed over the past year or so is unquestionably the need for greater emphasis on battlefield realities in training, and for developing "tactical maturity" and cooperation with other arms. This is the key to Soviet artillery's greatest weakness in a future conflict.

Western soldiers would be well advised to go for the points where Soviet artillery is in contact with the other arms, unhinge them, and break them open. Even high-ranking officers are clearly quite ignorant of all-arms tactics and battlefield conditions. Without orders, their subordinates (meaning in some cases battery commanders) may well be helpless. An article in the May-June 1983 issue of the *Field Artillery Journal* focused on the role of the division's chief of rocket troops and artillery (CRTA). As a major point of contact with the supported arm, the CRTA is indeed important, but prying the artillery apart from other arms at *any* level and in any way should have disproportionate and possibly traumatic effects.

Christopher Bellamy served as an officer in the British Royal Artillery; has a first degree in History from Oxford University; a Master's with distinction in War Studies from King's College, London; and is an Incorporated Linguist for Russian. He is currently completing an honors degree in Russian language and literature. He has written many articles on the Soviet Military (especially for the *RUSI Journal*) and has made a special study of Soviet artillery, which is to be published as a book by Brassey's (Pergamon) defense publishers. This article is based on his own analysis of recent open source material. Much in the field of Soviet analysis, especially in the area of command and control and training, is a matter of opinion, and the author would be pleased to receive comments and alternative suggestions via the "Incoming" column of the *Journal*.



What Is It?

by Colonel (Retired) Robert S. Riley

In its September 1983 issue, *Army* magazine published an article entitled, "Bigger Wallop from Army's Heavy Hitters." This article featured the "Division 86" force design of the division artillery of the armored and mechanized infantry divisions of Army 86. No sooner did this article hit the street than the Army's leadership directed a new look at division force design. Putting it bluntly, the leaders had realized that despite 7 years of study and testing, the Division 86 design was unaffordable. Now, in slightly more than a year's time, the Army's fighting forces have been redesigned into the more *balanced* Army of Excellence (AOE). In recent months readers have been barraged by this term, but many still ask, "AOE—what is it?" The aim of this article is to inform concerned professionals about the approved field artillery organizations within the *Army of Excellence*.

Background

The AOE force design was undertaken because Army 86 requirements exceeded the resources available. AOE represents the means to provide a combat-effective, responsive, and balanced total force that is realistically attainable. The US Army Field Artillery School (USAFAS) has participated in every step of the force redesign process which will totally reorganize the Army's divisional and corps structures.

The redesign effort has focused primarily on the structuring of the new light infantry divisions, the restructuring of the heavy divisions, and the realignment of corps forces. The need for such efforts becomes obvious when one recalls that the Army 86 design was grounded in the premise that an overall increase in the Army's end strength would occur throughout the late 80s and early 90s. This increase will not occur, and the Army's Active Component will remain within its current 780,000-man ceiling through fiscal year 1990. Thus, the *overall objective of AOE is to develop realizable, flexible, combat-ready forces capable of deterring aggression and, if deterrence fails, of defeating the enemy across the full conflict spectrum*.

Light Infantry Division Artillery

Infantry Division 86 called for a strength of approximately 18,000 personnel and demanded an excessive number of aircraft for overseas deployment. The division artillery alone had a strength slightly in excess of 3,000 personnel and comprised a headquarters and headquarters battery (HHB), a target acquisition battalion, three 155-mm M198 howitzer battalions, and a multiple launch rocket system (MLRS) battery. However, planners realized that the deployment of this relatively heavy force to outlying geographical areas might well be inappropriate, if not impossible, given the scarcity of strategic assets in times of crisis. They also recognized the need for an artillery force capable of operating in low-intensity conflict areas as well as in conventional venues with restrictive terrain. Thus, the force design challenge became to improve the Army's capability to deploy smaller, more strategically responsive, and highly flexible light forces.

The resulting light infantry division will be organized, equipped, and trained to respond to a broad spectrum of conflict environments and a wide array of contingencies. It will focus primarily on defeating light enemy forces in a low-intensity conflict and will be essentially foot-mobile. Although its tactical mobility will be constrained by limited ground and air transport, it can be employed in mid- to high-intensity conflicts. However, it will require augmentation in personnel, weapons, and equipment in order to perform a full range of missions in mixed or open terrain against heavily armored enemy forces.

The new light infantry division artillery will be austere and will make maximum use of lightweight systems. It will be capable of being displaced by either the ground or aerial transportation organic to the division. It will have design characteristics necessary for it to be highly deployable and tactically mobile. As depicted in figure 1, the division artillery will include an HHB, three towed 105-mm howitzer battalions, and one towed 155-mm howitzer battery. Its overall strength will be approximately 1,500 personnel. Each of the nine 105-mm firing batteries will have six howitzers for a division artillery total of 54; the single 155-mm firing battery will have eight howitzers. The 105-mm howitzer crew will be reduced from nine to seven men, and the crew for the 155-mm howitzer will be reduced from eleven to ten men. Ammunition sections will be found only in the firing batteries and will be justified on a resupply rate of 200 rounds per tube per day. The division artillery HHB and the direct support battalions will not have the tactical fire direction system (TACFIRE) in the near term, but the firing batteries will have the battery computer system (BCS).

The division's fire support teams (FIST) will be foot-mobile just like the infantry companies they support. Although the aerial observers in the division artillery HHB have been deleted, they may be reinstated depending on

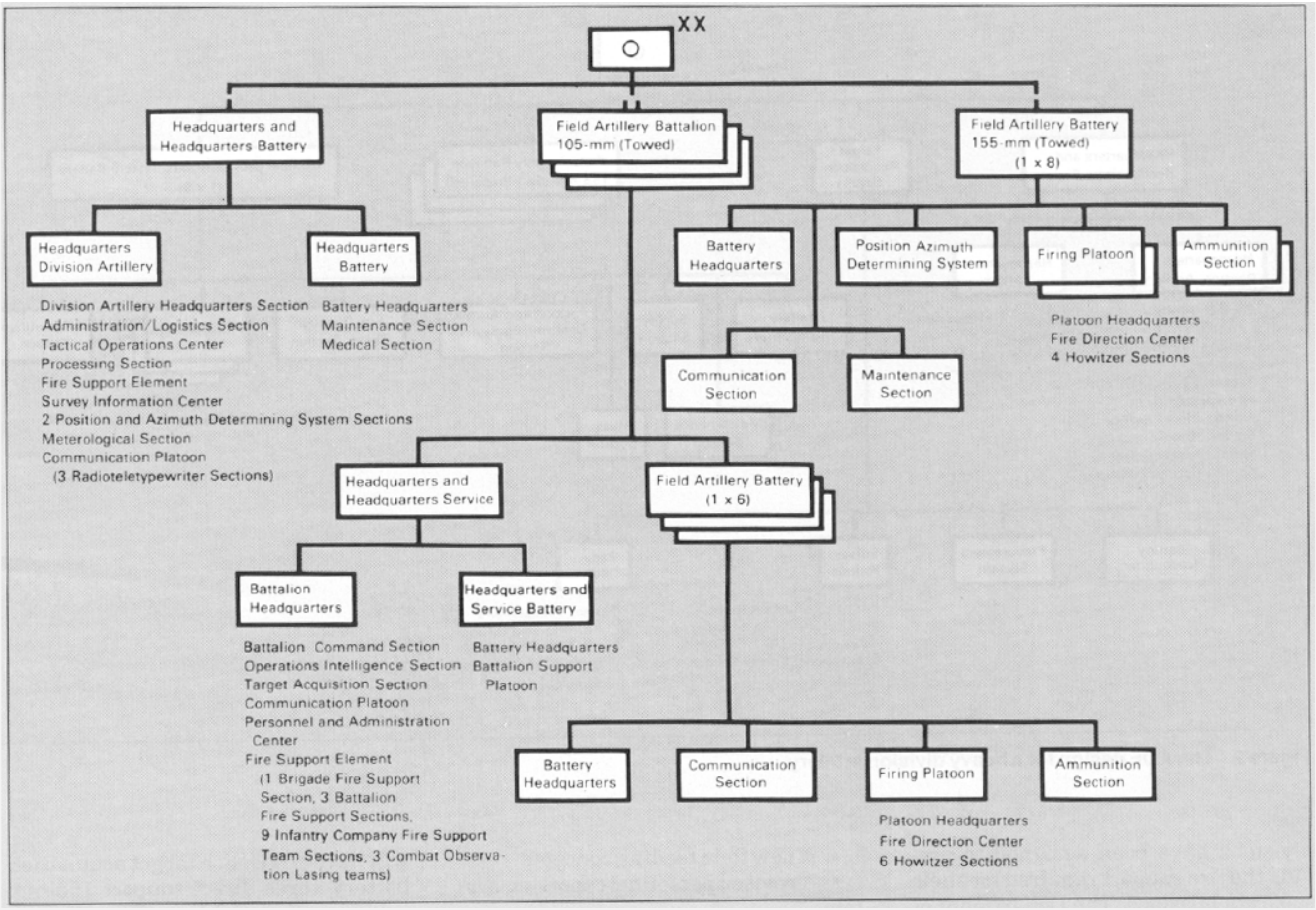


Figure 1. The AOE design for a light infantry division artillery.

the Close Support Study Group (CSSG) III recommendations. Each direct support battalion will have an AN/TPQ-36 Firefinder radar, and two position and azimuth determining systems (PADS). Moreover, the division artillery HHB will also have two PADS sections and a meteorological section. However, the remaining target acquisition assets as well as the general support (GS) fire capability will be transferred to corps.

Airborne and Air Assault Division Artilleries

In addition to the restructuring of the infantry division, the airborne and air assault divisions have been reorganized to bring their personnel strengths in line with those of the new light infantry division. These two specialized division artilleries are organized alike. They have an HHB and three direct support 105-mm towed howitzer battalions, each of which has a headquarters and headquarters service (HHS) battery and three firing batteries. However, unlike the light infantry division artillery, the airborne and air assault division artilleries will not have a general support 155-mm howitzer battery. The personnel ceilings for the airborne and air assault division artilleries will be approximately 1,400 soldiers.

Comparable to the light infantry division artillery, the airborne and air assault units will be highly deployable. They will have 54 105-mm howitzers. Their gun crews will remain at seven men each, and each battery fire direction center will have an increased capability for the temporary split of battery operations with the addition of three men plus the battery computer system. As in the light infantry division artillery, ammunition resupply will be justified on the basis of 200 rounds per tube per day. The HHS battery will be organized similarly to that of the light infantry division artillery direct support battalion but will have a few more personnel. The firing batteries will have four additional personnel for a total of 71 each rather than 67.

Other departures from the Airborne Infantry Division 86 force design involve target acquisition and fire support elements. The target acquisition battery has been completely deleted in the AOE version, and most of its assets have been reassigned to the corps artillery. Each direct support battalion will have an AN/TPQ-36 Firefinder radar assigned to the HHS battery, and the division artillery HHB will retain a meteorological data system section. The aerial observers in both division artillery HHBs have been deleted, but they may be reinstated depending on CSSG III recommendations. Also, there is an increase of personnel in battalion fire direction sections, and a medical section has been added.

Other Infantry Division Artilleries

There are two other infantry divisions that should be mentioned. The 2d Infantry Division in Korea will have a tailored organization specifically designed for its unusual mission. It's structure will be based on the AOE standard heavy division artillery. The 9th Infantry Division (Motorized) at Fort Lewis, Washington, has served as the experimental test bed for testing and adapting new systems evolving from today's high technology. The 9th Division will also have a specially tailored organization and will have a personnel strength not exceeding 13,000. The artillery structures of these two

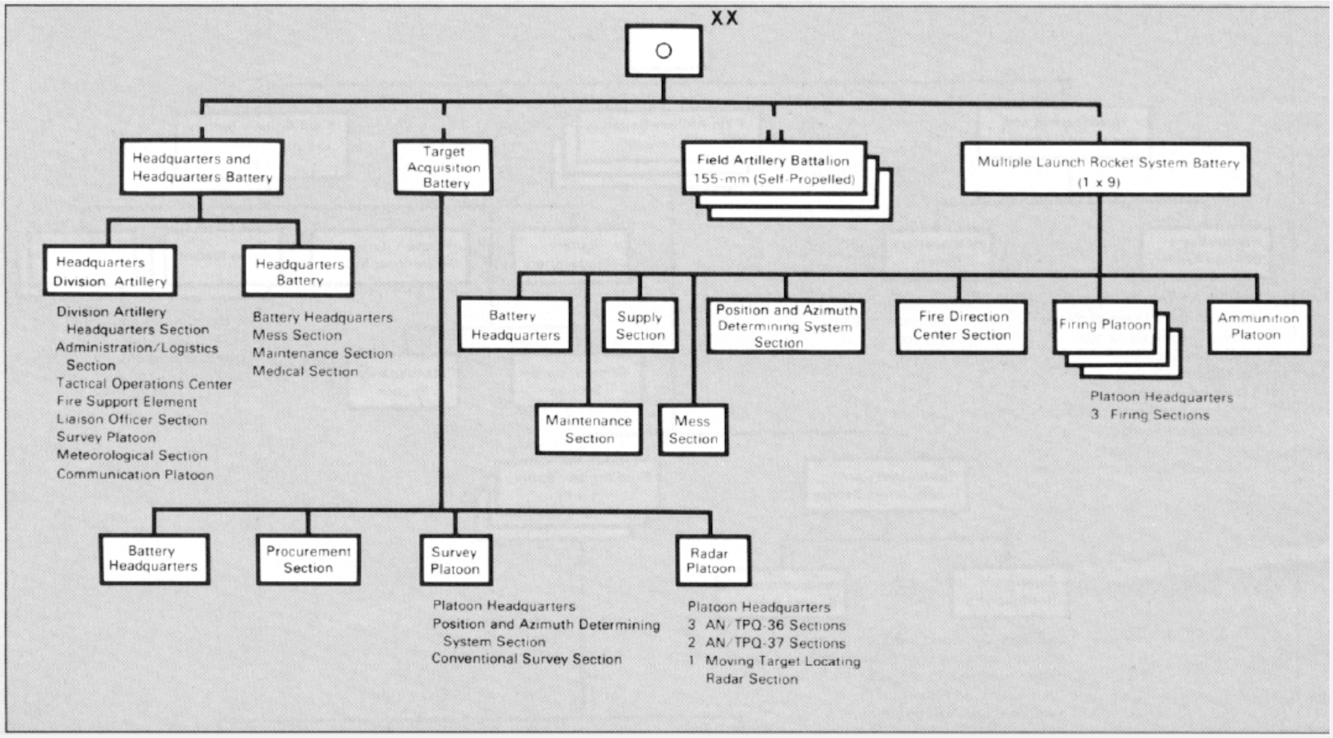


Figure 2. The AOE design for a heavy division artillery.

divisions have been designed to provide the fire support required for their separate missions. The Department of the Army and US Army Training and Doctrine Command (TRADOC) are, currently reviewing the force designs of these two divisions.

Heavy Division Artillery

The AOE heavy divisions—mechanized infantry and armor—are the products of years of force design effort. Originally approved by the Department of the Army under the Division 86 concept, their organizations have been developed to incorporate advances in armor and firepower technology designed to counter the Warsaw Pact threat confronting the North Atlantic Treaty Organization. In keeping with the AOE design goals, force structure refinements have been introduced in the Division 86 organizations to achieve manpower and materiel savings while retaining the fighting capability of the force. Thus, the AOE heavy division reconsideration was not so much a redesign effort as an attempt to restructure Division 86 to meet the affordable strength goal of approximately 16,000 personnel spaces. To achieve this goal, the following new concepts and personnel reductions will be implemented in the restructured division:

- A new field feeding concept.
- A revised personnel reporting system.
- Major revisions in communications systems.
- A movement of noncritical combat assets to corps.
- A reduction to nine men in infantry squads.
- The deletion of one attack helicopter battalion.
- The consolidation of division support command assets into main support and forward support battalions.

The changes and reductions in the division artillery are also quite significant. They include:

- The movement of the general support 8-inch self-propelled howitzer battalion to corps.
- The deletion of the sound and flash platoon from the target acquisition battery.
- The reduction of crews of both the 155-mm and 8-inch self-propelled howitzers by one man resulting in nine-man crews for the 155-mm and twelve-man crews for the 8-inch.
- The employment of the multiple launch rocket system battery as the only general support firing organization in the division artillery.
- The overall reduction of 650 personnel spaces throughout the division artillery.

As figure 2 makes clear, the restructured AOE heavy division artillery will have an HHB, a target acquisition battery, three direct support 155-mm self-propelled field artillery battalions, and a general support multiple launch rocket system battery. The figure also shows organizations of the three separate batteries. The three direct support 155-mm self-propelled field artillery battalions and their organic batteries are organized as shown in figure 3.

Each AOE heavy divisional and non-divisional field artillery battalion will be organized under the 3 by 8 concept resulting in 24 howitzers per battalion. Thus, the heavy division artillery will have a total of 72 155-mm self-propelled howitzers and nine multiple launch rocket system self-propelled loader launchers. The AOE cannon firing battery organization will operate with two platoons of four howitzers each.

Corps Artillery

The focus of the AOE realignment at the corps level has addressed three basic concerns.

- *Adequacy*—The corps commander is responsible for seeing that the corps operational plan is executed, but under Corps 86—the corps structure conceived in concert with Division 86—he had insufficient resources with which to influence the battle in accordance with the AirLand Battle doctrine.

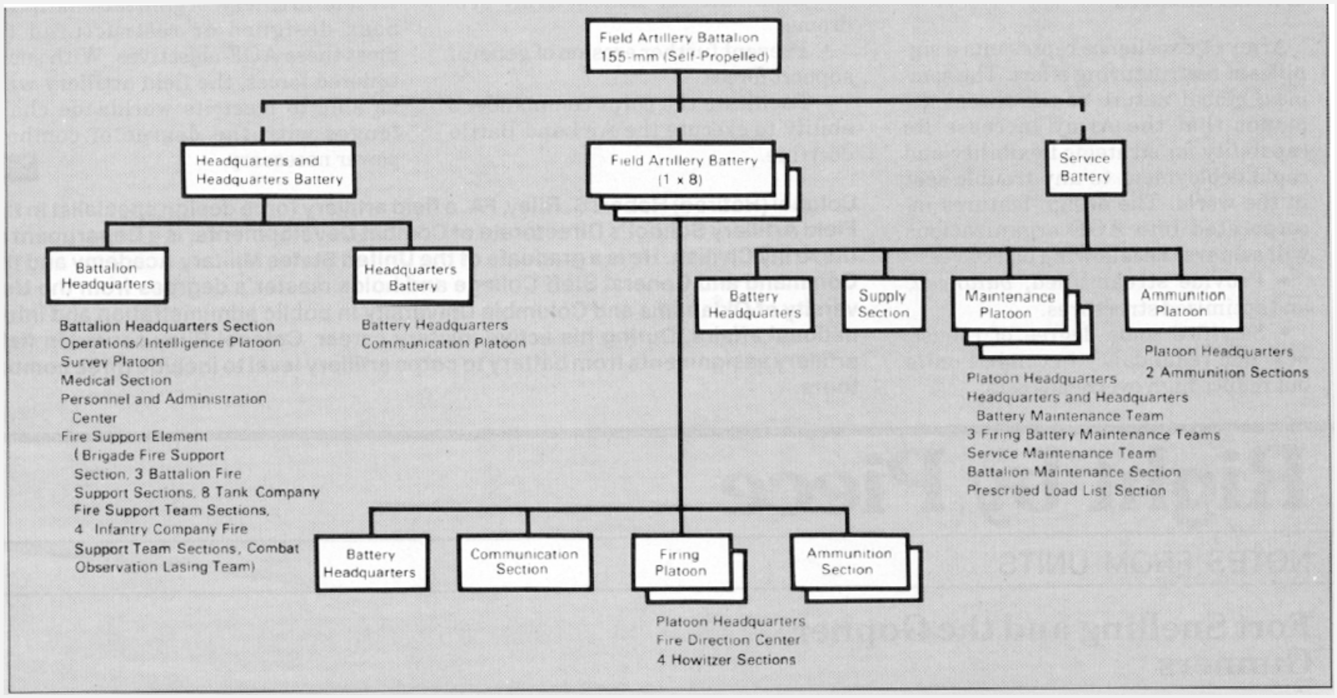


Figure 3. The AOE design for a direct support battalion in a heavy division artillery.

• *Agility*—The divisions were too large and unwieldy to deploy rapidly as the maneuver element in mobile warfare.

• *Authorization*—The personnel requirements for the total force exceeded the manpower ceiling authorized by Congress and would result in a "hollow" Army.

Once the available assets were identified, force designers developed an alternative corps structure to provide a *balanced* force within those resources. Each corps was allocated to only one theater, and each subordinate artillery unit was given only one mission and assigned to a specific corps. While tremendous emphasis has been placed on the reduction of the size of the divisions, realignment of the troop unit mix has served to improve the combat effectiveness of the corps. The restructuring effort has reduced overhead costs, centralized assets, and increased significantly the corps commander's ability to execute AirLand Battle doctrine.

For those redesigning the corps artillery, the task was to reorganize fire support assets to meet the AOE goal and to provide a balanced division force equivalent. The corps artillery structure features increased brigade strength, conversion of cannon artillery battalions to the 3 by 8 configuration, addition of a multiple launch rocket system battalion and a corps target acquisition battalion, and standardization of the internal brigade structure. Three design objectives were incorporated into the restructuring process.

• Place one cannon brigade having a notional structure of one 155-mm and two 8-inch battalions in support of each division. This mix will constitute that division's "slice" of the corps artillery and will permit the personnel ceiling to remain within the limits established by the Corps 86 study.

• Set aside sufficient personnel spaces in the light corps to allow for the creation of a corps target acquisition battalion. Because the corps will provide all target acquisition support other than the AN/TPQ-36 radars, position azimuth and determining system, and the meteorological data system section in the light infantry division artilleries, this organization is desperately needed.

• Activate a corps HHB to improve command and control of the corps artillery.

A typical AOE corps artillery structure for supporting a three division corps appears in figure 4. Each of the three divisions will be allocated a supporting cannon brigade from corps artillery as shown by the three columns on the right in the figure. The corps artillery will retain all rocket and missile assets as shown in the left column in order to strengthen the critical area in the corps zone and to influence the battle.

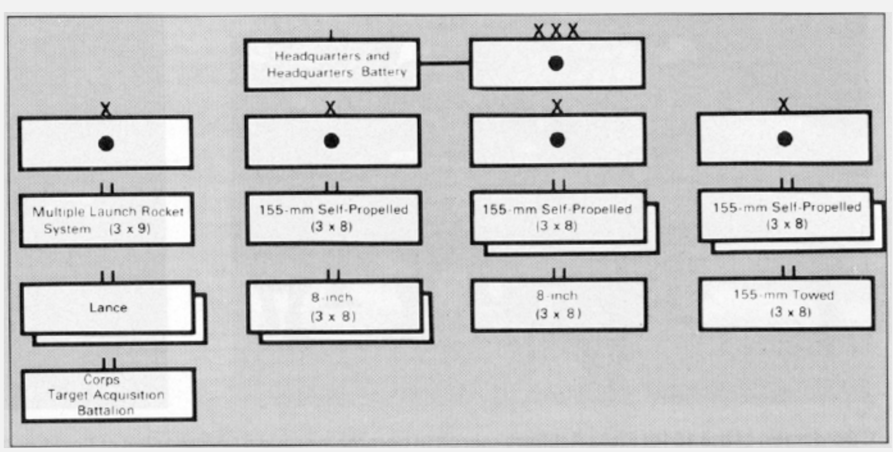


Figure 4. A typical AOE corps artillery structure for a three division corps.

Conclusions

Army of Excellence represents a significant restructuring effort. The complex, global nature of the threat demands that the Army increase its capability for strategic flexibility and rapid deployment to any trouble-spot in the world. The design features incorporated into AOE organizations will achieve the following objectives:

- Provide streamlined, *balanced,* and optimized structures.
- Sacrifice some degree of robustness and redundancy in combat units but reduce high overhead costs.
- Eliminate the hollow Army syndrome.
- Prevent further erosion of general support forces.
- Facilitate the corps commander's ability to execute the AirLand Battle doctrine.

Field artillery organizations have been designed or restructured to meet these AOE objectives. With such tailored forces, the field artillery will be able to meet its worldwide challenges with the degree of combat power necessary.

Colonel (Retired) Robert S. Riley, FA, a field artillery force design specialist in the Field Artillery School's Directorate of Combat Developments, is a Department of the Army Civilian. He is a graduate of the United States Military Academy and the Command and General Staff College and holds master's degrees from the University of Oklahoma and Columbia University in public administration and international affairs. During his active military career, Colonel Riley served in field artillery assignments from battery to corps artillery level to include three combat tours.

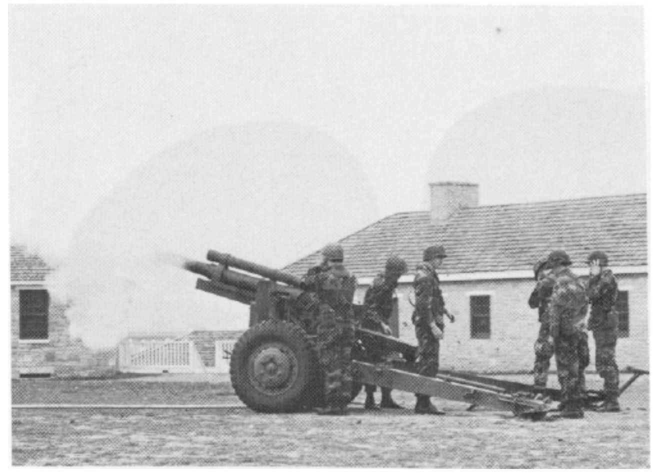
Right by Piece

NOTES FROM UNITS

Fort Snelling and the Gopher Gunners

FORT SNELLING, MN—Nearly a dozen World War II veterans of the Minnesota Army National Guard's 151st Field Artillery were on hand at Fort Snelling, Minnesota for ceremonies commemorating the unit's 120th anniversary. Several of the men experienced their first taste of battle in the deserts of North Africa and had subsequently played a major role in hurling back German armored counterattacks on 9 September 1943 at the Salerno beachhead.

Guardsmen of the 151st Field Artillery march in commemoration ceremonies at Fort Snelling for the unit's 120th anniversary. Crews from both the 105-mm howitzer and Parrot gun teams come together to honor the heritage of Minnesota's 151st Field Artillery.

An answering salute is fired by a 105-mm howitzer crew followed by the firing of a vintage 30-pound Parrot gun identical to those used in the Civil War.

Picturesque Fort Snelling, site of both World War I and II mobilizations, holds a special place in the 151st's history. The fort was the federal government's most important Army outpost on the northwest frontier in 1864 when the 151st Field Artillery was organized from existing Minnesota militia units. The battalion, then known as the 1st Minnesota Heavy Artillery, marshalled at Fort Snelling and then headed south to take part in the Union Army's defense of Chattanooga, Tennessee.

A highlight of the observance was an "answering" salute fired by a 105-mm howitzer crew from the present day Battery B, 1st Battalion, 151st Field Artillery and a second well-drilled crew firing a vintage 30-pound Parrot gun identical to the weapons used by the 151st's parent unit during the Civil War.

Sponsors of the program included the Gopher Gunners, a recently organized local chapter of the United States Field Artillery Association.

How Good It Is!

SCHWAEBISCH GMUEND, GERMANY—Soldiers of the 1st Battalion, 41st Field Artillery continue to sing the praises of the new Pershing II system. The most noticeable difference to those soldiers with the hardest jobs—the 15Es—is the reduction in cables as well as in air conditioning and high pressure air lines. Instead of the crew feverishly manhandling heavy, cumbersome cable and line bundles, they now breeze through emplacement with just a couple of cables that one man can handle.

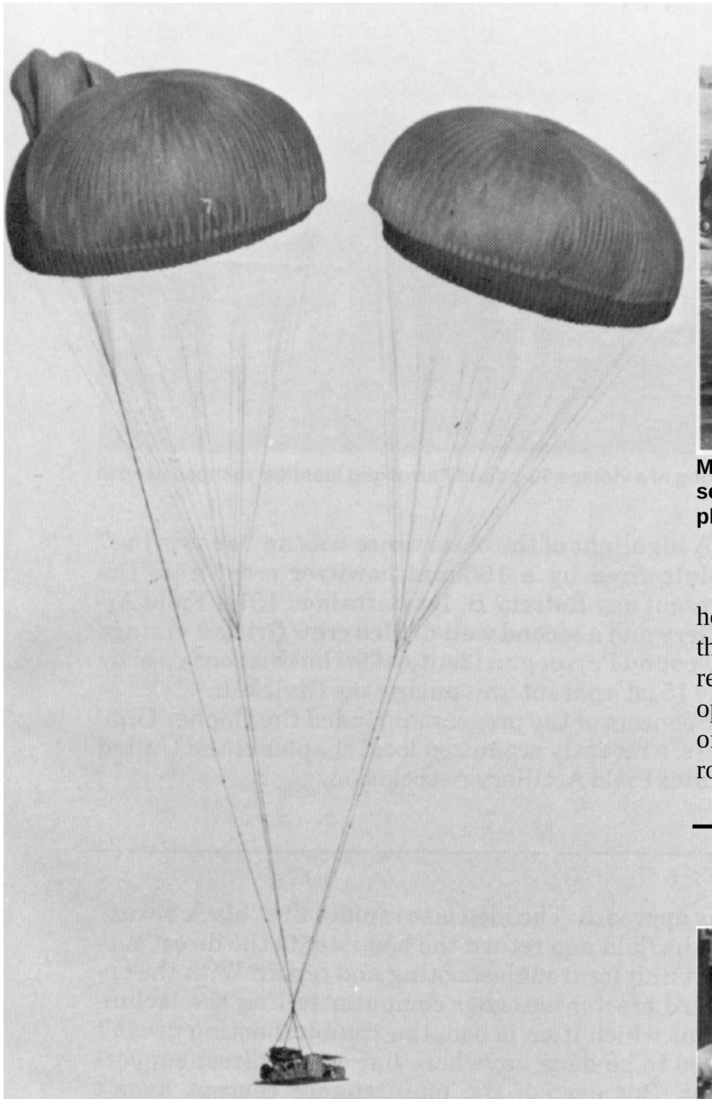
Platoon leaders also think the system is great. No longer are firing positions determined by available east-west road nets. This system can be emplaced to fit into the most suitable tactical position. Now tactics drives the train and not geography. This has opened up new vistas for platoon leaders who have come up with innovative firing positions and unique platoon configurations. A change in target is now a simple matter of recounting the missile instead of shifting the launcher.

The biggest complainers about the system, other than those on the target end of the trajectory, are the warrant officers! "I don't have anything to do anymore," is a common lighthearted comment heard where warrants gather. The new system just doesn't break as often as the old one did. The maintenance concept for Pershing II is also different in that the approach is now a component replacement instead of a card and module or circuit schematic troubleshooting approach. The idea is to replace the "black boxes" in the field and return the bad item to the direct support unit for troubleshooting and repair. With the onboard erector-launcher computer telling the technicians which item is bad, the troubleshooting doesn't need to be done anywhere but at the direct support unit. But even if the maintenance concept hadn't changed, the opportunity for fixing things still wouldn't be present as before. Unlike days gone by when crews hoped the red malfunction lamp wouldn't light, countdowns now finish. There is tremendous confidence in the system.

Command and control has made giant leaps forward as well. New and improved radios and a new platoon control central really let a platoon leader know what's happening. Moreover, his platoon control central even has nuclear, biological, and chemical protection for the crew.

The system hasn't been overlooked automotively either. Over and above the new brake system on the erector-launcher, there is a beautiful new 10-ton MAN tractor. The MAN tractor has the power and pull capability of two of the old M757s. So far, there hasn't been one instance where the MAN couldn't pull the Pershing II. The tractor also has an on-board winch for self-recovery, a 30-kw tactical generator, and a crane used to assemble and mate the missile.

Even after more than a year of working with the Pershing II system, missilemen maintain an undiminished enthusiasm about this exciting new system. (LTC Doug Middleton)



With five huge cargo chutes above, this M198 howitzer eases its way to the soft, sandy surface of Sicily drop-zone at Fort Bragg. This is the first operational heavy-drop of the Army's towed 155-mm cannon. (US Army photo by CPT Pete Eschbach)

First Training Drop

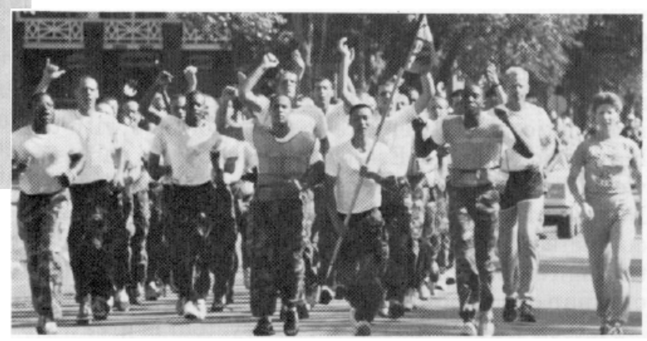
FORT BRAGG, NC—The 18th Airborne Corps Artillery recently conducted the first operational drop of an M198 howitzer. The event marked a major advance in the corps' ability to deliver long-range artillery to a future battlefield.

Members of Battery B, 1-39th Field Artillery, Fort Bragg, scramble to release this M198 from the ties that bind. (US Army photo by SP4 Stephen B. Pollock)

While the concept of parachuting the large 155-mm howitzer had been evaluated under test conditions before, this drop was the first time the cannon had been dropped in regular training. The total time required for the live fire operation was 22 minutes—the time from the gun's exit out of the back of a C130 aircraft to the time the last of three rounds sailed downrange into a Fort Bragg impact area.

790th Field Artillery Reunion

WASHINGTON, DC—The 790th Field Artillery Battalion will hold its annual reunion 4-6 October in Washington, D.C. For more information, contact either Mr. C.C. Carraturo, No. 1 Hydraulion Avenue, Bristol, Rhode Island 02809, phone: (401)253-8722 or Mr. James C. Brady, 11136 Riaza, No. 4, Saint Louis, Missouri 63138, phone: (314)355-1519.



Battery D, 7th Training Battalion, USAFATC crosses the finish line with CPT Charlotte Watson, battery commander, setting the pace.

A Redleg Memorial Day Run

FORT SILL, OK—The US Army Field Artillery Training Center (USAFATC) Chapter of the Field Artillery Association recently sponsored the first of what is to be an annual Memorial Day Run at Fort Sill, Oklahoma. Over 3,000 individuals participated in the run, many of them as a member of one of 46 units that entered. Units from the Field Artillery Training Center, III Corps Artillery, and the Field Artillery School met the challenges of the 1 mile, 5 kilometer, and 10 kilometer routes. (CPT Mary B. McCullough)

A Cobra attack helicopter fires a tube- launched, optically tracked, wire-guided missile during joint air attack team training.

PFC Joe Guay (left) and SSG James Winston from the 1st Battalion, 31st Field Artillery use the laser designator during exercises with the Air Force.

Training Thunderbolt Drivers

FORT CAMPBELL, KY—Detachment 5, 507th Tactical Air Control Wing (TACW), at Fort Campbell, Kentucky, recently helped to train students from the A-10 Fighter Weapons School, 57th Fighter Weapons Wing, Nellis Air Force Base, Nevada. Post units rendering support in the training were the 2d Battalion, 31st Field Artillery; 1st Battalion, 321st Field Artillery; 2d Squadron, 17th Cavalry; 229th Attack Helicopter Battalion; and 63d Chemical Company.

The 61 students, consisting of 21 A-10 Thunderbolt pilots and 40 maintenance support personnel, were at Fort Campbell to qualify five of the pilots as joint air attack team (JAAT) instructors.

The first week was spent training in low-threat scenarios in which the A-10 pilots worked with helicopters and moving targets. The Tactical Radar Threat Generator (TRTG) from Fort Hood, Texas, added realism by creating situations that tested the A-10 pilots' reactions to battle problems. The TRTG imitates four types of Soviet radar guided air defense systems that are displayed on special screens mounted on the control panels of the aircraft. A pilot's reactions to the threat are printed on videotape which can be played back later for evaluation. The videotapes help the pilots improve their actions against simulated threat air defense systems.

During the second week of training, the threat was increased—"Smokey Sam" ground-to-air missile simulators were fired during some of the missions. The A-10 pilots also had to conduct a search-and-rescue mission during which they had to find a downed helicopter or aircraft and lead rescue personnel to the location. Both inert and live rounds were used by the pilots in training. (Story and photos by SP4 John McGarrah)

112th Field Artillery Association Reunion

LAWRENCEVILLE, NJ—The 112th Field Artillery Association, Headquarters 112th, 695th and 696th Field Artillery Battalions with service in World War II, Korea, and the Berlin Crisis, is having its Annual Regimental Reunion from 8-11 November. The reunion will take place at the Trenton Artillery Armory, Eggerts Crossing Road, Lawrenceville, New Jersey. Former members and others interested should contact LTC(Ret) Nick Chiacchio, at Cdr, P.O. Box 5088, Trenton, New Jersey 08638 or phone: (609)292-3852 or (609)883-3871.

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