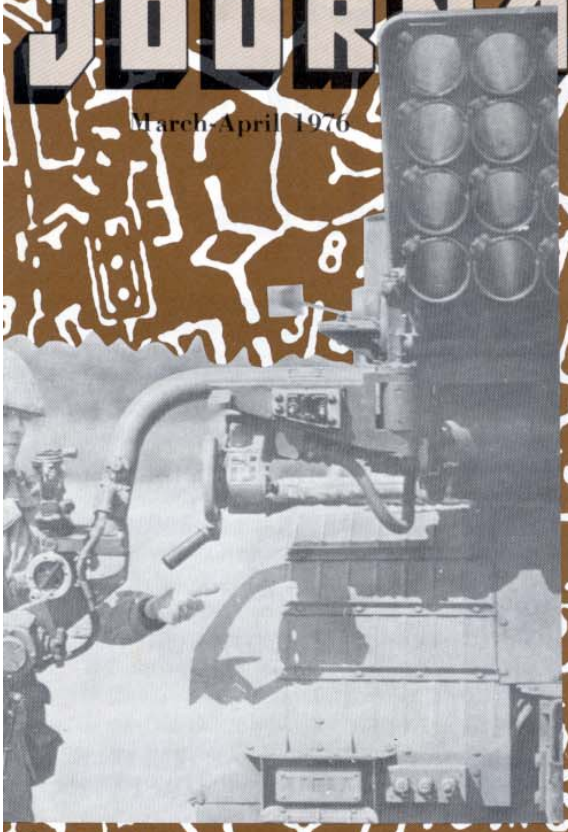
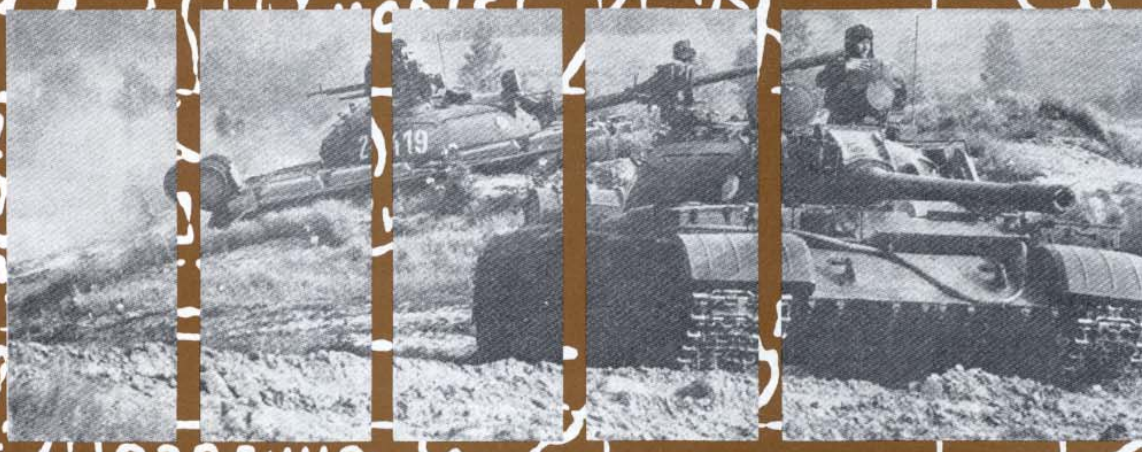
FIELD ARTILLERY JOURNAL

March-April 1976





Defend Outnumbered And Win

FIELD ARTILLERY JOURNAL

Volume 44 **March-April 1976** **Number 2**

The *Field Artillery Journal* is published bimonthly at the US Army Field Artillery School for the same purpose 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 powers 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."***

Funds for the printing of the publication were approved by the Department of the Army, 1 September 1973.

All articles and information submitted are subject to edit by the *Journal* staff; footnotes and bibliographies will be deleted from text due to limitations of space.

All letters and articles should be addressed to Editor, *Field Artillery Journal*, PO Box 3131, Fort Sill, OK 73503. AUTOVON 639-5121 or Commercial (405) 351-5121.

Subscriptions to the *Journal* may be obtained through the Field Artillery Historical Association, Fort Sill, OK 73503. The rate remains $6 per year.

Credit for this month's cover goes to Mrs. Bernie Weis of the Foreign Science and Technology Center Library. Through her gracious assistance we have been able to obtain the excellent photographs of current Warsaw Pact weapons and equipment [as well as the Russian battle map] which have appeared inside many of our issues.

Articles

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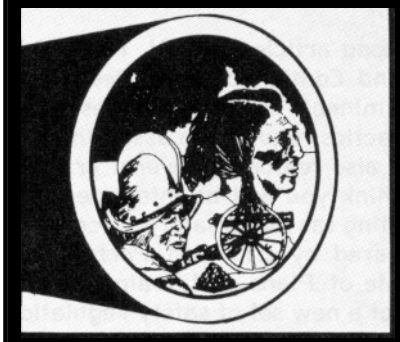

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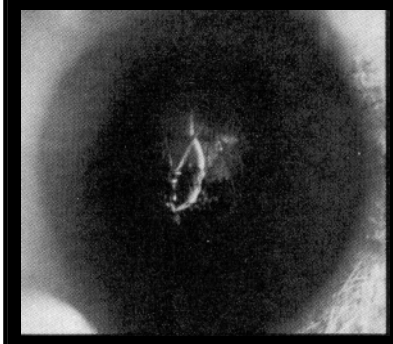

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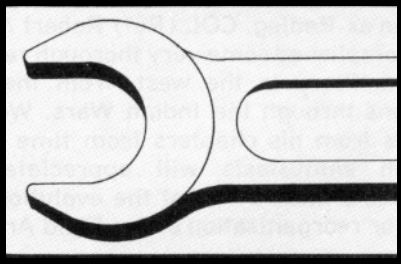

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a word from the editor

Although the Superbowl is behind us for another year, it occurs that one of the major themes for that sports spectacle happens to coincide with the thrust of this month's issue: defense.

A good deal of material has been published on new offensive tactics and doctrine along with the thinking on the attendant fire support for those tactics. This month we offer two articles on defensive tactics for your perusal and, hopefully, vigorous discussion. The first comes from a classmate and old friend, LTC David Tamminen of the Armor School's How To Fight Team. David's article, "How to Defend Outnumbered and Win," first appeared in the November-December 1975 issue of **Armor** and gives us an excellent insight to some of the new defensive tactics currently under study by both the armor and the infantry. Our thanks go to **Armor** for the permission to reprint and "spread the word."

The second article, by COL H. R. Guffey, head of Tactics and Combined Arms Department, dovetails with Tamminen's in that it focuses on some new fire support tactics required to assist the maneuver folks

We are also featuring several articles on training that we think you will be interested in reading. The most exciting (as far as safety officers are concerned) was prepared by LTC Jon Porter of the Fort Sill Directorate of Plans and Training. The article is a synopsis of a new set of safety regulations which has been forwarded to all tube units. It is also the subject of General Ott's "Forward Observations" column.

We have also placed emphasis on unit training articles to follow up on CPT Lee Baxter's "Hostile Training Environment" article from the last issue. Redlegs from Europe lead the way with two articles (which we combined) on new training techniques with the M-31 and an excellent article on maintenance training and organization by LTC William Hughes

"Operation Redleg," written by CPT Bruce Olson of the Texas National Guard, details the conversion of an M-102 airborne unit to an SP 155 unit. Finally, MAJ Ed Greenwell, formerly of the Target Acquisition Department, provides us with some new training tips for Q-4 radar operators.

There is also a new history series beginning in this issue. An ex-Redleg, COL (Ret) Robert M. Stegmaier, has accomplished some very thorough research on the use of artillery in the west, from the Spanish explorations through the Indian Wars. We plan to run excerpts from his chapters from time to time. Ammunition enthusiasts will appreciate CPT John deTreville's fine review of the evolution of shrapnel

A major reorganization of the Field Artillery School has recently taken place. The major aspects are contained in the "View From The Blockhouse" section of this issue.

The "Sea-going Howitzers" article was taken from the unpublished memoirs of Rear Admiral (Ret) Norman E. Smith. Admiral Smith was a graduate of the Naval Academy in 1931 and saw action in China, the European and Pacific Theaters in WWII and the Korean War. LT John L. Shriner of the Wyoming National Guard wrote the article. He is related to the admiral by marriage.

In our efforts to thank the Redlegs of V Corps Artillery for providing a batch of articles recently (see the editor's letter in our January issue), we managed to overlook an entire field artillery group — the 41st, commanded by COL Charles Hoenstine. We are most appreciative of their efforts — even if we didn't say so the first time.

As we went to press with this issue we learned the results of brigadier general and commander designee selection boards. The following field artillerymen have been nominated for promotion to brigadier general: Robert W. Sennewald, Requirements Directorate, ODCSOPS, DA, who just turned over the 4th Mech Div Arty; Charles W. Bagnal, Commander of the 101st Aviation Group; Robert H. Forman, Director of Instruction, USAFAS; Paul F. Pearson, Director of Gunnery, USAFAS; Michael N. Bakarich, Chief of Staff, 2d Infantry Division; Frank J. Palermo, Hellfire Project Manager; Benjamin F. Doty, Officer Personnel Directorate, MILPERCEN; and, Richard D. Boyle, Executive to the Secretary of the Army. This is a great list!

Congratulations are also in order to the 33 Redleg colonels, including five from Fort Sill, who made the recent Combat Arms Command Designee list. The list includes (in alphabetical order):

Kenneth R. Bailey
Llyle J. Barker Jr.
Robert T. Basha
Jack O. Bradshaw
William F. Burns
Emory W. Bush
Larry L. Cook
Robert E. Cottle
Sidney Davis
John E. Donohue
Amil J. Eckhart
Wendell H. Gilbert
Howard R. Guffey
Kenneth S. Heitzke
Jere L. Hickman
Claude M. Kicklighter
Robert E. Leard
Joseph J. Leszczynski
David B. Lucke
James F. McCarthy
John H. Mitchell
Robert A. Mountel
William R. Owel
Joe S. Owens
Dan Holly Ralls
Donald M. Rhea
Michael Rhode Jr.
Joseph J. Skaff
Lowell G. Smith
Gary L. Turner
Frank J. Wasko Jr.
Russell A. Weathersby
Orren R. Whiddon

We also tip our hats to the captains selected by the most recent board for promotion to major, AUS, to include the 75 percent of those eligible assigned to USAFAS.

Enjoy your **JOURNAL!**

"Thanks, but. . ."

I would like to call attention to a typographical omission [on page 38 in the November-December 1975] in. . .the *FA Journal* under "Space and Time Factors." The second sentence should read: "The most efficient way to use such units (TA) is to assign *missions to battalions and batteries in the form of target areas to be covered* and to leave to the battery commanders, with guidance from their battalions, the means to be used and positions to be occupied." The omission does change the original sense.

I would also like to thank you for the space you have been giving me in your excellent journal.

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

Cover Photo

The purpose of this letters is to ask your assistance. On the cover of the September-October 1975 *Journal* there is a picture of a crew loading an M102 howitzer. I would like to know if you could send me a negative of this picture so that I can reproduce it here in the battalion darkroom. I will be glad to pay for any costs involved.

Robert G. Morris
CPT, FA
C Btry, 3d Bn, 35th FA

The negatives are in the mail.—Ed.

Old Vehicles

For the past year I have been assembling a collection of photographs of all of the motor vehicles used by the US Army since the 1900s. Research and photocopying has been performed at the Pentagon, the Research Collection at Carlisle and over a score of other such military organizations, resulting in an excellent photo collection of over 1800 prints. A representative set of the photographs is being placed in the Ordnance Museum for reference purposes.

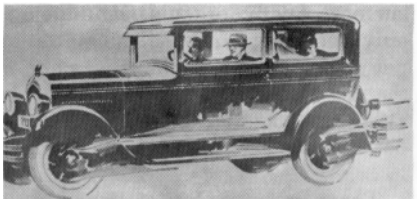
There are, however, some aspects in which I hope the *Field Artillery Journal* or some of its readers can help.

I need photographs of military owned cars and truckers of all types prior to World War I and for the 1920 to 1939 era. These were primarily commercial vehicles with military serial numbers. As I have my own photocopying facilities, I can return borrowed photographs usually within 24 hours.

Perhaps the files of the *Journal* would include some useful photos such as the 1928 Chrysler "62" touring car which the Field Artillery used as staff cars. I know that over 100 were purchased but I've never found a photograph.

I would appreciate any help which your office might be able to render. Please make any responses to the undersigned at: PO Box B, Aberdeen Proving Ground, MD 21005.

F.W. Crimson
MAJ, OrdC
Aberdeen, MD



Redleg car buffs take note! An intensive research of the Morris Swett Library's periodical archives netted but one illustration of the "62" (*a la Detroit showroom*) *and an exhausted lieutenant.—Ed.*

ICM GFT

I have just finished reading your article titled "Suggestion Prompts ICM GFT." This was on page 26 of the September-October 1975 issue of *Field Artillery Journal.*

I am the FDO of a battery in the New Hampshire Army National Guard which will be taking an ATT during summer camp. Is there any way that I may get a couple of the paste-on scales for the GFT as mentioned in the article? If so, would you please let me know how? Any help you could give me would be greatly appreciated.

Thomas F. Pawnell
1LT, FA
NHARNG

The Gunnery Department is now distributing the paste-on scales to all Active, Reserve and National Guard field artillery units.—Ed.

Counterfire

I am currently serving as the Roanoke, VA, Army recruiting area commander. The *Field Artillery Journal* provides me with the capability to keep in touch with the Field Artillery and recent changes in our tactics and doctrine. Your staff is doing an outstanding job of keeping branch immaterial field artillerymen informed of progress in our profession. Please continue your fine efforts.

I particularly enjoyed the very informative article regarding counterfire in the November-December 1975 *Journal.* I served as assistant S3 of the 210th Field Artillery Group, USAREUR, during the time when our target acquisition and counterfire capabilities, methods and organizations were being studied and questioned. I also participated in several exercises in which various counterfire organizations were tested. Therefore, I am familiar with some of the background from which current changes have evolved.

Having read "Counterfire Part One," I am left with several questions concerning the status of the field artillery group headquarters. What will be the status of the group commander when his units become attached

to a division? Will he take a back seat to the division artillery commander? How have the command and control relationships between the two senior artillery commanders — FA group and div arty — been worked out? Where will the group operations center fit into the fire control and coordination scheme? Will it become a radio relay for the div arty or will it have a specific function? What will be the role of the corps artillery commander and the corps fire support element?

My questions are based on my experience in a group headquarters which tested several concepts mentioned in "Counterfire." I agree that our target acquisition, targeting and counterbattery capabilities need modernization. The problems we are creating, however, by crossing chains of command and giving commanders of field artillery battalions and groups the problem of serving two masters must also be addressed in order to make our modernization work smoothly during peacetime and effectively when we will need steel on target in battle.

I realize that this lengthy letter cannot be published in "Incoming" and that some of the answers to my questions may be classified. I would appreciate your passing along this letter to the appropriate department for information and action.

Again, thanks for keeping me well informed.

Daniel M. Ferezan
CPT, FA
Roanoke, VA

The official Department of the Army training circular is scheduled for dissemination in the April 1976 time frame. It should answer your questions.—Ed.

Trainer for Q4

"A Trainer for Q4 Radar," in the July-August 1975 issue of the *Field Artillery Journal,* refers to a training aid which could be very useful in operator training in South Carolina National Guard units.

The Training Aids Services Office at Fort Sill provided this office with plans for the basic trainer but were unable to give any guidance in the preparation of the slides used with the trainer.

It would be appreciated if you would forward this letter to the proper authority or advise this office of the name and address of knowledgeable individuals so that we may contact them concerning these slides.

Bill B. Dimmery
Director, TASO
Fort Jackson, SC

Your letter has been forwarded to the trainer's inventors through the Adjutant General of Missouri.—Ed.

More C/V Needed

The current United States Army allocation for air defense weapons is extremely light to protect the units from massive air strikes. . . .The sparsity of these weapons assures the Warsaw Pact countries a large probability of success against our field forces, should a conflict arise. We should take note of the lessons learned from the 1973 Arab-Israeli War, where the Egyptians employed massive air defense fires, which denied the Israeli aircraft the airspace to attack the Egyptian forces. The Israeli Air Force was forced to attack the Egyptian maneuvering forces; however, they had to accept extremely high aircraft losses inflicted by the massed Egyptian air defense weapons systems. Taking this example one step further, if a conflict arose on the European continent, our already scarce resources would be extremely vulnerable to the massive air attacks the Warsaw Pact countries are capable of launching. . . .

The air defense assets available to protect the field forces under the current Army organization include only one Chaparral/Vulcan battalion per division. A vast improvement in the air defense protection could be attained by adding a Chaparal/Vulcan battalion to each corps artillery group . . . .

These additional battalions would vastly increase the amount of fire that could be directed against attacking aircraft. When the attacking aircraft meet the heavy volume of fire at the lower altitudes, they will be forced to gain altitude and then they will become targets of Hercules and Hawk batteries, and, if they are not destroyed, at least their effectiveness will be minimized. Not only would the vulcan batteries increase the air defense coverage, but they would be able to deliver valuable suppressive fires against ground targets.

This battalion's fires would be able to supply the necessary protection that the Redeye sections presently authorized cannot adequately provide. At the present time, it is extremely difficult to defend the entire field artillery battalion with only the Redeye section, even when supplemented by the battalion's organic machine guns and small arms. It is almost impossible to defend the firing batteries, the battalion operations/FDC complex and the ammunition trains. The ammunition train assumes even greater importance when transporting special ammunition, and this ammunition must be protected. The heavy artillery and the Lance missile battalions of the corps artillery groups, which have no organic air defense assets authorized, will certainly be primary targets of hostile aircraft attacks and therefore must be heavily defended.

By adding the Chaparral/Vulcan battalions, corps would be able to combine more air defense assets to achieve a more effective and complete air defense protective umbrella. At the present time, the corps artillery units are forced to rely on the divisional Chaparral/Vulcan battalions and corps air defense missile batteries. The addition of the Chaparral/Vulcan battalion would give the corps units more freedom of movement since they would have their own protection. Now, too few units in the corps artillery groups are unfamiliar with the divisional units they must monitor for early warning and with the Chaparral and Vulcan systems. Consequently, they do not know how to integrate these weapons to form a complete protective network.

In garrison, the Chaparral/Vulcan battalions would provide the training guidance for the Redeye sections that are organic to the artillery battalions in the corps artillery groups. Also, other benefits in training would be derived from the addition of the air defense battalions. The personnel could be rotated among positions in the artillery battalions and the Chaparral/Vulcan battalions. The result would be personnel well trained in many different aspects of air defense and very capable of fulfilling their combat missions. At the present time, the Redeye personnel have a difficult time in maintaining their MOS proficiency. The reason for this is personnel in the air defense sections

have the same basic MOS as the units to which they are assigned. For example, in an artillery battalion they would have a 13B MOS, a cannoneer. However, the personnel train in the Redeye section, and, although they are expert Redeye gunners, they have a great amount of difficulty on MOS tests because they are not exposed to the cannons and the duties of a cannoneer. If the MOS for Redeye personnel is changed to 16P, a Chaparral launcher crewman, Redeye personnel will still not be able to become experienced with the Chaparral equipment unless they are exposed to the equipment.

The addition of the Chaparral/Vulcan battalion to the corps artillery groups would increase the air defense umbrella in times of conflict and improve the general readiness during peacetime. This addition would substantially increase the protection of the corps artillery units and our maneuvering forces on the battlefield in general.

Ralph E. Mills
1LT, AD
Redeye Section Leader
HHB, 3/35th FA

Open Letter To Molly

Dear Molly,

Things are changing here at the "Home of Field Artillery." This letter is about the rebirth of an old artillery unit that will have a direct effect on every artilleryman and artillery unit in the Army. On 1 July 1975 the Field Artillery Training Center was reestablished here at Fort Sill. All the old Redlegs remember this unit with mixed emotions as "The ATC" and that's the handle we will continue to use. The important part is that on or about 20 February 1976, Redlegs will receive all initial training here. You guessed it, Molly, we're going to have Basic Combat Training (BCT) right here next to Medicine Bluff. Now I reckon that you're not too excited about the return of ATC and BCT to Fort Sill. In fact, grandpa told me how you got on-the-job training during an actual battle. Our training won't be that realistic but we're going to come as close as horse sense allows.

As I sit here on the sandbags writing about all of this, I realize how enthusiastic I am about the opportunities here. I've been listening to the section sergeants talk about how they plan to start making every soldier a field artilleryman the moment he walks through the door of the Reception Station. The officers are talking about instilling the "Pride of a Redleg" in every man and teaching him how all the things he learns in BCT and Advanced Individual Training (AIT) relate to his eventual assignment to a regular unit. These people mean it when they talk about building Redlegs! I heard the XO say he plans to "paint the soldier red" the first day he arrives. From what I hear about the training program, the supply sergeant had better stock a lot of red paint as the training is going to wear it off the troops. The first sergeant has been talking to all the NCOs about teaching self-discipline, personal responsibility, pride and making every soldier a winner — Molly, he means it! The Chief of Smoke and the training NCO are rewriting the training program in the battalion commander's (BC) office right now.

Though ATC Headquarters runs the show, it's located where the staff can get down here on the guns where most of the hard work is done. Under the ATC Headquarters are five training battalions and the Specialist Training Battalion.

Before I go any further, however, I should explain the concept of the One Station Training program.

One Station Training means that the new soldier receives BCT and AIT at the same post. Recognizing the benefits and advantages of such training, we're going one step further with the One Station Unit Training program. Run by the 1st, 2d and 3d Cannon Training Battalions, the soldier will take BCT and AIT in the same battery. The cadre will be the same during all training and will get to know the men on an individual basis — helping everybody with problems and especially those who have trouble adjusting to artillery life. The 4th Basic Training Battalion and three batteries of the 5th Composite Training Battalion will run the BCT program for men taking AIT in one of the specialist or missile MOSs. Those scheduled for School courses will be transferred to the Specialist Training Battalion. Missileers will take their training in ATC and transfer to one of the two missile batteries of the 5th Composite Training Battalion.

Another important organization is the Training Command, a battalion-sized unit with the mission of providing hard-core, MOS-related instruction for the entire ATC. It has a normal headquarters staff and separate committees for BCT, missile crewmen, self-propelled and towed cannoneer training. By checking enlistment contracts and enlistment options on each soldier, we can tell what type of unit each soldier will be assigned to and provide him with specialized training on that unit's particular weapon. This will allow field units to devote more time to unit training and developing sharp gunners.

Molly, here is where you can help us get the word out. When you are making your way around to all the field units, be sure and remind those guys that ATC trains *numbered cannoneers* and *missile crewmen.* Batteries that train NCOs and officers will initiate unit programs for gunner, assistant gunner and driver training. ATC forgoes such training because every man doesn't require those skills. Section sergeants know the men to choose for such positions and what to expect of them. Mine sure do! I've been bucking for gunner for 18 months and I've enrolled in some School correspondence courses to help me qualify.

This letter would not be complete without a word concerning the Special Training Battery. This unit will work with the men experiencing learning problems and those who need extra physical training to get in shape. Also, a special motivation platoon will be available for those guys who always sham and shirk and mess up the rest of the section. From what I've seen, I wouldn't want to end up there even for a day — the drill sergeants are fair but can be real tough.

Well Molly, that's it for now. I know you and Saint Barbara are watching over us Redlegs around the world. I'd appreciate it if you'd spread the word about the One Station Training program we have here. Field units will have to be tight and professional in order to keep up with this new breed of Redleg. The BC is serious when he says training is a continuing program throughout the Army and that he intends to live up to his end of it.

A Trainee

Decisive Lateral Repositioning

by COL Howard R. Guffey

Technological advances and developments in armored warfare have changed the complexion of the modern battlefield, creating an era of challenge to US forces never before experienced. Mobility and the capability to shift forces about the battlefield have enabled commanders rapidly to concentrate combat power in order to exploit success or to counter threats. Future combat will require quick decisions and fast, violent exploitation of enemy weaknesses. Battles can be won or lost in a critical instant.

The increased pace of the battle, the magnitude of the enemy threat and the newly evolving doctrine pose particular challenges for fire support. Targets will be more numerous and more fleeting. Lucrative target concentrations will be of short duration and decision-making time will be reduced, thus placing a greater reliance on procedures and battle drills. The fluidity of the fight will force frequent displacement of fire support assets. Competition for fire support resources will be keen, and conflicting requirements will be the norm — not the exception. In essence, the modern battlefield places unprecedented heavy demands on the field artillery system for responsiveness, increased mobility and survivability and accurate and timely massing of fires.

New defensive doctrine (see "How To Defend Outnumbered And Win," this issue) indicates that success on a modern mid-intensity battlefield can only be achieved through teamwork.

All members of the combined arms team must contribute to the massing of combat power. Decisive lateral repositioning (DLR) of field artillery units complements this new doctrine by allowing the commander to concentrate one element of combat power — his field artillery — at the proper time and place in the battle. DLR is not a *new* concept but rather a state of mind, an action brought about by the recognition of the field artillery's defensive role on the modern battlefield. When the field artillery commander understands the nature of the modern battlefield, the magnitude of the enemy threat and the dynamics of the new defensive doctrine, DLR becomes nothing more than a logical means of fulfilling his fire support responsibilities to maneuver.

The maneuver community in recent months has made great strides in evaluating old defensive doctrine and in developing new defensive doctrine. The most recent doctrine shows the defensive battle to be a series of short, violent encounters characterized by rapid movement and small unit actions. Combined arms teams will fight from a series of battle positions, attacking the enemy in planned likely engagement areas (LEA). The battle will be one of centralized planning and decentralized execution, with the war fought at brigade level and below.

The battlefield will be designed to bring the enemy under an ever increasing volume of fire, stopping him forward of our rear boundaries. The fight will take place in two areas: the covering force area (CFA) and the main battle area (MBA).

A covering force heavy in combat power will seek to strip away the enemy reconnaissance screen, force him to deploy, bring up his artillery and commence his attack. This action will delay his advance and reveal his strengths, capabilities and, most importantly, his intentions. Throughout the covering force battle, the enemy must be denied momentum and any exploitable penetration.

The battle in the MBA differs from the covering force battle only in the amount of combat power committed and in the degree of preparation. Both supporting fires and maneuver elements are fitted to the terrain. Detailed

preparations will be made in advance and continue during the covering force battle. Upon the return of the covering force, maneuver elements and their supporting fires will be used to thicken the defensive strength of the MBA. This will require a high degree of centralized control and direction of fire support resources. Centralization provides for the most efficient use of our numerically inferior fire support assets by assuring that they can be concentrated and used to tip the balance of combat power to a favorable ratio in the region of the most critical threat. In the MBA the destructive war of attrition takes place in its full lethality and violence. It is there that the decisive battle will be fought. FA units must be in position, within range, and ready to support that battle.

Whether in the CFA or MBA, the maneuver commander's tactical responsibility will be to determine the main enemy thrust and then mass combat power at the proper time and place on the battlefield to achieve the combat ratios necessary for success. The commander defines the main enemy thrust through all-source intelligence and an active and aggressive covering force. He masses combat power at the critical point on the battlefield by lateral movement of maneuver units to "thicken" his defenses and by decisive lateral repositioning of field artillery to concentrate its element of combat power. DLR is a three-faceted concept based on the ability of field artillery to mass fires rapidly. The basic principles which the division and div arty commanders must consider when applying DLR follow:

- First, laterally reposition out of the path of the main enemy threat. FA fire units located *in the path* of the main enemy threat are repositioned early, both laterally and in depth, to the flanks of the developing penetration. Once repositioned, these FA units are relatively unaffected by the rearward movement of the fight and are able to provide uninterrupted fires. Rapid movement is essential to insure the shortest break in fire support. The normal fire support relationship between the direct support battalion and the supported maneuver brigade is not disturbed; however, these FA units may or may not be located in the zone of the supported force. Positioning would be a function of range and the fire support requirements of the supported unit. For units under direct control of div arty (general support (GS) or general support reinforcing (GSR) mission), positioning would be a function of range with primary consideration being the FA unit's ability to range the critical area. This lateral movement, out of the path of the main enemy thrust, provides for minimal displacement of FA units and uninterrupted fires during the critical time of the battle.
- Secondly, laterally reposition FA units toward the main enemy thrust. FA fire units located *away from the main thrust* are repositioned laterally, essentially closing on the main attack and concentrating their fires into the critical area. In this technique, as in the previous one, the direct support relationship is not disturbed. Those FA units repositioned and possibly assigned new tactical missions normally will be the attached or reinforcing corps artillery units or the divisional general support battalion. Again, rapid movement is essential to insure that units are in position and ready to support at the crucial time.
- Finally, *mass FA fires, not FA units*. While DLR necessarily involves movement and repositioning of artillery units, the primary consideration is the impact point of concentrated fires. Whenever possible, fires should be concentrated by shifting tubes — not units. FA units must be in position in order to deliver accurate and responsive fires. We will reorient the zones of fire of those units able to range the critical area focusing their destructive fires against the threat. It is a combination of steps two and three that allows the fires of the majority of the field artillery supporting the division to be massed into one area.

As DLR is completed and additional maneuver units enter the fight, the complete combat power of the division can be brought to bear on the decisive area of the battlefield. When the main penetration becomes too costly, the enemy commander may elect to reinforce and exploit a supporting attack. However, DLR properly executed also increases the FA's ability to react to additional penetrations. Through DLR, FA units (which have been located to the flanks of the initial penetration) are echeloned in depth throughout adjacent zones. Through centralized control of his FA assets, the division commander can now bring the enemy under an ever-increasing volume of fire from these FA battalions with minimal displacement.

DLR must be an integral part of the division commander's decision to mass. It is a forceful and positive commitment of a significant portion of the division's combat power following a deliberate decision-making process. It requires a strong, integrated intelligence-gathering effort, an accurate and purposeful assessment of enemy intentions and a will to act decisively on the part of the division commander. Its execution must be aggressive and in concert with the movement of maneuver units at the critical time and place on the battlefield.

DLR Scenario

The concepts of DLR become more apparent when expanded through the following scenario. An armored division is preparing for defensive operations. The division's combat power has been augmented with the attachment of the headquarters troop and two armored cavalry squadrons from the corps armored cavalry regiment (ACR) and with the attachment of an FA group

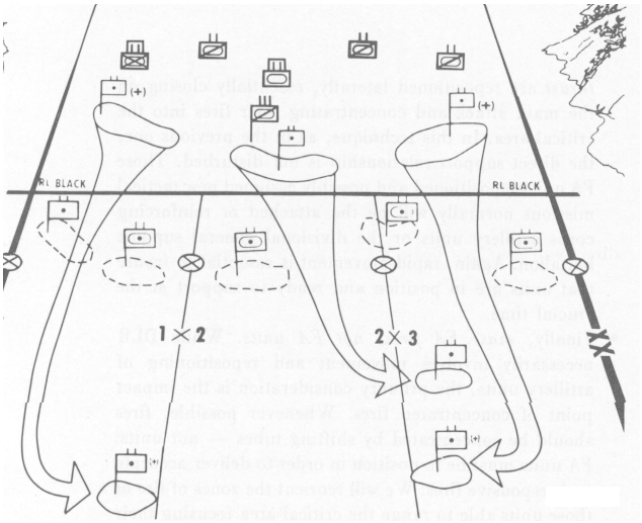


Figure 1.

consisting of a group headquarters and four cannon battalions (two 155-mm SP and two 8-inch SP).

Intelligence sources indicate that the division can expect to be engaged by elements of a combined arms army within 48 hours. Enemy first echelon divisions can be expected to follow current doctrine and advance along multiple routes, possibly in battalion columns. Extensive fire support will be provided by regimental and divisional artillery groups of two to four battalions of mixed caliber. Air defense weapons will be well forward to engage fixed and rotary wing aircraft. Second echelon divisions will exploit any successes achieved by the first echelon divisions.

The division commander decides that, due to the terrain and distances involved, the forward brigades will not be able to control adequately the fight in the CFA. He elects to employ a separate covering force under the control of the ACR headquarters. The covering force is heavy in combat power, consisting of two squadrons of the corps ACR, the divisional armored cavalry squadron, and a mechanized infantry task force from the first brigade and an armor task force from the second brigade (Figure 1).

The primary means of fire support for the covering force will be field artillery and organic mortars. Covering force artillery must be of representative caliber and at least as mobile as the force it supports. Since the covering force is not under the control of the forward brigades, the division artillery commander recommends that an FA group consisting of two 155-mm self-propelled battalions and one 8-inch self-propelled battalion be attached to the covering force. The group is comprised of three of the four corps artillery battalions habitually associated with the division. To achieve centralized management of assets, the two batteries organic to the ACR are detached from the squadrons and attached to the two 155 battalions of the group.

If the responsibility for the covering force had remained with the forward brigades, the fire support responsibilities for the covering force would remain with the direct support battalions supporting those brigades. Additional support would be provided through the assignment of reinforcing or general support-reinforcing missions to the other FA assets of the division.

Covering force artillery must be kept highly mobile. Only mission-essential equipment is taken forward. Headquarters and service battery personnel remain behind to prepare and harden primary positions to support the fight in the MBA. Movement into MBA positions will be by previously selected routes and will occur when the covering force withdraws behind Report Line (RL) BLACK and when the tactical situation warrants. Ammunition will not be offloaded in battery positions and mobile ammunition supply points will be established to support the covering force action.

Covering force artillery, positioned as far to the rear of the CFA as possible, will be able to range the zone of observation of the covering force. It serves no useful purpose to position FA units to fire on targets which cannot be acquired. Positioning to the rear of the CFA also provides the covering force with a longer period of uninterrupted support prior to initial displacement and facilitates a smooth transition into DLR.

FA units in the MBA are also preparing for the battle. Direct support battalions are located in forward supplementary positions in order to assume their fire support responsibilities when control of covering force units passes to their respective brigades. Division artillery has also located GS and GSR units forward in supplementary positions to increase the tempo of fire support during the change of control. As with the covering force artillery, only mission-essential equipment goes forward into the supplementary positions. Again, headquarters and service battery personnel are preparing or improving primary positions within the MBA in accordance with existing contingency plans. Ammunition is stockpiled and engineer support is requested as required. Division artillery coordinates those requests, forwarding them to division.

At 0400 the division makes contact with elements of two motorized rifle divisions. Enemy pressure is being applied along the entire division front. Covering force units have engaged the enemy from their initial battle positions and are fighting to the rear. Concentrated FA fires into the likely engagement areas have caused the enemy units to button-up and lose momentum. Supporting enemy infantry has been separated from its armor and several "mobility kills" have been reported (Figure 2).

Enemy units moving toward RL BLACK are brought under an ever-increasing volume of FA fire. Main battle area artillery located in forward supplementary positions

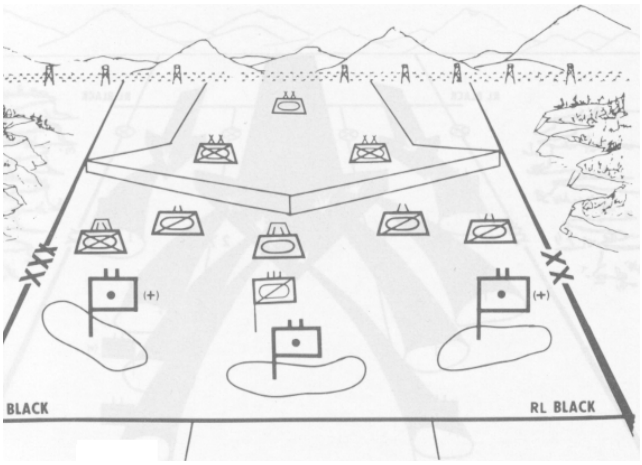


Figure 2.

augment the fires of the covering force artillery as the enemy moves within range. As the fight moves deeper into the CFA and maneuver units pass through RL BLACK, control of the covering force elements passes to the forward brigades. Direct support battalions assume the fire support responsibility for covering force units in their brigade zones as the covering force action continues.

The commander has monitored the aggressive action of the covering force and compared the progress of the battle with other sources of intelligence. He now determines the enemy's main thrust to be developing within the second brigade's zone of action. The decision to mass combat power is made, maneuver units begin to deploy and the field artillery begins to reposition.

As the MBA artillery assumes the fire support responsibilities for the covering force, covering force artillery begins displacing to positions within the MBA (Figure 3).

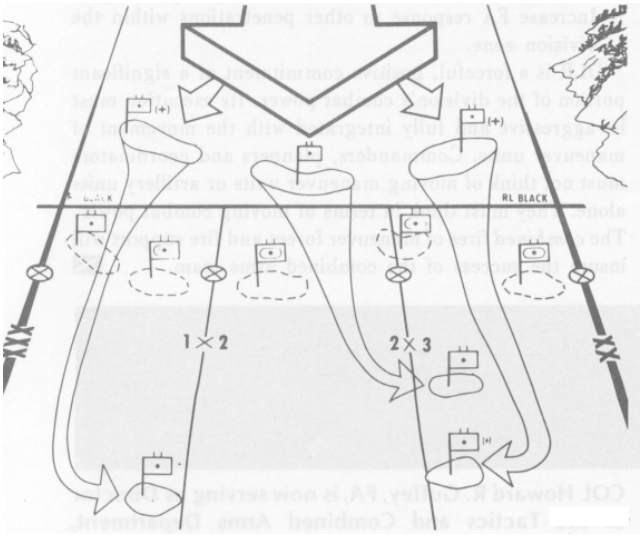
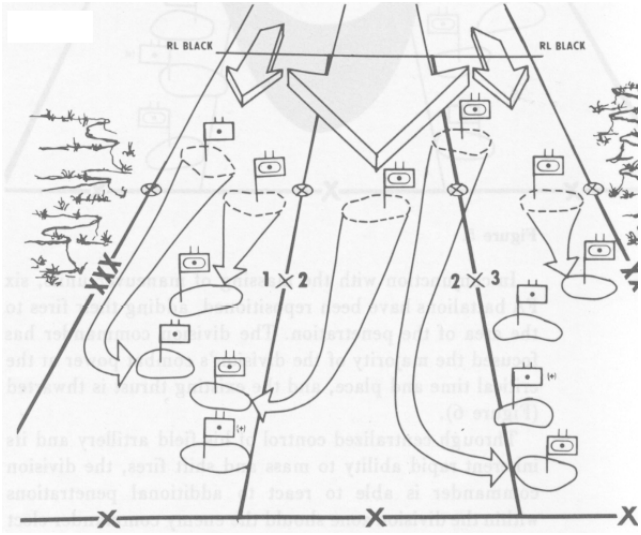


Figure 3.

They displace laterally and in depth to the flanks of the developing penetration, moving into previously hardened positions. Movement into these positions is closely coordinated through the div arty and division headquarters, insuring the maximum use of existing road networks and minimum interference between field artillery and maneuver units. The center and right FA units are able to move directly to their new positions by their prearranged routes. But, the situation in the first brigade's zone forced the leftmost battalion to stop and fire several missions prior to continuing to its final position. The three field artillery battalions from the covering force are reattached to div arty, assigned tactical missions and positioned to range the critical area.

MBA field artillery battalions located in the path of the enemy thrust rapidly reposition to the flanks of the penetration. This movement insures minimal displacement of these battalions and uninterrupted fires during the rearward movement of the fight. The fire support relationship between the direct support battalion and the second brigade has not been altered. The FA battalion commander has merely repositioned his fire units to insure continuous support (Figure 4).

Figure 4.



The direct support battalions with the first and third brigades are not in the area of the main thrust and do not need to be laterally repositioned. Each battalion will reposition as necessary to support its brigade to maintain the shoulders of the penetration. Under extreme circumstances it may be necessary to reposition part or all of these direct support battalions to add their fires to the area of the main attack. However, some capability must be retained in support of all frontline elements. In this case, the div arty commander repositions the GSR units

associated with the flank brigades, closer to the second brigade's zone. These units are still able to provide additional fires in support of the flank brigades while preparing to fire into the area of the main penetration.

The battle has progressed rearward into the MBA, producing a well-defined penetration in the second brigade's zone (Figure 5). The first and third brigades are successfully maintaining the shoulders of the penetration supported by their direct support artillery and other fire support agencies. Other maneuver units are massed in the second brigade's zone, engaging the enemy with a heavy volume of medium- and long-range direct fires.

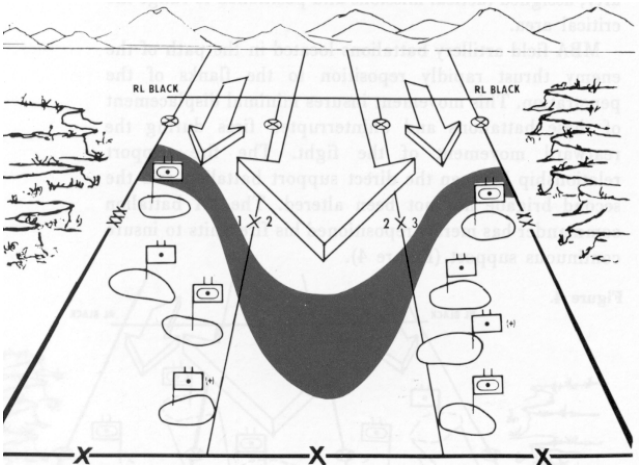


Figure 5.

In conjunction with the massing of maneuver units, six FA battalions have been repositioned, adding their fires to the area of the penetration. The division commander has focused the majority of the division's combat power at the critical time and place, and the existing thrust is thwarted (Figure 6).

Through centralized control of his field artillery and its inherent rapid ability to mass and shift fires, the division commander is able to react to additional penetrations within the division zone should the enemy commander elect to reinforce his efforts in either the first or third brigade

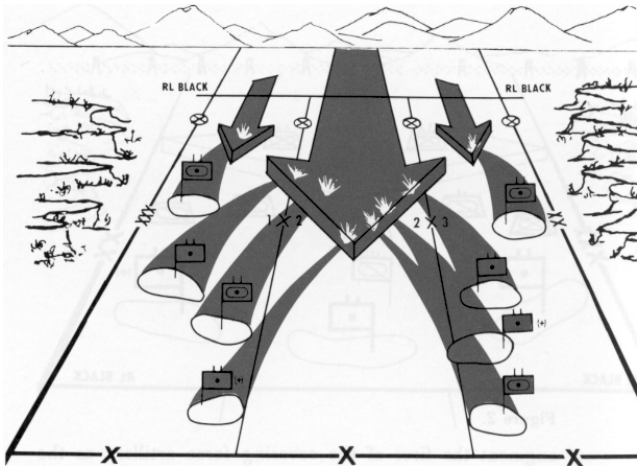


Figure 6.

areas. FA units located in depth and to the flanks of the initial penetration will be able to bring the second penetration under an ever-increasing volume of fire with minimal displacement.

All members of the combined arms team must contribute to the massing of combat power in order to insure success on the battlefield. The technique of DLR is an important factor in the combined arms effort to defeat the enemy. The concept of DLR is based on the ability of field artillery to mass and shift fires rapidly. When properly executed it will:

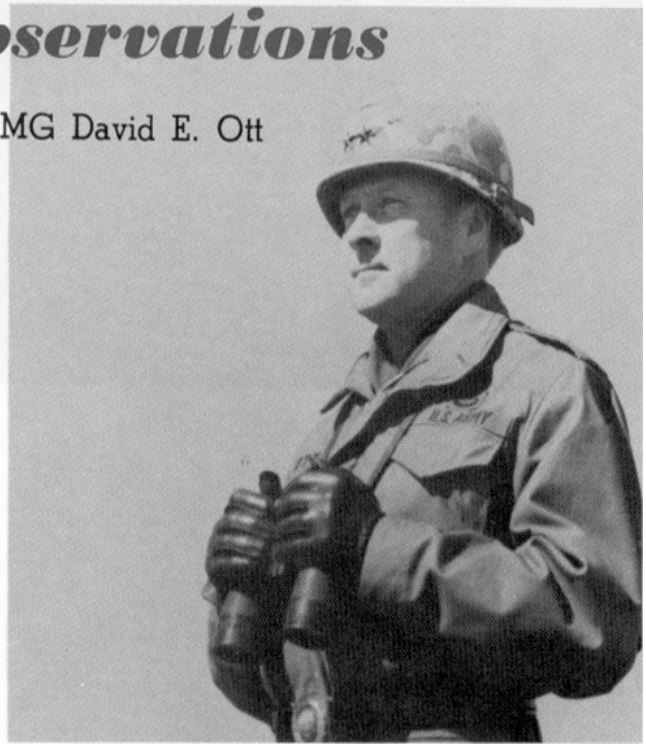
- Concentrate FA fires at the critical place on the battlefield.
- Insure continuous fire support at the critical time of the battle.
- Increase FA response to other penetrations within the division zone.

DLR is a forceful, positive commitment of a significant portion of the division's combat power. Its execution must be aggressive and fully integrated with the movement of maneuver units. Commanders, planners and coordinators must not think of moving maneuver units or artillery units alone. They must think in terms of moving combat power. The *combined* fires of maneuver forces and fire support will insure the success of the combined arms team.

COL Howard R. Guffey, FA, is now serving as Director of the Tactics and Combined Arms Department, USAFAS.

forward observations

MG David E. Ott



One aspect of unit training that has been receiving increased emphasis here at the School, as well as within FA units, is the addition of realism. To paraphrase the old athletic adage, you fight like you train. Realism was one of the factors uppermost in our minds in the development and testing of the ARTEP, and it was one of the driving forces behind the design of the in-bore mount for the 14.5-mm M31 trainer. An excellent recent example of increased realism by field units is the design of the AN/MPQ4A trainer (see July-August 1975 *Journal* by SFC John Oetting and CW2 William Harmon of the Missouri National Guard.

It has been my opinion for some time that a particularly frustrating deterrent to realistic field firing is the problem of safety. We have all seen an eager and aggressive forward observer utilize every trick of the trade to get adjusting rounds on target rapidly — only to have to wait an interminable length of time to see his fire-for-effect. The same frustration is evident in the firing battery; gun crews move with alacrity to follow all fire commands and then take a five-minute break in place while the harried safety officer hustles from weapon to weapon. These extremely unrealistic conditions begged alleviation.

To this end, last June I commissioned an *ad hoc* committee to study safety officer procedures with the guidance to determine which procedures promoted the safe firing of field artillery and, at the same time, which procedures reduced combat realism. The committee included officers of all ranks from battery executive officers through battalion commanders, as well as representatives from the School's Weapons and Gunnery Departments.

The result of the study has been a complete revision to the Fort Sill Range Regulations, which I have directed be disseminated to all FA units (battalion and above) for information and consideration. Units should have begun receiving the new safety regulation after 1 April.

Without stealing the thunder from LTC Jon Porter's article in this issue on the new regulation, I would like to mention a few of the key revisions. First of all, **none** of the independent safety checks we are all familiar with have been eliminated. What we did was to modify the requirement that the safety officer have no other duties. We have placed the responsibility for safety, in fact, where it has always been — within the chain of command, i.e., the section chief, chief of firing battery, executive officer, etc. Thus, we have eliminated the safety officer *per se.*

The other key aspect of the revised regulations I would like to stress is the requirement for major subordinate commanders to certify the competency of all individuals performing safety duties. In the past, we mainly have been concerned with certifying each new lieutenant as he came into the unit. Commanders will now need to address the question of qualifying their noncommissioned officers. We are continuing to study this certification and any comments or questions in this vein may be addressed to the Directorate of Plans and Training, USAFACFS, Fort Sill, OK, 73503. We welcome them.

In addition to reducing the unrealistic safety delay and more closely approaching actual combat conditions, there are some side benefits to the revised regulations. We are giving the chief of section complete authority over his weapon and crew, undiluted by the presence of a safety officer outside of the chain of command. This will result in an increase in the competence of our NCOs and, I suspect, an increase in their confidence as well.

I am sure Redlegs at all levels will agree with this emphasis on realistic training. The canned shoot, CPX or exercise must become a relic of the past, along with the yellow-helmeted safety officer, if we are to properly prepare today's soldiers for tomorrow's battle.

The Vanishing Yellow Helmet

by LTC Jon Porter

The gold-barred, yellow-helmeted safety officer, so familiar to field artillerymen has disappeared from Fort Sill's artillery ranges.

Rather than causing remorse, the disappearance of the safety officer has been cheerfully accepted by members of Fort Sill's Field Artillery community, particularly by the junior officers and noncommissioned officers who were destined to serve as safety officers/NCOs. Commanders are particularly joyful. Firing units are now realizing improved opportunities for speedier, more realistic training during live-fire exercises. They are no longer confronted by training delays caused by some of the safety officer's functions, even though none of the independent safety checks previously required have been eliminated. These safety checks are now performed by members of the unit chain of command as part of their normal responsibilities during firing exercises. This shift of safety responsibilities started with an intense desire at Fort Sill for more combat realism in field artillery training and was implemented only after careful consideration and study.

The FA community recognized that recent developments in field artillery tactics and techniques (designed to improve the timeliness and responsiveness of field artillery fires) created a demand for similar developments in training techniques. For the artilleryman to realize how swiftly artillery fires must be delivered on the modern battlefield, his training must approximate combat as nearly as possible. During training he must be allowed to perform his

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duties just as he would in combat. Speed in firing and speed of movement must become second nature to him. Any delays in training which detract from combat realism must be minimized or eliminated.

In June 1975, MG David E. Ott, Commander, US Army Field Artillery Center and Fort Sill, appointed an *ad hoc* committee to study safety officer procedures. The committee was to determine which procedures were necessary to insure continued safe artillery firing, while minimizing the degrading effect safety procedures have on combat realism in training, and whether current safety regulations were too restrictive. The committee was composed of a cross section of battalion commanders, battalion S3s, battery commanders and battery executive officers (XOs) from III Corps Artillery and the US Army Field Artillery Training Center (USAFATC), plus representatives from the Field Artillery School's (USAFAS) Weapons and Gunnery Departments.

The committee's deliberations and discussions resulted in several important recommendations:

- The requirement that safety personnel have no other duties assigned while acting in a safety capacity should be eliminated.
- The independent safety checks previously required of the safety officer should be performed by members of the chain of command commensurate with their duty positions.
- The chief of section (C/Sec) of each weapon should be responsible for all safety checks on his weapon and his section's ammunition, provided he is certified by the command as competent to perform these safety checks.
- The battery XO and/or the chief of firing battery (C/FB) should be responsible for general safety checks of the battery during firing and assist the officer-in-charge (OIC) with prefire checks.
- The OIC should remain responsible for establishing the overall safety system within the firing unit.
- The chain of command should be responsible for command certification of competency of personnel required to perform safety checks.
- At least one commissioned officer should be present in each firing position during firing.

The committee recommended that **none** of the independent safety checks previously required be eliminated. The only provision eliminated was the requirement that safety personnel have no other assigned duties when acting in a safety capacity.

Fort Sill's Range Regulation (USAFACFS Reg 385-1, Post Range Regulation) has been revised to incorporate the committee's recommendations. The entire regulation has been rewritten, and it will be distributed for information to US Army Field Artillery units worldwide.

The Firing Safety Section, Section IV of USAFACFS Reg 385-1, which includes the changes recommended by the *ad hoc* committee, has already been published as an interim change and was distributed to Fort Sill units in December 1975. Some of the major provisions in the interim change are furnished here for information and possible incorporation into units' range safety procedures. The Fort Sill safety regulation is written for all field artillery units training at Fort Sill, including Active Army and Reserve units conducting unit training, units of the USAFATC conducting individual training for new soldiers and units firing in support of USAFAS exercises; however, in some instances, the provisions of the regulation are general in nature so as to apply to all categories. A safety regulation written for a particular unit could probably be more specific in some areas.

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Some of the more important aspects of the revised regulation follow:

- Each commander/department director conducting or supporting an exercise or problem on the Fort Sill Military Reservation designates a commissioned officer as the OIC. The OIC has overall responsibility for his exercise or problem. Depending on the size and scope of the exercise, the OIC may also assume the duties of a position commander (Pos Cdr). For USAFAS exercises there are usually two designated OICs:
- The **instructor officer-in-charge** (IOIC) is the designated commissioned officer assigned to USAFAS who has responsibility for the general conduct of the exercise. Except for insuring that each Pos Cdr participating in the exercise is certified by the appropriate commander as qualified, the IOIC will usually have no responsibilities associated with firing safety unless he is simultaneously performing functions in the firing unit chain of command; e.g., dire direction officer (FDO) during fire direction center (FDC) training.
- The **standard troop requirement officer-in-charge** (STROIC) is the designated commissioned officer assigned to the unit which has been specified as the primary support unit for a given USAFAS exercise who has responsibility for all actions of personnel of the support unit, to include those associated with firing safety. The STROIC is also responsible for insuring that all actions taken by the support unit in response to the directions of the IOIC are not in contravention of applicable safety regulations and policies.

The definitions of IOIC and STROIC apply to Fort Sill. These individuals may not have exact counterparts in other organizations.

The Pos Cdr is the designated commissioned OIC of all activities at a particular firing point and is responsible for all firing safety aspects associated with those activities. A Pos Cdr is required for each position requiring a separate safety card.

The chain of command to which the Pos Cdr is assigned has complete responsibility for all aspects of firing and firing safety. Each commander is responsible to insure that personnel who are participating in firing problems and exercises are properly trained and supervised as specified in the safety regulation.

Appropriate commanders/department directors insure that the positions of OIC and Pos Cdr are firmly established before the firing exercises. The commander/department director must insure that appropriate assignments are made based on his training requirements. Examples of combinations of responsibility follow:

Type of Exercise	**OIC**	**Pos Cdr**
Field training exercise	Bn Cdr	Btry Cdr
Operational readiness training test	Chief Umpire	Btry Umpire

For a detailed breakdown of primary and supervisory responsibility, see Table 1.

Major subordinate commanders are responsible for establishing procedures for qualifying and certifying all personnel within their commands who are required to perform safety duties. Certification procedures must include, as a minimum, a comprehensive proficiency test covering those safety duties the individual will be required to perform.

The procedures for certifying the competency of individuals performing safety duties are very important aspects contributing to the unit commander's increased responsibilities under the safety regulation. The detailed procedures are the responsibility of major subordinate commanders and are not included in the regulation.

The commissioned officer present in each firing position requiring a separate range safety card is the Pos Cdr. Depending on the size and scope of the firing exercise or problem, the Pos Cdr may also be the OIC. The Pos Cdr is normally the commander of the unit firing, but, during training tests, the chief umpire or his appointed representative becomes the Pos Cdr.

During firing in support of USAFAS instruction, the Pos Cdr coordinates all aspects of the School problem with the instructor being supported. In those instances when USAFAS instructor personnel replace the unit chain of command, a designated officer instructor becomes the Pos Cdr and assumes all safety responsibilities associated with that title.

The Pos Cdr's next higher commander must insure that the Pos Cdr is properly instructed in his safety responsibilities and is certified as qualified. Generally, the Pos Cdr's responsibilities include:

- Coordinating with the range officer (Rg Off) to obtain or verify the proper, authorized firing position and impact area.
- Establishing an overall safety system within the firing position.
- Insuring that personnel required to perform safety checks are competent, properly briefed on their duties and command-certified by their parent units.
- Insuring rigid compliance with the safety regulation and common sense safety rules and practices.

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Before departing for the range, the Pos Cdr will insure that the following references and items of equipment are available for use in the firing position for safety purposes:

- USAFACFS Regulation 385-1 with current changes.
- Authorized range safety card.
- Applicable tabular firing table.
- Applicable graphical firing table.
- Applicable graphical site table.
- Map of the area.
- A second properly functioning and declinated aiming circle.
- A serviceable gunner's quadrant.

Before firing begins, the Pos Cdr is required to accomplish the following tasks:

- Verify that the range safety card applies to his unit, exercise and date and confirm any pen-and-ink changes with the range office.
- Prepare the safety diagram. The Pos Cdr must have copies of all range safety cards and safety diagrams applicable to the firing for which he is responsible. All other personnel performing safety duties will have copies of appropriate safety diagrams. The accuracy of safety diagrams must be verified by independent computations.
- Verify that all personnel responsible for safety checks are command-certified and have the appropriate safety diagram.
- Verify that the battery/launcher is in the position specified on the range safety card.
- Verify the lay of the battery/launcher to within one mil variation from parallel by magnetic needle, using a properly declinated second aiming circle. Because of magnetic variation, a maximum variation of plus or minus 10 mils will be allowed between the second aiming circle and the circle used for initial lay.
- Verify that the referred deflection used to compute the safety diagram is being used by all sections and the FDC.
- Verify that the FDC has the range safety card data drawn on the firing chart.
- Verify that range clearance has been obtained from range control.

Before firing begins, the Pos Cdr will also insure that the following actions are properly accomplished. He may be assisted in these tasks by qualified command-certified members of the chain of command, such as the battery XO, FDO or C/FB.

- Verify the proper positioning of the aiming posts, collimator or aiming point in reference to the referred deflection by sighting through the weapon sight.
- Verify boresight of each weapon after each change of firing position.
- Verify the sight settings (to include slipping azimuth scale) and placement of any safety stakes or safety tapes/chalk marks (self-propelled weapons).
- Verify minimum quadrant elevation (QE) determined by the XO/firing platoon commander. Compare the XO's minimum QE with the QE for the minimum range from the range safety card, using the larger of the two as the safe minimum QE.
- Verify that ammunition to be fired is the type specified on the range safety card.
- Verify that the visible portion of applicable danger areas are clear of personnel (check with the forward observer). Insure that firing does not commence until rounds can be observed visually from manned observation posts or electronically with reliable radar.

During firing, the Pos Cdr, assisted by the command-certified battery XO, FDO and C/FB will:

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- Report accidents, malfunctions, erratic firings and violations of range regulations immediately to the appropriate next higher commander and to range control.
- Visually check for parallel laying.
- Closely supervise the safe firing of the battery, to include proper performance of safety duties by all personnel and elimination of unsafe conditions. Examples of unsafe conditions are:
- Safety features of weapon not operative.
- Powder bags exposed to fire.
- Personnel smoking near pieces.
- Improper handling of ammunition.
- Time fuzes previously set and not reset to SAFE.
- With separate-loading ammunition, primer inserted before breech is closed.
- Failure of cannoneer to inspect powder chamber and bore after each round fired.
- Failure to swab powder chamber after each round fired from weapons using separate-loading ammunition.
- Failure to level bubbles.
- Failure to listen to fire commands and readbacks.
- Failure to properly apply registration corrections to appropriate safety diagrams.

The Pos Cdr will designate a command-certified officer or NCO to be responsible for the safety duties of the C/Sec for sections led by an uncertified C/Sec. If no command-certified individual is available to assume the safety responsibilities of a particular section, that section may follow all commands but may not actually cut charges, set fuzes or fire rounds. Such sections may only "dry fire."

The Pos Cdr may also perform the functions required of the battery XO, FDO, C/FB or C/Sec when the size and scope of the exercise or problem is such that he can accomplish these tasks and still assure safety. While live firing is in progress, the Pos Cdr's duties will be limited to those he can perform without leaving the firing position.

Battery personnel also perform important firing safety functions:

- The battery XO and C/FB are responsible for the general safety practices of the firing battery and for the professional competence of their personnel.
- The C/Sec is responsible for all safety checks required within his section to include checks of the weapon and ammunition, provided he is command-certified as being qualified to perform these checks. The safety responsibilities of the C/Sec are transferred to any command-certified officer/NCO who temporarily assumes the duties of the C/Sec.

During firing, the command-certified C/Sec, supervised by the Pos Cdr, Btry XO or C/FB, will:

- Insure that his section fires only serviceable rounds of authorized ammunition. If he has any doubt whether a particular type round is authorized, he will check with the Pos Cdr before allowing the type round in question to be loaded and fired.
- Insure that his section fires only the proper, safe charge as reflected in his safety diagram. He will insure that the proper charge increments for each type round are present before the round is prepared for firing. Once the round is prepared, he will insure that the correct number and type of remaining charge increments are held up to the rear of the pieces and visually counted before firing. For mortar rounds, the remaining charge increments must be physically counted and verified as correct before each round is fired.
- Insure that rounds are not fired below minimum QE or above maximum QE, outside lateral safe deflection limits or with fuze settings below minimum time, as specified on his safety diagram.
- For all commands which are unsafe to fire, command UNSAFE TO FIRE and give all reasons.
- Accept final responsibility for safety of weapon settings and crew prior to command FIRE.
- Command CHECK FIRING if he observes any unsafe conditions, report these conditions to the chain of command and suspend firing until the unsafe conditions are corrected.

The FDO will insure that the safety limits specified on the range safety card are properly plotted on the firing charts and that only safe fire commands are transmitted to the firing sections. The FDO will be designated by the IOIC when USAFAS personnel are either immediately supervising or accomplishing fire direction computations and may be either a commissioned or a noncommissioned officer. Further, he will:

- Verify and apply registration corrections to appropriate safety diagrams, to include those held by other individuals performing safety duties within the firing position.
- Exercise special caution in special situations. If deflection differences or special corrections are sent to the firing sections, he must insure that for each section the total of the announced deflection and the deflection on the gunner's aid will be within lateral safety limits. This applies to quadrant corrections and range limits as well.

In addition to the safety responsibilities outlined, other aspects of range safety that severely limit a unit's capability to provide realistic combat training are the restrictions applied to "Surface Danger Area E." Fort Sill's current interim change to the safety regulation still includes these provisions:

- The Surface Danger Area E for all cannon firing indirect fire is that area immediately in front of the piece bounded by the deflection limits expanded right and left by 445 mils and extending forward by 300 meters for a

105-mm howitzer, 350 meters for a 155-mm or 8-inch howitzer and 450 meters for a 175-mm gun.

- During firing, personnel or vehicles will **not** be permitted inside Area E unless they are inside a concrete dugout. Access to roads passing through Area E must be controlled by the firing unit. Road guards must be able to communicate with the fire control element of their unit. Traffic on improved roads (paved or gravel) cannot be stopped longer than five minutes at a time.

Obviously, these provisions make it impossible to employ tactical formations, such as the diamond, star or circle, and severely limit terrain positioning. This tends to remove the "tactical" from tactical training. For this reason, when Fort Sill's revised range regulation is published, it should also include this additional proposed provision (now being staffed) covering unit training:

- Only during the conduct of unit training using position areas in tactical configurations (such as terrain positioning, box, circular, star, etc.) may personnel be inside Area E during firing. These personnel will be limited to gun crews and the minimum number of people required to lay the weapons, complete ammunition preparations or perform safety functions. Commanders are responsible for insuring that personnel inside Area E adhere strictly to the hearing conservation provisions of USAFACFS Regulation 40-557-1.

The changes in safety procedures have advantages other than those associated with improved combat realism in training. The disappearance of the safety officer means the commander is no longer constantly borrowing and lending people to keep the safety requirements covered. More important, the shifts in safety responsibilities underscore the conficence the US Army Field Artillery places in its junior officers and noncommissioned officers.

Other organizations may have already taken similar steps in safety procedures to improve training. If that is the case, Fort Sill would like to hear about it. Questions or comments on any portion of the revisions discussed may be addressed to Commander, USAFACFS, ATTN: ATZR-DPTRA, Fort Sill, OK, 73503.

Table 1 — Primary and Supervisory Responsibility for Firing Safety

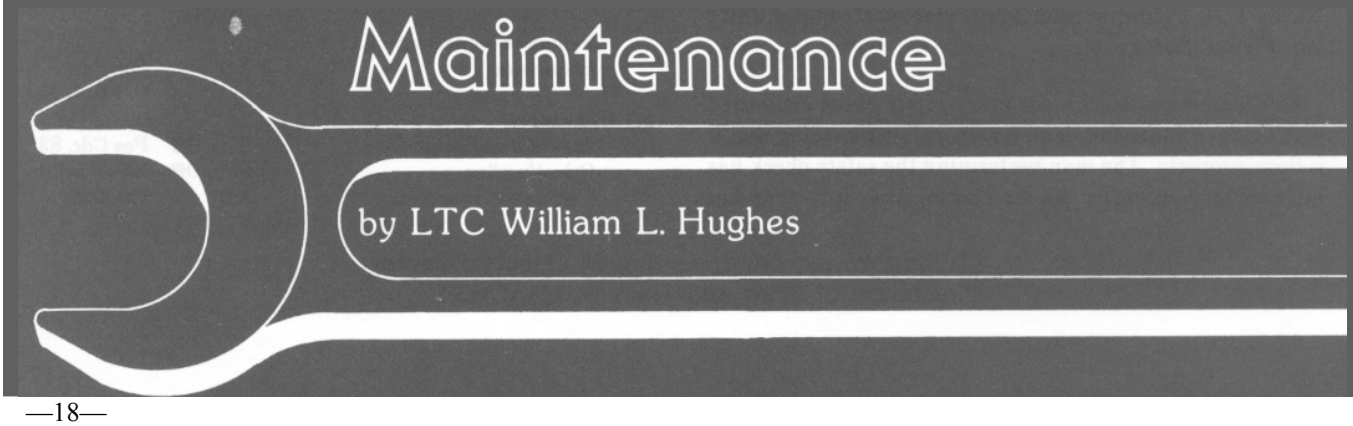
One man is responsible for every *safety check* connected with firing, and another man is responsible for seeing that it is done properly. The man performing the safety check has *primary responsibility*; the man seeing that it is done has *supervisory responsibility.* In practically all cases, the supervisory responsibility rests with the chain of command. If any unsafe acts are committed, naturally the severity of any disciplinary action taken against those responsible depends on the unsafe act, the circumstances and the responsibility (primary or supervisory) of the individuals involved.

The following list indicates who has primary or supervisory responsibility for preventing an unsafe act, resulting in a round being fired out of safety. The list is not all encompassing but is detailed enough to indicate clearly what type firing safety responsibilities rest at which level in the chain of command.

	Responsibility	
Unsafe Act	***Primary***	***Supervisory***
1) Unsafe deflection set by gunner and fired by C/Sec.	**C/Sec**	
2) Unsafe QE set by asst gunner and fired by C/Sec.	**C/Sec**	
3) Unsafe fuze setting set by cannoneer and fired by C/Sec.	**C/Sec**	
4) Wrong charge cut by cannoneer and fired by C/Sec.	**C/Sec**	**C/FB, XO**
5) Improper boresight by gunner.	**C/Sec**	**C/FB, XO**
6) Counter reset or slipping azimuth scale error by gunner.	**C/Sec**	**C/FB, XO, Pos Cdr**
7) Preparation or handling of ammo, resulting in damage to personnel or equipment.	**C/Sec**	**C/FB, XO, Pos Cdr**
8) Weapon deficiencies:		
Bad ram.		
Bad recoil mechanism.		
Bad sights.	**C/Sec**	**C/FB, XO**
9) Unsafe data sent by FDC, set by howitzer crew and fired by C/Sec.	**Btry FDO**	**C/Sec, C/FB, XO**
10) Incorrect laying of weapon.	**XO**	**Pos Cdr**
11) Intervening crest (XO min QE).	**XO**	**C/Sec, Pos Cdr**
12) Incorrect range safety card.	**Rg Off**	**Rg Off**
13) Incorrect safety diagram.	**Pos Cdr**	**Off/NCO performing independent computation**
14) Wrong firing point.	**Pos Cdr**	**XO**
15) Unauthorized ammo.	**XO**	**Pos Cdr, C/FB, C/Sec**
16) Suspended lot of ammo:		
Failure to properly notify units.	**Ammo Sup Off (DIO)**	
Failure to implement suspension.	**XO**	**Pos Cdr, C/FB, C/Sec**
17) Bad survey:		
Grid of firing point.	**Surv Off**	**Pos Cdr, S3**
Orienting line.	**Surv Off**	**XO, Pos Cdr, S3**
Declination constant.	**XO**	**Pos Cdr**

LTC Jon Porter, FA, is serving as Deputy Director, Directorate of Plans and Training, USAFACFS.

Mobility *Versus* Maintenance



by LTC William L. Hughes

In the history of warfare, man continually has striven to improve the mobility of his forces. Even a cursory review of the evolution of military forces quickly would substantiate this. Though the trend toward mobility has been an evolutionary process, the rate of change has been an ever increasing one. In recent years it has become readily apparent that mobility has served as a milestone for measuring progress in the Army.

The field artilleryman has become more acutely aware of the requirements for increased mobility. Initially, the emphasis in this area was directed toward the "ground gaining arms"; however, soon it was realized that the supporting artillery must have equal mobility. Additionally, since the maneuver units must have cross-country mobility to accomplish assigned missions, the artillery must also adapt equipment and techniques to provide similar capabilities. Heavy dependence toward mechanized forces is not unique to the United States; in fact, the stimulus for our movement in this direction can be related easily to the Soviets and their satellites. These countries long have measured combat power in terms of mechanized forces and their supporting artillery. As the Soviets have modernized their maneuver elements through mechanization, there has been a similar movement toward self-propelled artillery.

Since the advent of self-propelled artillery, the field artillery commander has been placed in a dilemma. Provided with a weapons system that will furnish the mobility necessary to support the armored or mechanized infantry units, he also has inherited a previously unexperienced problem — the magnitude of the maintenance requirements associated with self-propelled weapons. Additionally, no longer does the option exist of "manhandling" a weapon into position or rapidly changing prime movers if a mechanical failure occurs. It is from these thoughts that the title "Mobility Versus Maintenance" was drawn.

Today, faced with an austere defense budget and manpower limitations, the title takes on added importance. Not only is the unit commander challenged to maintain his artillery pieces and supporting equipment in a high state of operational readiness, but he also must accomplish this with very limited funds and personnel. Based on these considerations, the mobility versus maintenance dilemma becomes even more complicated.

The newly assigned commander of an artillery battalion stationed in Germany may find he has been allocated as little at $35,000 with which to operate his battalion for a full quarter. This $35,000 must offset the cost of all logistical expenditures. The major expenditures which must be provided from these funds are the cost for all POL products, repair parts, self-service supply items and installation property. Even the newly assigned commander recognizes immediately that he is faced with a tremendous management problem. It is apparent that if the commander is to successfully counter the mobility versus maintenance dilemma he must become a resourceful manager.

The commander previously has been briefed that during the quarter his battalion will move to the Grafenwoehr training area for 35 days of preparation for a battalion Operational Readiness Training Test (ORTT). This is a major event which will measure thoroughly the unit's ability to displace rapidly on short notice. A quick review of the logistical records revealed that on previous battalion training exercises at Grafenwoehr the cost of POL alone had run as high as $14,000. There was no doubt that the new commander soon would get his introduction to the mobility versus maintenance dilemma in the European environment.

To further complicate the battalion commander's financial problem, a recent inspection by the Corps Maintenance Evaluation Team had determined that a high number of the battalion's M548 cargo tractors and M577 command vehicles were nonoperational due to cracked track shoes. A rapid assessment indicated that it would cost approximately $13,000 to replace the track. The inspection revealed other deficiencies which caused the commander to

have serious doubts about the effectiveness of the maintenance program within his new command.

In facing this initial problem, the commander consulted his S4 to determine the best course of action to improve the track vehicle status within the battalion. There would be insufficient funds to purchase new track and still meet the numerous additional funding requirements resulting from the training exercise, and there was no definite indication as to when new track could be made available from the supporting supply facility.

Instilled with the intense desire to have all the equipment in a combat-ready status and faced with the rapidly approaching date for the departure to Grafenwoehr, the commander sought feasible solutions to the problems. Research of a technical manual revealed that some of the track shoes could be repaired by welding; however, most had to be replaced.

As a last resort, the possibility of locating serviceable track at the local property disposal activity was considered. A 10-minute drive to the disposal activity, with the battalion maintenance technician, resulted in the solution to the track problem — there was a large quantity of track. With the assistance of a technical representative from the unit's supporting maintenance battalion, the track was confirmed to be in a serviceable condition. After laborious hours of selecting and replacing track shoes, the commander's first maintenance crisis was solved. He was ready now to move the battalion to Grafenwoehr and face the next challenge — that of proving that the unit was combat-ready.

The next 35 days proved to be one big frustrating experience. The commander saw numerous areas that needed significant improvement.

Though the battalion struggled at times, it was able to complete the ORTT and was awarded a combat-ready rating. The commander was elated with the successful completion of the first major event after his assumption of command; however, he was appalled at the numerous equipment failures during the training period. It was apparent that the unit had problems in its maintenance program.

After returning from Grafenwoehr, the commander began an analysis of the maintenance problems. One of the very apparent deficiencies was a personnel shortage. A comparison of the authorized and assigned maintenance personnel indicated that the unit was operating at 60 percent strength. Of the 12 noncommissioned officers authorized in the maintenance sections, only five were assigned. The personnel situation, coupled with the severe limitation of funds, hardly produced an ideal environment for an effective maintenance program. However, the unit had an outstanding maintenance facility — large enough to house all battery maintenance sections and the battalion maintenance section and equipment.

In seeking assistance on the personnel situation, the battalion commander received little hope for relief in the near future. The corps adjutant general section stated that a shortage of maintenance personnel existed throughout the corps and, when personnel became available, the first priority would go to other units.

Realizing that outside support was not going to be available, the commander considered ways to use more effectively the maintenance personnel currently assigned. He also began to consider a long-term solution. Drawing on his previous experience and that of his officers and noncommissioned officers, the commander decided to centralize maintenance at the battalion level.

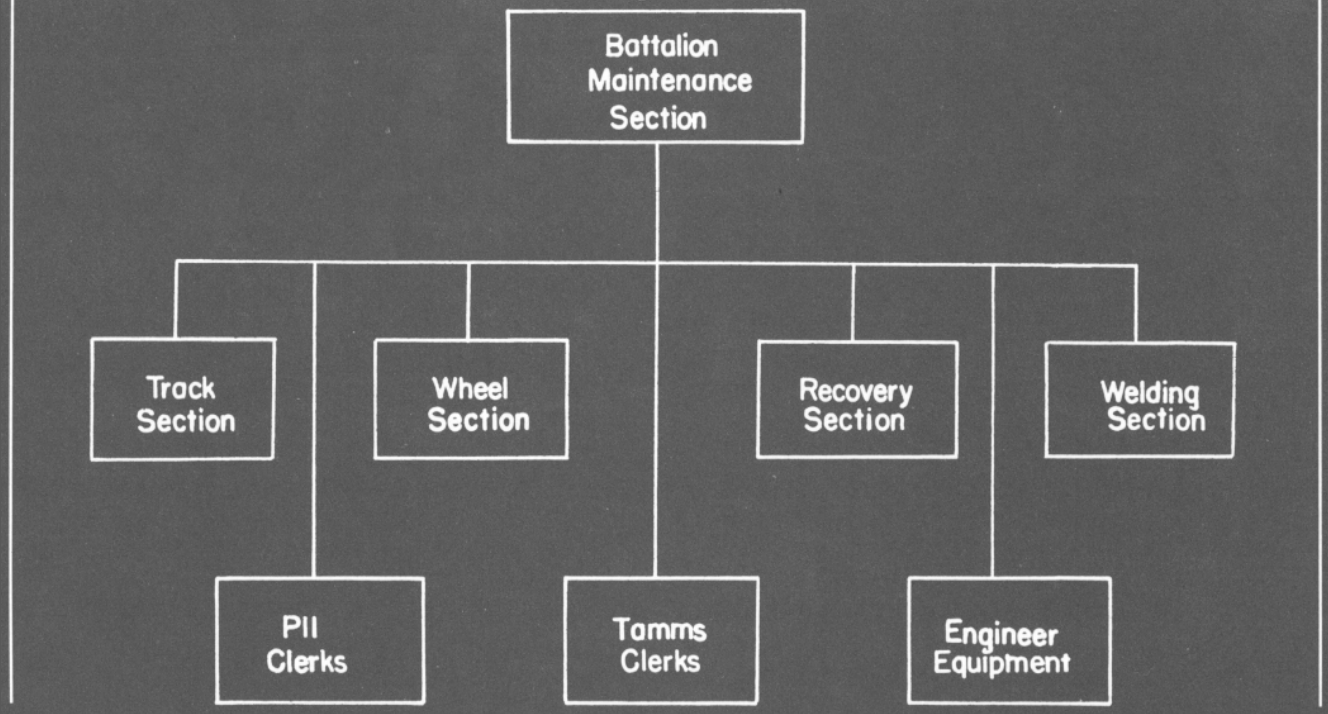
This plan called for maintenance personnel to be consolidated under the direct control of the battalion motor officer and his maintenance technician. In the centralized maintenance concept, the section would be organized along functional lines as depicted in figure 1.

Each of the functional areas would be placed under the control of the best technically qualified noncommissioned officer or specialist in that specific area. These section leaders would be supervised by the battalion motor sergeant.

This organization would provide a much more efficient management tool. With the critical shortage of NCOs, the span of control would be shortened and a more judicious use of leadership personnel could be realized. Additionally, it was recognized that one of the most important advantages of centralizing maintenance was that it would facilitate training the less skilled and qualified personnel.

As an adjunct to the newly organized maintenance program, the battery commanders were required to screen their personnel for individuals who could be placed in on-the-job (OJT) training programs to fill the maintenance personnel shortages. As these individuals were identified, they were placed into either the wheel or track vehicle section under the supervision of a skilled mechanic and began an official OJT program.

Figure 1.



Concurrently, the S3 sought and received allocations for personnel in the OJT program to attend a formal training course for either wheel or track vehicle mechanics. These courses were taught at the Seventh Army Training Center. It was noted that those who participated in the OJT program and then attended the formal mechanic's course were very effective in their assigned jobs and very easily acquired secondary MOSs.

Significant improvements had been realized in the maintenance program. As a final measure, the commander requested that his unit be afforded a visit by the corps Maintenance Assistance and Instruction Team (MAIT). He specifically requested that the team orient the program of instruction toward daily maintenance responsibilities of the drivers and crews. Special emphasis was to be placed on the need to involve everyone in the maintenance program. The request was honored, and the MAIT team provided the battalion an eight-day comprehensive program of instruction on all aspects of maintenance.

With the new focus on maintenance, the commander saw a continuous improvement in the overall maintenance posture and operational readiness condition of the unit.

Though he had not totally solved the mobility versus maintenance dilemma, he certainly was much more confident that if he were called upon to perform his combat mission his unit would respond well. The self-propelled artillerymen would be there with the necessary mobility to provide the accurate and timely fires required by the maneuver units.

This example may seem flavored with extracts from a contrived case study used at one of the service schools. Unfortunately, the material was drawn from a real-life situation. The intent is to illustrate some of the challenges facing today's commander. Hopefully several worthwhile deductions can be drawn: It is apparent that maintenance is more important today than ever before and, with the shrinking defense dollar and manpower limitations, the commander, at all levels, must be a more skilled and resourceful manager than ever before.

No longer can we be stereotyped in our approach; we must look for innovative means to solve problems such as the mobility versus maintenance dilemma — effectively and efficiently.

LTC William L. Hughes, FA, is now serving as Commander of the 2d Battalion, 75th Field Artillery, 41st Field Artillery Group.

Polynesian Redlegs

SCHOFIELD BARRACKS, HI — The *Hiki No* or "Can Do" spirit prevailed as the Polynesian Redlegs of the 1st Battalion, 487th Field Artillery (Hawaii National Guard) met and surpassed the standards of the recent ARTEP administered by the 25th Infantry Division Artillery.

The exercise emphasized realism through the utilization of Soviet vehicular mock-ups, crater models for crater analysis and live mortar fire for counterfire evaluation. The test also required the actual demonstration (versus verbal explanation) of standard operational procedures.

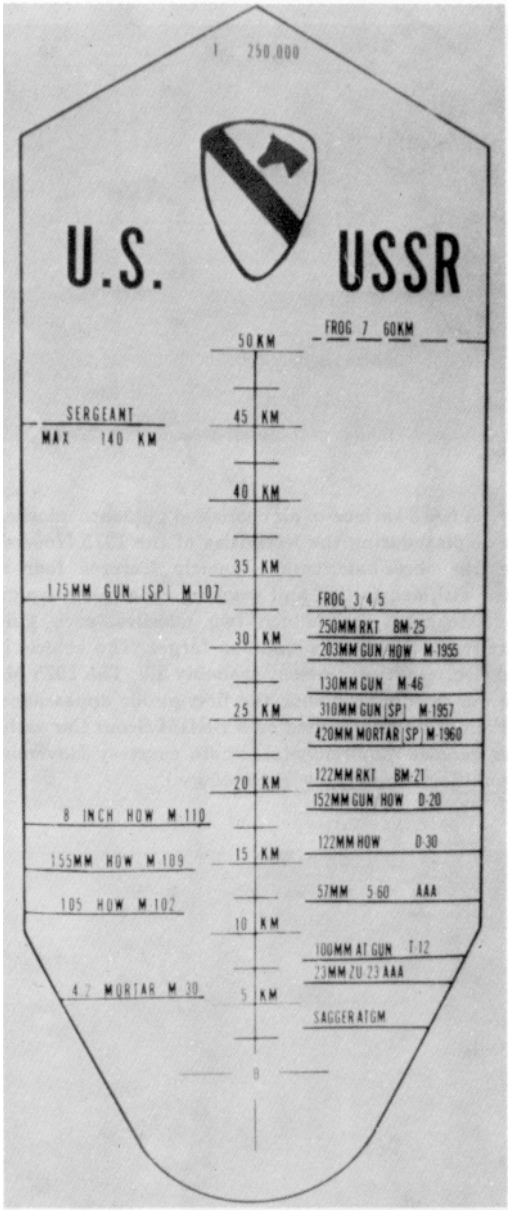
The realistic theme of the exercise was highlighted when a service battery soldier was exposed to small arms fire in the firing battery area. Judged and designated a casualty, the unit was evaluated on first aid and medevac procedures. A helicopter from the div arty aviation section responded to the medevac request and within minutes the soldier experienced his first helicopter ride. On return to the Administrative Control Area, the casualty was "revived," issued a set of orders and returned forward as a replacement. Subsequent orientation and administrative processing procedures were closely examined.

The *Hiki No* battalion excelled in all ARTEP phases to include a superior performance on the firing range — expected behavior for such a highly-motivated unit.

Templates Minimize Craters

FORT HOOD — Those unsightly enemy shell craters around the mess tent can now be minimized through the use of a series of Artillery Range Templates recently developed by the 1st Cav's G2 Operations Section. Printed on strips of thin, transparent plastic, the overlays provide a means of computing enemy artillery ranges and coverages in conjunction with analyses of enemy artillery unit disposition and firing capabilities. The templates also include comparative listings of US weapons and capabilities.

The Fort Hood TASO fabricated the templates to be compatible with 1:50,000 and 1:250,000 maps. The center of the scale is a line graduated at 500 meters (1:50,000) or

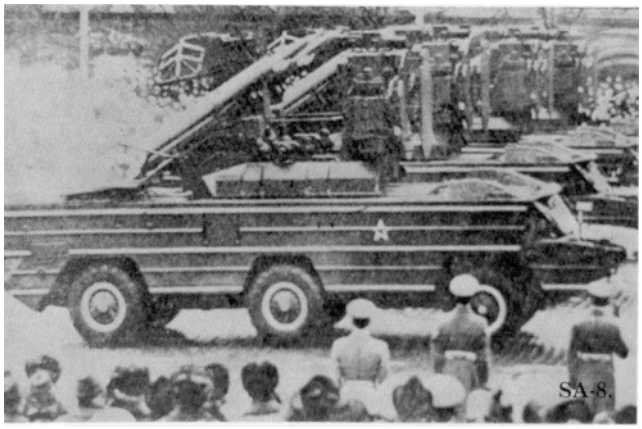


2,500 meters (1:250,000). The 1:50,000 templates display ranges to 25 kilometers and the 1:250,000 show an excess of 50 kilometers.

The device has received wide acceptance and use by all recipients, proving particularly valuable to intelligence and

artillery personnel. The templates have also been employed successfully by CPX controller personnel in the preparation and conduct of divisional exercises.

Originally designed by SFC Joseph Terrien of G2 Operations, the templates have been distributed throughout the 1st Cav and to other units at Fort Hood. Copies of the device have also been sent to TRADOC and the Intelligence School for evaluation.



The Soviet SA-8 surface-to-air command guidance missile. Rolled out for display during the festivities of the 1975 November 7th Parade, the three-axle launch vehicle features four missiles equipped with acquisition and tracking radar plus two guidance radars. One SA-8 can launch two missiles, each guided on separate frequencies, on a common target. The vehicle is fitted with an electro-optical tracker, probably TV. The 1975 May Day Parade was highlighted with the first public appearance of the SA-9. Four missiles mounted on a BRDM Scout Car satisfy low-level air defense requirements. (Photo courtesy November 1975 *Aviation Week and Space Technology*.)

Seagoing Howitzers

USS DORAN, 1945 — A US Navy destroyer with Army 155 howitzers mounted as part of its main armament!

It sounds unusual today, but perhaps no more unusual than it did during the last year of World War II; yet men looking for an answer to a problem will try a variety of solutions. It was just such a problem that led to an unusual experiment in seagoing artillery.

The problem was to provide effective close support fire from naval vessels to the Army and Marine ground troops engaged in the island-hopping campaigns in the South Pacific. On some of the atolls the naval support ships had provided intense curtains of preparation fires before amphibious assaults by the ground forces, but when the troops landed they were still met by well-entrenched Japanese soldiers little affected by the bombardment. Part of this lack of effect, it was decided, was caused by the rather flat trajectory of the Navy destroyers' 5-inch guns and the hard coral of the Pacific atolls. During the preparation firing, the Japanese only had to take cover in their trenches and foxholes and ride out the barrage. Because of the flat trajectory of the naval guns, the shells would strike the hard coral of the island's surface and ricochet toward the rear areas upon impact, providing little effect in the trenches. The need for plunging fires to get steel down into the holes with the enemy troops was obvious.

A plan was developed to mount 155-mm howitzers on the carriage mechanisms of the Navy destroyer's organic 5-inch guns when needed and then remount the 5-inchers when the need for the 155s had passed. The idea appeared to have some merit and immediately brings to a field artilleryman's mind the present Army system of switching tubes and using the same carriage to fire both the 8-inch and 175-mm guns. The go-ahead was given to begin experimentation, and the vessel chosen to conduct the tests was the destroyer *USS Doran,* commanded by Captain Norman E. Smith (USN).

The ideas, which looked so good on the drawing boards, immediately began to show some flaws in actual practice. The first major problem was switching the tubes. The original plan called for a tender, fitted with cranes and cargo hoists, to heave-to alongside the destroyer in the open sea, lift the 5-inch guns out of their mounts and secure them. It was estimated that the switch could be made and the guns could be in action within 24 hours; however, the task of removing the armor shields from around the guns at sea was abandoned within a few hours. These heavy steel plates were held in place with hundreds of bolts, and the years of sea-water rust and corrosion, plus many liberal applications of deck paint, had made each bolt impossible to turn. The shields had to be removed before the guns could be taken out; so the ship returned to dock for more

stable working conditions. The bolts refused to budge in spite of the best efforts of any available wrench. Finally an acetylene cutting torch was brought into action and each bolt was cut off so the shields could be removed. Then all the bolt stubs had to be drilled out, the holes re-tapped and new bolts inserted before the shields could be installed again. When all this work was completed and the 155s were seated firmly on the 5-inch mounts, two weeks had passed. Since most destroyers could be expected to have accumulated as much rust as had the *Doran,* the outlook for installing the system easily and quickly on any ship began to look much less optimistic. At any rate, the two howitzers were now finally installed on the destroyer. With their stubby muzzles poking out of the 5-inchers' usual places, they made a strange alteration in the ship's silhouette.

While the transfer of guns had been taking place, the officers and men who would actually be involved in firing them had been taking crash courses in the duties of 155 howitzer firing crews and FDCs. Two Marine artillerymen were borrowed and assigned to the *USS Doran* to drill the gun crews while Navy gunnery officers met with Marine counterparts to learn about computing fire missions. Again, many problems not anticipated in the original plan surfaced as the crews began training.

It quickly became apparent that almost all of the techniques and instruments for firing the 5-inch would not apply to the howitzers. The only organic 5-inch component that could be used with the 155 was the mounting itself. This component was called the stable zenith mechanism and served to compensate for the pitch and roll of the ship on the sea while the guns were firing. This was fortunate since the 155 requires a stable firing platform to deliver accurate fire.

The actual firing of the 155s depended on accurate data from an FDC. However, on the *Doran* all systems were set up for the 5-inch. Gunnery officers had to use sliderules and firing tables to determine firing data. The faster automatic system they were accustomed to was useless.

The gun crews, taught to fire from the conventional land-based carriage mounts, adapted quickly to firing from the ship. The gun crews were concerned with an additional problem, however, which had not been considered in the original concept of the project. The 5-inch fired a fixed round with all components encased as a single unit. The 155 separate loading ammunition caused two areas of concern. First was the disposal of surplus powder that accumulated when any but maximum charge was fired. These extra increments had to be stacked somewhere until they could be thrown overboard. The piles of cloth powder bags were a constant fire hazard, and the Marine sergeants began to yearn for a well-dug powder disposal pit. Second, getting both powder and projectiles to the guns was a major endeavor. The 5-inch ammunition was stored below deck in bunkers and brought on deck by an elevator which lifted each fixed round individually and sent it up to the guns. The 155 projectiles did not fit well into the lift, and there was continual jamming of the mechanism; so most of the 155 ammunition was brought to the gun site by hand. On a moving ship, this constituted another serious safety hazard.

Finally, the 5-inch gun was a major proportion of a destroyer's antiaircraft defenses, and it quickly became obvious that the 155 could not function effectively in this role.

With all these problems, it was soon realized that the project had serious shortcomings. The long installation time, the loss of organic firepower and the considerable safety hazards caused the project to be sent back for reconsideration. A few weeks later the surrender of Japan made the concept a moot point, and thus ended this experiment with the seagoing howitzers.

by CPT John R. deTreville

Antipersonnel Shrapnel Rounds

The 'Beehive'-type antipersonnel round is a uniquely American invention and this type of artillery ammunition was first employed in combat in Vietnam in the mid-1960s.

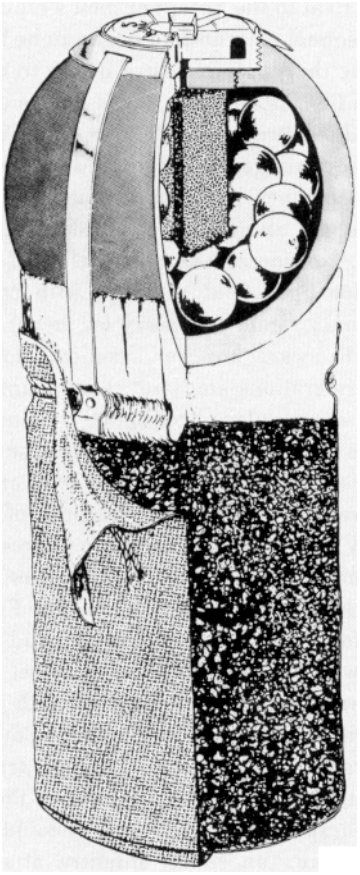
If you are like the majority of US Field Artillerists a statement such as the previous is taken for granted. However, if you have studied the history of field artillery development, or perhaps asked questions about the small lead balls or bullets often found on some of our WWI-era Army posts, you are likely to be one of those who knows that, far from being a new type of ammunition, artillery projectiles of the Beehive family go back nearly 200 years. Indeed, the Beehive, while more effective at point-blank range than its forebears, is not as versatile in indirect fire. These types of ammunition have gone by many names, but are most commonly called "Shrapnel" rounds, named for their inventor LT Henry Shrapnel (1761-1842), a British artillery officer. In their heyday, Shrapnel rounds were so feared and respected that any casualty caused by artillery fire is today said to be caused by Shrapnel or a piece of Shrapnel.

Before confusing everybody, perhaps it would be best to define Shrapnel: a thin-walled artillery projectile filled with pre-formed submissiles (lead or iron balls, steel bars or flechettes). Fitted with a time fuze, it is designed to hold the submissiles together until the round reaches an optimum point in front of the target, usually personnel, at which point it bursts, having the effect of a long-range cannister round. Purists may insist that Shrapnel must contain only lead balls as the submissiles, but this is not true now, nor has it been in the past.

Shrapnel shell did not just happen, of course; it developed to fill a need caused by the limitations of early artillery and explosives. The pre-Shrapnel artillerist generally had only three types of ammunition available to him, all effective in their own way, but with severe limitations which decreased the effectiveness of artillery, especially light field artillery.

The first of these early types of ammunition was called "shot" (the traditional "cannonball") which had good range and destructive power but required a direct hit to do any damage. It was not effective against personnel. The second type was "cannister," consisting of a metal cannister or cloth bag filled with lead bullets, iron balls, nails, rocks, etc. Propelled from the gun by a hefty charge of powder, the cannister disintegrated as soon as the round left the muzzle, scattering the fragments in the manner of a large shotgun. Highly effective against personnel, it had short range, no more than about 500 yards at very best. The last available type was "shell," a hollow iron ball filled with black powder and fitted with a time fuze to detonate it, hopefully at the target. It had, like shot, good range and did not always have to hit its target directly to accomplish its mission. Balancing this, however, were several disadvantages that were not overcome during the age of black powder. Inaccurate time fuzes (there were no PD fuzes, though attempts had been made in that direction) might detonate the shell harmlessly short of the target or result in the shell burying itself behind the target before exploding or, indeed, it might lie sputtering on the ground while its intended victims moved out of the way. More importantly, black powder, the only explosive known, was not very powerful and might only break the shell into two or three fragments.

Early artillerists recognized these faults, of course, and attempted to combine the advantages of both shell and cannister as early as 1573, when the Germans developed "hail shot," a common shell filled with powder and lead balls, but it never caught on. The soft lead balls frequently fused together on detonation of the shell, negating its value. There things remained for some 200 years until Lieutenant Shrapnel began to experiment, at his own expense, with similar ideas in 1784. His early models consisted of thin-walled shells filled with hardened lead alloy bullets and loose gunpowder. Like the shell, they were fitted with a time fuze. The hardened lead was successful in keeping the bullets from sticking together, but friction between the bullets, powder and inner shell wall sometimes resulted in premature explosions. He solved this by fixing the bullets in a matrix of melted sulpher or rosin and placing the powder charge in a separate chamber near the center of the shell. Shrapnel's new shell was accepted by the British in 1803. In April 1804, this British "secret weapon" was used in combat for the first time when Shrapnel fired at



John Hooper

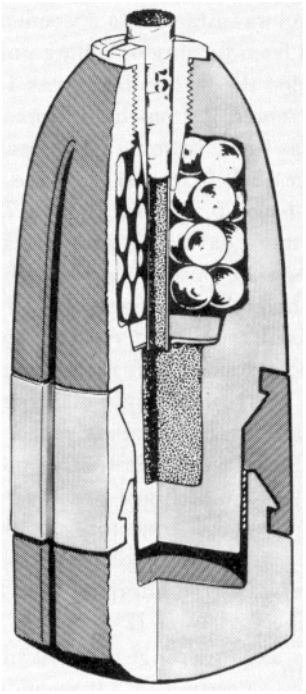
Figure 1 – Six-pounder spherical case shot [or Shrapnel] of the Civil War period. The fuze, a Bormann time fuze, was set by cutting through the thin lead over the compressed black powder time ring at the proper time setting. When the gun was fired, burning gases, leaking around the shell, ignited the exposed portion of the powder train. The wooden sabot served to prevent the shell from turning in the bore and also served to attach the powder bag to the shell forming fixed ammunition. Wood time fuzes or paper-wrapped time fuzes as shown in Figure 2 also were used in many shells. Likewise, Bormann time fuzes were used in some adapted rifled shells.

a range of 2,050 yards caused the Dutch defending Fort Amsterdam in Batavia to surrender. The defenders were so surprised at receiving "musket fire" at so astonishing a range they gave up after the second round. It soon played a part in the wars with Napoleon. British artillerymen gave it major credit for the victory at Waterloo.

What, then, were the gunnery procedures for this "secret weapon"? The Shrapnel projectile was prepared by estimating the range to target and consulting the firing table for the correct time setting, charge (different amounts of powder were normally used for shot, shell or Shrapnel) and elevation. The wooden tubular time "fuze" was "cut" to the correct length and inserted into the shell. The powder charge and shell were then inserted into the bore of the weapon. The shell was attached to a wooden sabot designed to keep the shell from turning or rolling until it had left the bore. This enabled the fuze to face away from the powder charge and prevented it from being forced into the shell when the gun was fired. Burning gases, leaking around the shell, ignited the shell fuze. (By the time of the US Civil War, this type of time fuze ignited about 75 percent of the time.) Even in those days, it is interesting to note, heavy artillery used separate powder bags for the charge, while light artillery had the charge fastened to the sabot, resulting in a fixed round. After firing, the shell followed the normal trajectory until the fuze ignited the shell charge, rupturing the shell wall and dispersing the bullets somewhat. These Shrapnel bullets relied not on the explosion of the shell for their destrictive power, but on the terminal velocity of the shell just prior to bursting, as they continued to follow the trajectory to the target. This requirement for a relatively high terminal velocity limited the maximum range of the Shrapnel shell to around 2,000 yards or less. (The Civil War 12-pounder "Napoleon," for example, had a maximum range of 1,200 yards at 4 degrees elevation and a fuze setting of 5.0 seconds.) If the round was off target, it was adjusted by varying the time setting and elevation until correct, although the gunner with initiative was not above removing some powder if he decided a more plunging trajectory was called for.

As far as the US Artillery is concerned, Shrapnel shell was first mentioned in the *Ordnance Manual* of 1841, though it was probably in use prior to that time. By the time of the War Between the States, it was considered the primary antipersonnel (and antihorse) round of the field artillery. (Forty percent of Union purchases of smooth-bore 12-pounder ammunition was Shrapnel, the remaining 60 percent being about evenly divided between solid shot and common shell. Cannister was still in use for close-in work.) The Confederates also used Shrapnel in quantity but, due to shortages of lead, often had to substitute iron bullets for lead with resulting losses in effectiveness.

The US Civil War also saw the first use of rifled artillery in quantity and Shrapnel shell was quickly developed for these new weapons. Due to the very newness of rifled artillery, there was no standardized type of Shrapnel; different arms companies and designers come up with their own ideas as to how best to adapt the shell to the new system — Parrot, Schenkl and Hotchkiss types being the most prevalent. Some of the rifled Shrapnel shells were no more than direct adaptations of smoothbore types, still relying on terminal velocity of the shell to do the damage. With rifled artillery, however, the artillerists could now depend on the fact that the nose of the shell would always face to the front — toward the target. Some ordnance designers immediately utilized this fact to improve the effectiveness of Shrapnel shell. The most notable of these was the Hotchkiss



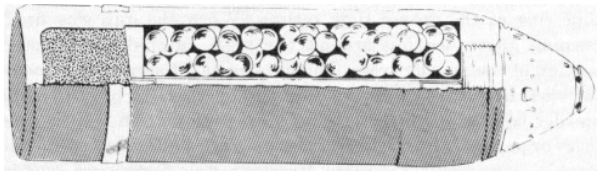
John Hooper

Figure 2 – A 3-inch [10 pounder] Hotchkiss case shot. The time fuze here is a paper-wrapped column of compressed black powder. The fuze was cut to the correct burning length just before firing and inserted into the brass fuze adapter. On firing, the fuze was ignited by the burning gases of the propellant which also acted on the base section of the shell, forcing the lead rotating band into the rifling of the gun. The Hotchkiss rotating band system was so effective that special grooves were cast in the shell to allow gas leakage. The fuze burned until it set off the shell's powder charge forcing the piston plate and lead bullets through the nose of the shell.

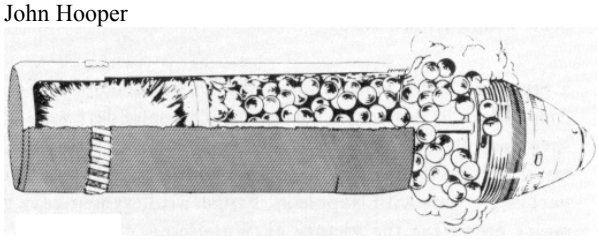
Company, whose designs for rifled artillery shells were probably the most advanced of the Civil War period. (The current 4.2 mortar shells use the same basic principles for expanding the rotating band into the rifling of the mortar.) In the Hotchkiss Shrapnel design, the time fuze is still located at the front of the shell, but now the shell's powder charge is placed in the base of the projectile. When ignited by the time fuze, it forces out a pusher plate which acts like a piston and drives the Shrapnel bullets out through the nose of the shell, thus increasing the velocity of these bullets. This increase reduces the reliance on terminal velocity, and thus, in effect, increases the effective range of Shrapnel shell out to nearly the maximum range of the particular gun.

Following the Civil War, Shrapnel continued to develop along the lines of the Hotchkiss principles, with most changes being the result of improvements in technology: breech-loading guns and time fuzes initiated by set-back of the shell rather than by flame leaking around the shell being the most important.

With the turn of the century, however, the first indications of a rival to the Shrapnel shell's reputation as the prime antipersonnel ammunition began to be heard. It was about this time that high explosive began to replace black powder as the filler in common shell. By the eve of World War I, this had resulted in an HE shell that could fragment into thousands of ragged splinters and was effective, not only against personnel, but against materiel as well. Even so, as WWI began, all major armies, including that of the United States, considered the Shrapnel shell as the basic ammunition for light field artillery, with common shell being the primary round for heavy (or siege) artillery. By the end of the war, however, tactical, logistical and technical considerations had put Lieutenant Shrapnel's invention in second place. Shrapnel was nearly useless against troops in bunkers and trenches and, after the beginning of trench warfare, found less and less use. (However, in reading journals and histories of the first few months of WWI, a person soon gets the impression that the machine gun must share some of the credit for ending mass infantry tactics with the Shrapnel shell. The French 75, for example, could fire 20 rounds a minute and in the early weeks of the war was employed in the direct fire role extensively. It was very effective against both infantry and cavalry, but was also highly effective against other artillery, especially horsedrawn, and the opposing artilleries soon forced each other off the front lines.) As the guns were forced back, Shrapnel shell, even when it could be used (for example, to counter an enemy infantry attack), became inaccurate due to poor time fuzes and the lack of extensive communications with forward observers. (Adjustment of



John Hooper



John Hooper

Figure 3 and 4 – 75-mm Shrapnel of the WWI era was fired in a manner similar to the Hotchkiss, except now the artillery was breech loading and the time fuze was improved. Setback of the shell when fired ignited the black powder time train and the fuze was "cut" by turning the numbered brass ring, which varied the length of the train. A very similar fuze is still in use on the current 81-mm mortar illumination round. The fuze shown, the M1907M Scovill Combination Fuze, also had an inertial percussion element for graze bursts.

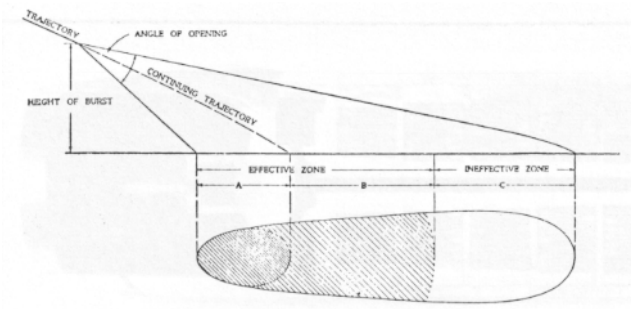


Figure 5 – A typical Shrapnel burst. The number of balls striking in area A is approximately 50 percent; in B, 35 percent; and in C, 15 percent. The length and width of the beaten area depend on the angle of fall and the height of burst.

fire using observers not located in the battery positions was just beginning. Most indirect fire was done by sending back the target coordinates to the guns, which would fire for effect with zone fire hoping to hit the target. Those readers who have fired a time transfer recently know how difficult that can be even with modern time fuzes. With the burning time ring fuzes of the era, it was even more difficult.) In addition, Shrapnel was more difficult to manufacture and used more strategic materials (lead, brass, sulfur) than did HE.

At the end of WWI, the US had large stocks of Shrapnel remaining and its manufacture was ended. Experimentation continued to some extent (a prototype Shrapnel was developed for the M2 105-mm howitzer in 1934, but never produced in quantity) and remaining stocks were used in training and practice, but its days were numbered as it came to be considered more and more obsolete.

By the time of US entry into WWII, Shrapnel was still listed in the inventory and was used to a limited extent in

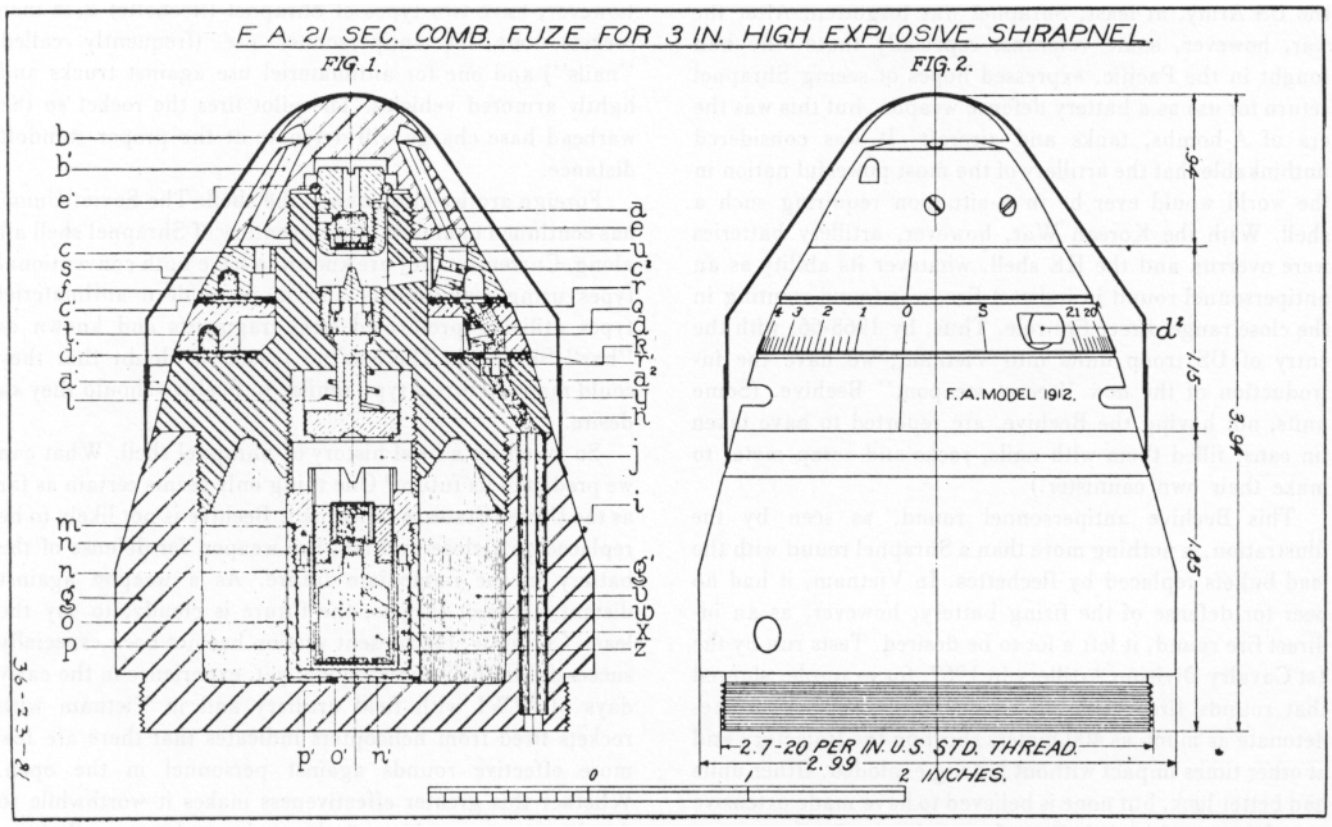


Figure 6 – Many attempts were made to come up with a single, all-purpose shell for the artillery. In 1912, high explosive Shrapnel was the latest rage. By using TNT as the matrix fixing the bullets instead of sulfur or rosin, the shell could be set for either air burst Shrapnel or a graze HE burst. If set for Shrapnel, the time fuze fired the black powder charge as on a normal shrapnel burst, the fuze and booster continuing to the ground bursting on impact. The HE matrix did not burst. Set for impact or graze, the fuze acted only as a PD, exploding not only the booster but also the TNT matrix. It was neither a very effective HE shell nor a very effective Shrapnel and was obsolete by 1918.

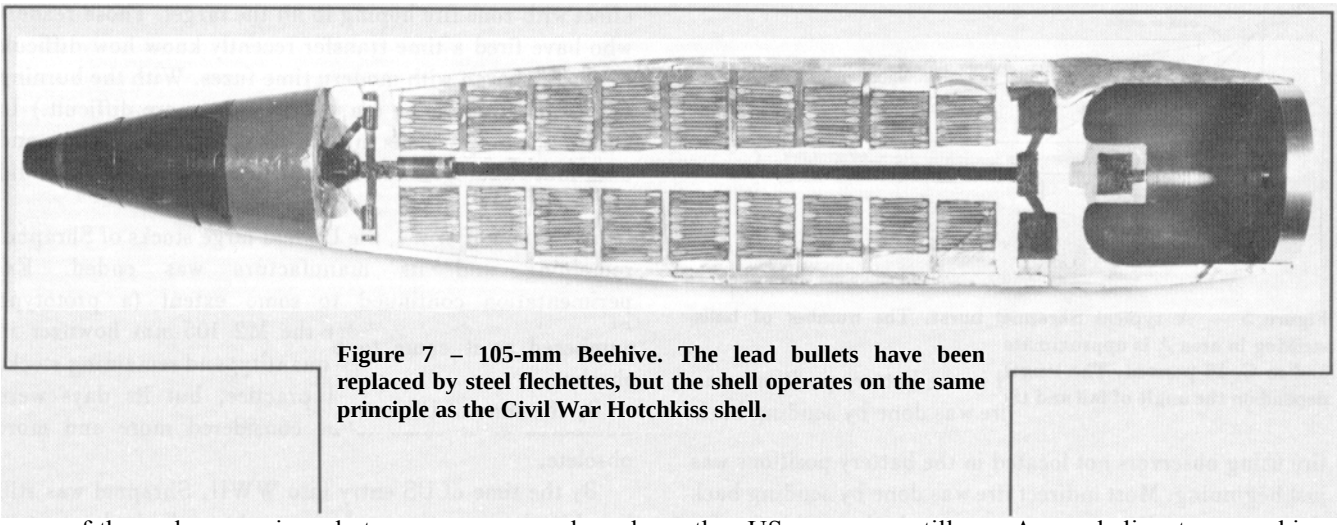


Figure 7 – 105-mm Beehive. The lead bullets have been replaced by steel flechettes, but the shell operates on the same principle as the Civil War Hotchkiss shell.

some of the early campaigns, but no more was made and in the US Army, at least, Shrapnel was forgotten. After the war, however, some veterans, especially those who had fought in the Pacific, expressed hopes of seeing Shrapnel return for use as a battery defense weapon, but this was the era of A-bombs, tanks and aircraft. It was considered unthinkable that the artillery of the most powerful nation in the world would ever be in a situation requiring such a shell. With the Korean War, however, artillery batteries were overrun and the HE shell, whatever its ability as an antipersonnel round in indirect fire, was found wanting in the close range direct fire role. Thus, by 1965-66, with the entry of US troop units into Vietnam, we have the introduction of the new "secret weapon," Beehive. (Some units, not having the Beehive, are reported to have taken tin cans, filled them with nails, rocks and scrap metal to make their own cannister.)

This Beehive antipersonnel round, as seen by the illustration, is nothing more than a Shrapnel round with the lead bullets replaced by flechettes. In Vietnam, it had no peer for defense of the firing battery; however, as an indirect fire round, it left a lot to be desired. Tests run by the 1st Cavalry Division Artillery in 1967, for example, showed that rounds fired with the same data would sometimes detonate as much as 400 meters short on the trajectory and at other times impact without having exploded. Other units had better luck, but none is believed to have made extensive use of the round in an indirect fire mode; the fleeting nature of personnel targets and the difficulty of adjusting time fuze made the shell too uncertain regardless of how effective under perfect circumstances. Articles in professional journals in recent months indicate that Beehive may be issued in the future with a fuze having muzzle action only without a time option. If so, technically it may no longer be a Shrapnel round, but an expensive and complicated cannister round.

This, then, is where the Shrapnel shell stands today in the US cannon artillery. Army helicopter gunships, however, have two types of Shrapnel (flechette) 2.75-inch rockets, one for antipersonnel use (frequently called "nails") and one for antimateriel use against trucks and lightly armored vehicles. The pilot fires the rocket so the warhead base charge will detonate at the proper standoff distance.

Foreign armies also possess the shell. The Soviet Union has continued to maintain an inventory of Shrapnel shell all along. Currently, they are known to have both conventional types using lead bullets and more modern antimateriel types utilizing preformed steel fragments and known as "bar" Shrapnel. There is no reason to doubt that they could manufacture a type similar to Beehive should they so desire.

So much for a brief history of Shrapnel shell. What can we predict of its future? One thing only seems certain as far as the United States is concerned: Beehive is not likely to be replaced as a close-in direct fire weapon for defense of the battery in the immediate future. As a weapon against distant, indirect targets, the future is cloudy, to say the least. Certainly, the present version has not been especially successful in the indirect mode; yet, experience in the early days of WWI with field artillery and in Vietnam with rockets fired from helicopters indicates that there are few more effective rounds against personnel in the open. Whether this greater effectiveness makes it worthwhile to develop a more usable round remains to be seen. Perhaps the substitution of a VT fuze for the unloved time fuze might increase the value of antipersonnel shells by reducing reaction times and increasing their accuracy. In any event, since it seems likely to be carried in the inventory for battery defense anyway, it would seem a good idea to give it a dual purpose.

CPT John R. deTreville, FA, is assigned to HSB, 1st Battalion, 320th Field Artillery, Fort Bragg.

Operation

Redleg

On 1 November 1973, the 1st Battalion (Airborne), 133d Field Artillery, Texas Army National Guard, underwent a major reorganization. The battalion converted from an M102 airborne unit in direct support of the 71st Airborne Brigade (Separate) to an M109 unit in direct support of the 49th Armored Division.

The majority of the airborne Redlegs were disappoined with the loss of the airborne mission; however, I considered the new assignment the most challenging of my military career. I had been the executive office (XO) of Battery C, 1st Battalion (Airborne), 133d FA, and was selected as the XO for the new Battery C, 133d FA, which would be comprised of the personnel from the old 271st Engineer Company, 71st Airborne Brigade.

CPT Harold L. Brent was selected as the battery commander for the new unit. He and I had worked together as a

Station training was conducted (above) using the battery's aiming circles concurrent with classroom instruction and practical exercise on the only M109 assigned to the unit.

by CPT Bruce A. Olson

team for some six months, developing a below-par firing battery into one recognized as the best in the battalion.

The battalion commander gave us a free hand in selecting personnel to accompany us to the new unit. We selected only those key persons whom we felt would be necessary for a fast, yet smooth, transition — the assistant executive officer (AXO), one forward observer (FO) and two fire direction center (FDC) personnel.

Objective

Captain Brent stated in a message to the battery on 9 January 1974, "I choose these men because they are experienced and know artillery well; and, with the cooperation from all members of the battery, we can and will assemble the best battery in the battalion and, probably, the best. . .within division artillery."

Planning Phase

Personnel files were screened by the battery commander and first sergeant. Personnel for key positions were selected and sections were organized. August 1974 was the cut-off date for a combat-ready posture. Actual training time available would be 20 days, or 10 drills. The battalion master training schedule did not include all of the drills available for training artillery. One month would be devoted to civil disturbance training, one month for a recruiting campaign and one month for preparation for annual training (AT). Seven drills, or 14 days, remained for transforming engineers into Redlegs. Thus, objectives were established and a master training schedule was developed for the unit.

Master Training Schedule

Only a nucleus of artillery-qualified personnel had been brought to the new battery; therefore, it was decided that training would be conducted utilizing the committee training concept. Each of the "transplants" would be given a subject area in which to gain expertise. Then, each would be responsible for all the training conducted in the specialized area. The committee assignments were as follows: AXO — fire direction; FO — forward observer; BC — tactics; XO — firing battery and maintenance; and, FDC personnel — staff assistants to AXO.

"SHOT OVER" during Annual Training 1974.

Committee training, conducted in separate classrooms, was divided into three phases: I — advanced individual training (AIT); II — section level training; and, III — battery level training.

The AIT phase and the section level training phase would be the most time-consuming and critical periods; therefore, an equal amount of training time was allotted for each. The AIT phase would consist of four drill periods, each having four blocks of instruction, consisting of four hours of classroom instruction or practical exercise. During the AIT phase, section unity would be maintained and section training would be incorporated when possible. The section level training phase would be three drill periods — one at the home station performing section drill and the other two at Fort Hood, TX, performing service practice. The battery level training phase would be incorporated with Phase II during section drill and service practice, but the battery level training highlight would be conducted during annual training at Fort Hood.

During the AIT phase of training, the FO training would complement the FDC training. Coordination between the two committees was essential and must begin before and continue through each drill. The battery recorder was trained with FDC personnel to provide a replacement in the FDC if one were needed. Only one classroom was needed for the FO and FDC sections. However, the firing battery had more than 80 men, so two classroom sections were formed. Each firing battery classroom section included three gun sections and either the firing battery headquarters or the ammunition section. Battery personnel not having field artillery military occupational specialties were to perform on-the-job training and classroom instruction at the section level during drills.

The 271st Engineer Company did not have the equipment organic to an M109 unit, including the most mission-essential piece of equipment — the M109 howitzer. During the November drill, the unit received six M102s from the old Battery C to use in training until the M109s arrived.

AIT Training

Training for the newly organized battery began with the AIT training phase in November 1973. The mission for the committees during the AIT phase was to prepare the unit, after six days of actual instruction and practical exercise, to function as sections during live-fire service practice at Fort Hood.

Training was conducted at a fast pace and there were few breaks. The gun sections were introduced to firing battery terminology, artillery ammunition, safety, field artillery organization and field artillery missions. When the M102s arrived, two training stations were established for the firing

battery. The M102s became Station 1 and a classroom became Station 2. Station 1 allowed the cannoneers to become familiar with the equipment and to get hands-on training during preparation for action, firing and march order. Station 2 provided instruction in tactics, theory, principles and procedures. Also, at Station 2 the Redlegs were allowed to ask questions which arose during the practical exercise at Station 1. Each drill contained 16 hours of instruction and practical exercise. The gun sections were rotated between Station 1 and Station 2 every two hours. Coordination between the instructors at each station was essential to insure that accurate information was presented and to resolve conflicting information. Instruction presented at one station had to complement that at the other station; i.e., if the instruction at Station 1 were duties of the cannoneer, the instruction at Station 2 should be battery operations, not organization of the armored division.

During the AIT training phase, the firing battery committee had as many as four training stations operating, providing instruction in such diverse areas as track maintenance to operation of the aiming circle. Utilizing the station training system, the trainer was limited only by his imagination. The FO and FDC committees determined the necessary subjects and divided the responsibility for providing instructors. Communication between the FO and FDC classrooms was established to add a degree of realism while practicing communication procedures.

Section Level Training

In April 1974, the battery went to Fort Hood for live-fire service practice to familiarize the unit with live firing, to practice procedures learned from instruction since reorganization and to evaluate the training received. The battery drew six M109s and section equipment from the annual training equipment pool. Since the battery's M102s had been replaced with one M109 in January, the battery personnel had become familiar with the M109 weapon system. During the weekend service practice, speed and accuracy before, during and after firing were emphasized. At first, the cannoneers were startled by the noise and recoil of the weapon during firing; however, after the section personnel became more familiar with the reaction of the weapon, operations became smooth and efficient. During subsequent service practices, rough edges were smoothed out and the battery began to function as a team.

Battery Level Training

In August 1974, 10 months after being organized, the battery, determined to be recognized as the best battery in the battalion, deployed to North Fort Hood to conduct AT — the two-week period of active duty which National Guard and Reserve units spend at military installations to maintain the efficiency and state of training of the units. The period gives a unit the opportunity to combine all instruction from the training year and to operate in a field environment for a prolonged time. During AT, Regular Army evaluators are present during each level of training to advise, assist and evaluate the units.

During AT-74, Battery C functioned as a firing battery. The FOs performed as separate teams, calling multiple fire missions into FDC. FDC processed the fire missions immediately, and the guns put steel on the target. Up to three fire missions were fired simultaneously. Evaluators and visitors were pleased by the unit's hustle and sense of urgency during fire missions and with the enthusiasm and dedication of the individuals during maintenance drills.

By the end of AT-74, the battery had become as Captain Brent had predicted — recognized as the best battery in the battalion, and, as far as battery members were concerned, the best in the 49th Armored Division.

Lessons Learned

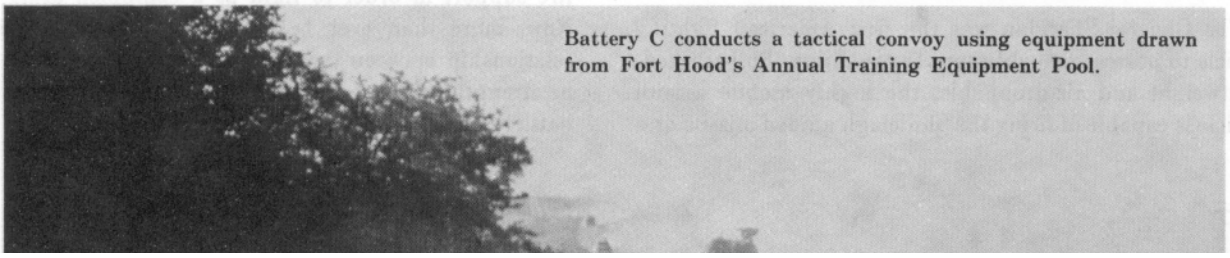
The lessons learned during the nine-month training cycle include:

- The committee training concept, in which a limited number of qualified personnel are available for a limited amount of time, is efficient and effective.
- Using station-type training, a limited number of qualified instructors can train effectively with limited equipment and tools since instructors have fewer classes to prepare and, therefore, are able to incorporate more detail. Additionally, student interest is stimulated by rotating the students among several stations during the training day.
- The establishment and identification of training phases enables the trainer to evaluate the effectiveness of his instruction, to keep sight of training goals and to monitor progress.

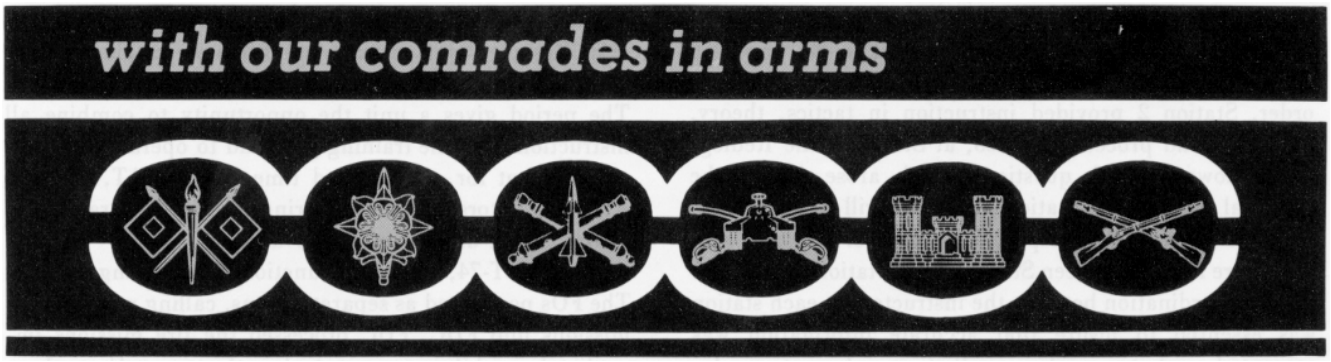
Prologue

After 51 actual training days, I departed Battery C knowing my predecessor inherited personnel knowledgeable in field artillery. With only one artillery piece to train with at the home station, the unit had learned its lessons well and had become the best.

CPT Bruce A. Olson, IN, Texas Army National Guard, is the Assistant S3-Air, 36th Airborne Brigade.



Battery C conducts a tactical convoy using equipment drawn from Fort Hood's Annual Training Equipment Pool.



M551 Slated For Improvement

Department of the Army officials recently announced plans to initiate a Product Improvement Program (PIP) for the M551 "General Sheridan" light tank.

The Sheridan PIP will consist of 22 subtasks and is scheduled to take nearly three years to complete. Over 55 million dollars has been allocated to the program which was halted earlier this year due to a funding cutoff. Most of the improvements will be modifications to the existing model. Of the 22 subtasks scheduled, 18 will be performed at Rock Island Arsenal, IL. Watervliet Arsenal, NY, and Frankford Arsenal, PA, will each have two subtasks.

Packing the punch of a guided missile and a 155-mm gun, the General Sheridan will undergo significant modification during the course of a three-year Product Improvement Program.

The General Sheridan was the first American fighting vehicle to possess a dual firepower capability. Full-tracked, lightweight and air-droppable, the highly mobile assault vehicle is capable of firing the Shillelagh guided missile or a multi-purpose conventional round from the same tube. The system was designed to provide close support to the fighting soldier.

Combat Arms OAC Exchange Program

An agreement has been reached among the branch chiefs in the Company Grade Combat Arms Division of US Army Military Personnel Center (MILPERCEN) to formalize a quota exchange for officer advanced courses (OACs). Essentially, 10 FA officers will attend the Infantry OAC at Fort Benning and 10 will attend the Armor OAC at Fort Knox each year. In return, 10 Infantry and 10 Armor officers will attend the Field Artillery OAC at Fort Sill each year. The program is to be implemented fully with the advanced courses starting after 1 July 1976.

The idea for an exchange program is not new. The Field Artillery School has participated with the Infantry and Armor Schools in an exchange program for advanced course students for some time. However, the participation by officers from the three combat arms branches has been on an infrequent, unstructured basis.

To provide the infantry and armor officers an even footing with their field artillery contemporaries, BG Albert B. Akers, Assistant Commandant, USAFAS, has proposed that the Field Artillery School conduct a three-week preparatory course for the exchange officers. After completion of this instruction, the armor or infantry officers will have the entry level skills necessary to qualify them to enter the Field Artillery OAC. The majority of the instruction in the preparatory course will be in gunnery and field artillery weapon systems.

The exchange program will broaden combat arms officers' understanding of the integration of maneuver and fire support in order to fight as a combined arms team. Now, more than ever before, it is imperative that the relationship between the maneuver and fire support arms be strengthened in preparation for combat on the modern battlefield.

Frisbee Flinger

The Frisbee Flinger — that's the nickname given to a portable land mine dispenser by Army troops. The Mine Branch, Ammunition Development and Engineering Directorate of Picatinny Arsenal, Dover, NJ, is responsible for the technical development.

The XM128 Dispenser, part of the Ground Emplaced Mine Scattering System, is capable of hurling different types of mines simultaneously over a variety of terrain according to preselected minefield patterns and densities.

The dispenser, which has been in development one and a half years, was tested in Germany by the 3d Infantry Division to shake out its "bugs" and, as one staff member said, "make it GI proof." The dispenser has been returned to Picatinny Arsenal since there are only two such machines currently in existence.

The machine works on a system in which a hydraulic drum-magazine holds a number of small, specially built mines. When the controls are activated, the dispenser feeds the mines from their magazine, flips them through a directional tunnel and sends them spinning to the ground.

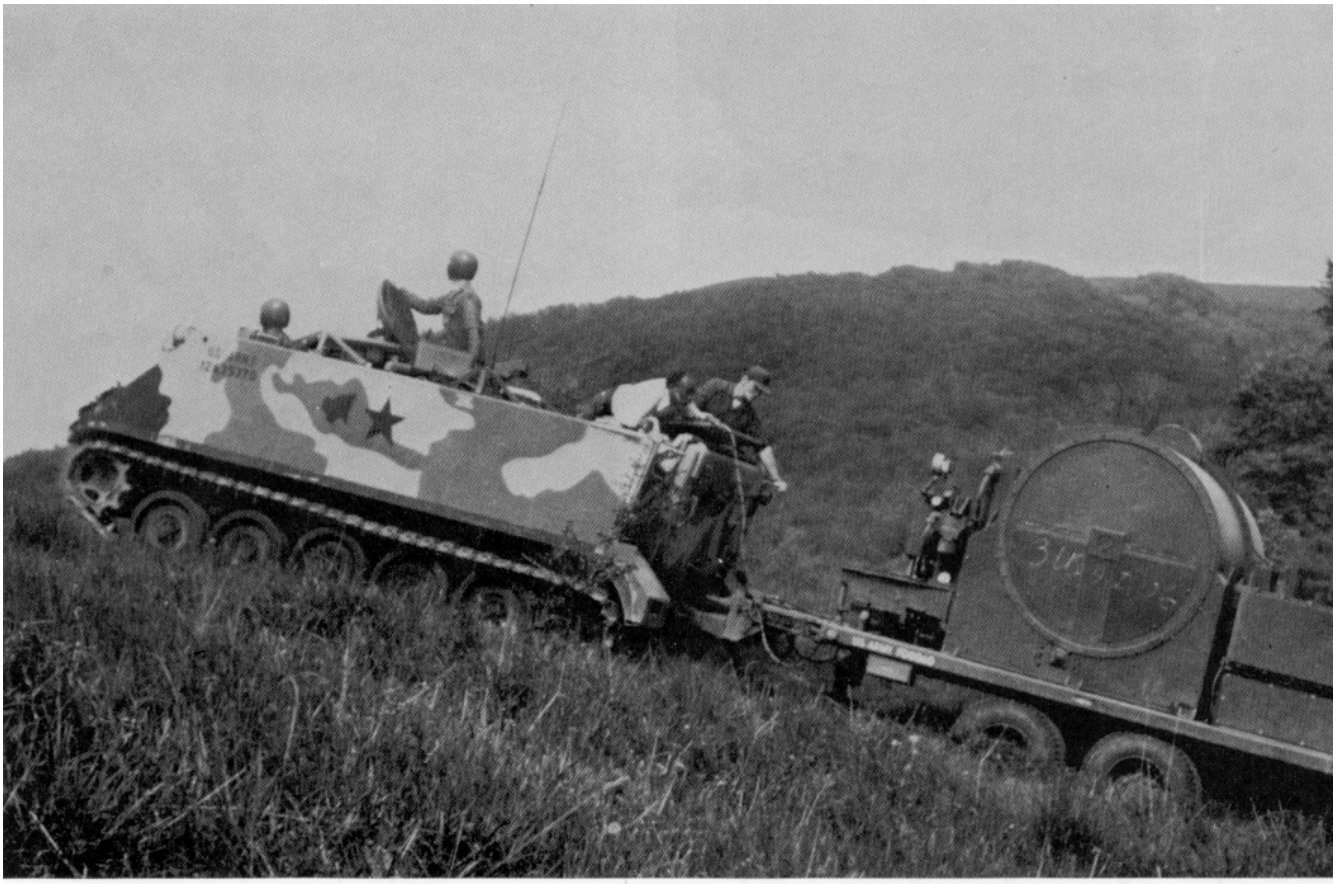
The entire apparatus is mounted piggy-back on a standard four-ton trailer. It can lay a wide or thin trail of antipersonnel or antitank mines depending on set-up procedure. The dispenser can be towed by any of the wheeled and tracked vehicles used by tactical units. The device is simple to operate and involves a minimum of training.

Capable of scattering antitank or antipersonnel mines in preselected patterns and densities, the XM128 Mine Dispenser was recently put through a series of durability tests over rugged USAREUR terrain.

Roland Connects At White Sands

Roland, the French-German missile that the US Army has selected to meet requirements for an all-weather, short-range air defense system, recently intercepted a jet drone at White Sands Missile Range, NM. A German crew fired the missile, the first of several live firings planned in this country under the US-European cooperative test program.

The joint effort provides US Army personnel a preliminary look at the system now in production for the French and German armies. The operational and performance data obtained through the program will ease and facilitate the eventual integration of Roland into the US



inventory.

Each Roland fire unit carries 10 missiles with two "in the chamber." The system consists of two automatically reloading launchers, a search radar and a tracking radar mounted on a turret. The system may be employed in vehicular or fixed configurations.

Roland's optical tracking mode was employed during the drone intercept test but later firings will be made in the system's fully automatic search and track mode.

Boeing and Hughes will build the US Roland system in the US and mount it on an American vehicle. The Roland is designed to protect battlefield troops, equipment and rear area emplacements against low-level air attack.

Roland will be produced in the US and mounted on an American vehicle for use against low-level air attacks.

XM1 Prototypes Accepted

The Army recently accepted prototypes of the XM1 tank from Chrysler Corporation and General Motors Corporation during a formal ceremony officiated by MG Robert J. Baer, XM1 Project Manager, at Aberdeen Proving Ground, MD.

Competitors are predicting that their respective entries will achieve or surpass the rigid government project performance standards. Developmental and operational testing will be conducted by the Army from February to May 1976. The vehicle to emerge with the best results will be sent into full scale engineering development.

The prevailing theme governing XM1 development

General Motors XM1.

emphasizes improvement of traditional tank strong points and elimination of battlefield vulnerabilities.

The Chrysler entry achieves a top speed of 45 mph (hard surface) through the power of a 1500-hp Avco Lycoming regenerative, multi-fuel turbine engine capable of running 12,000 miles without overhaul, requires no oil changes and

Chrysler XM1.

has 30 percent fewer parts than regular powerplants. A hybrid suspension system combines the advantages of the familiar torsion bar with simple rotary shock absorbers.

A 1500-hp turbo-supercharged, variable compression, air-cooled, 12-cylinder Teledyne Continental diesel engine pushes the General Motors entry along at a brisk 48 mph on hard surface roads. The cliche, "rides like a tank," is overcome with a unique hybrid suspension utilizing torsion

Chrysler's turbine-powered XM1 travels at 45 mph on hard surfaces, 35 mph cross-country and accelerates from 0 to 20 mph in seven seconds. The vehicle is capable of operation on any kind of gasoline or diesel fuel and runs a minimum of 12,000 miles without overhaul.

General Motors' XM1 submission features a 1500-hp variable compression diesel engine, pushing the 58-ton vehicle at 48 mph on hard surface roads. An improved fire control system provides an excellent day and night-fighting capability and greater first hit potential than previous tanks.

bars and hydropneumatic shock absorbers developed by National Water Lift.

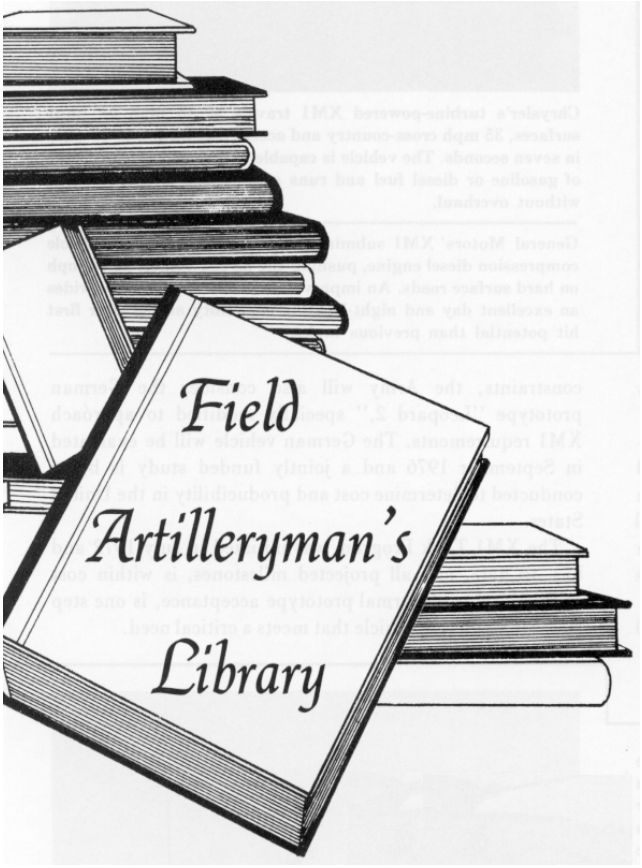
Both vehicles weigh in at a hefty 58-tons, rely on a 105-mm weapon for main gun armament and feature reduced combat silhouette and unprecedented crew protection through effective compartmentalization of on-board fuel and ammunition. The desired unit cost for the production vehicle, including government-furnished equipment, runs $507,000 in constant Fiscal Year 1972 funds.

To obtain the best possible vehicle within given fiscal constraints, the Army will also consider the German prototype "Leopard 2," specially modified to approach XM1 requirements. The German vehicle will be evaluated in September 1976 and a jointly funded study is being conducted to determine cost and producibility in the United States.

The XM1 Tank Program was initiated in July 1972 and has, to date, met all projected milestones, is within cost ceilings and, with formal prototype acceptance, is one step closer to fielding a vehicle that meets a critical need.

The Army's new XM723 mechanized infantry combat vehicle (MICV) has been undergoing developmental testing at Aberdeen Proving Ground, MD. Allowing occupants to fight mounted or dismounted, the MICV transports an infantry squad at speeds up to 45 mph on land and approximately five mph on water. The XM723's armament consists of a turret-mounted, stabilized 20-mm cannon, a 7.62-mm machine gun and six swivel ball-mounted, internally served automatic weapons located on the sides and rear of the vehicle. Firing port tests are scheduled for April 1976, the results of which will determine the selection between the M3A1 submachine gun or a modified version of the M16 (XM231) for the firing port positions.

Following exhaustive all-climate testing, type classification and a final production decision is tenatively expected in the 1977 time frame.



by James H. Byrn

Just as the US Army Field Artillery School at Fort Sill is considered the home of all loyal "cannon cockers" (at least, US type), the Morris Swett Library is considered the repository for the written lore of the US Army Field Artillery. The library is named for MSG (Ret) Morris (Mike) Swett, who guided its fortunes in both a military and civilian capacity from 1915 to 1954. Brought to Fort Sill by LT (later, MG) Ralph McT. Pennell, the first Secretary of the Field Artillery School of Fire, Swett built the library from extremely modest beginnings to one of the best of its kind. He was personally instrumental in saving, literally from the trashpile, many irreplaceable documents, letters and other material concerning the fort and the famous personages connected with its history. Later, as the result of a shortsighted school administration policy in the 1950s, many of these documents were disposed of; but, fortunately, a large number was salvaged by both the Field Artillery Museum and the Museum of the Great Plains. An even larger number remains in the library collection.

Master Sergeant Swett also proved an invaluable resource to COL Wilbur S. Nye while the colonel researched material for his book *Carbine and Lance*, the definitive history of old Fort Sill. Swett was able to direct Colonel Nye to many still living persons, both Indian and white man, who were direct contributors to this saga. Mike Swett was often referred to as "Mr. Fort Sill" and his legacy to the library provided his own epitaph.

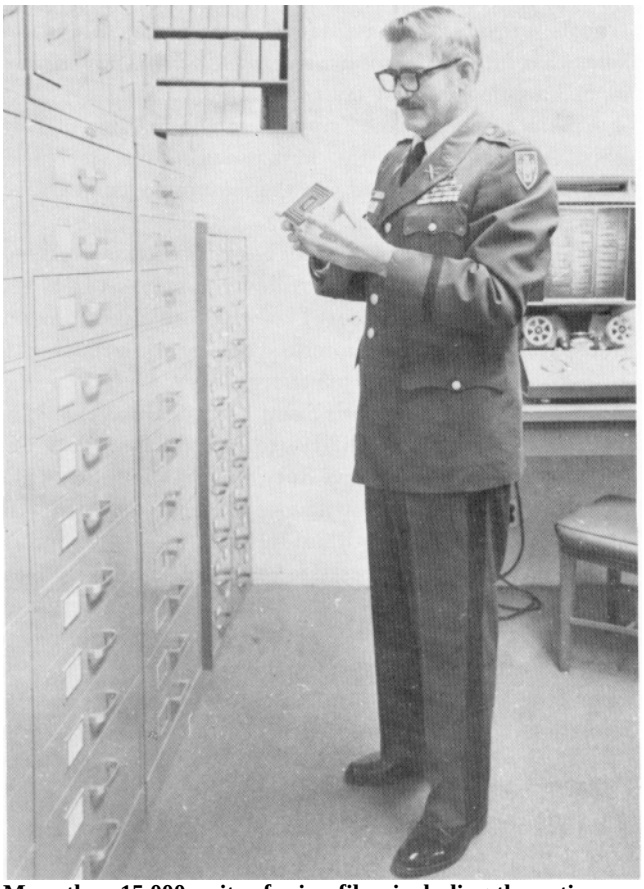
A major strength of the library is the unusual depth of its retrospective collection. The oldest discovered work in the library is dated 1702 and there are many more of a comparable nature — particularly, as one would expect, in the area of military history, military science or artillery. This collection would compare favorably to that of most university libraries.

A portion of the library collection includes a document file of more than 10,000 items — a wealth of information on such varied subjects as Saint Barbara, former officials of USAFAS, operational reports from WWII, reports on past major maneuvers and correspondence of former leaders. These reports provide a great deal of food for thought for today's serious professional. Consider the comments of a captured German lieutenant general of Artillery contained in his *Detailed Interrogation Report*, dated 27 June 1945. He says, "Almost invariably, the German observers in WWII could plot the US divisional sector lines (boundaries!) upon terrain merely by making note of gaps between zones of fire of division artillery."

The permanent portion of the collection contains such treasures as the annual reports of CPT Dan T. Moore, founder of the present FA School, in which he sounds the perennial gunnery instructor's lament about the deplorable lack of students' gunnery knowledge upon their arrival at Fort Sill, despite years of service, etc., etc.

Then there is General Snow's manuscript of his book describing his services as Chief of Field Artillery during WWI. He presents a spirited defense of the need for such an office. There are also copies of several reports and studies made over the years which caused profound effects on field artillery organization, materiel, etc. For example, there is the report of the Westervelt or Caliber Board, tasked with the mission of making "a thorough study of the armament and types of artillery materiel to be assigned to a Field Army." This study was made in France for the Chief of Field Artillery immediately after WWI. The board results guided field artillery research and development up to WWII. Its counterpart in organizational concepts was the *Report of the Hero Board.* This study was conducted during the same time frame and was based primarily on the results of firsthand experiences in the American Expeditionary Force (AEF), as well as in the conduct of stateside training.

The history of the Field Artillery has been shot through with attempts to either combine artillery with or separate it from another arm or branch. Many studies have been made on this subject; even though some are not available in the library, the gist of each is contained in available studies and periodical articles. One of the best sources is *The Artillery Branch Study* (1966-1967) which provided the final impetus for the most recent split with the Air Defense Artillery. In addition to an excellent bibliography on the subject, it also provides one of the best capsule histories available of the trials and tribulations of the artillery since its birth in the Revolutionary War. Questions generated in this study immediately triggered *The Artillery Branch Knowledge Study* which drove the final nails into the coffin containing the dead body of an "integrated" artillery. Judging from history, however, don't be surprised if it suddenly pops up from the grave in the future. As a matter of interest, this last board was chaired by then COL David E. Ott (now CG of Fort Sill and Commandant of USAFAS) and one of the members was then LTC Clayton L. Moran (now Deputy Assistant Commandant).



More than 15,000 units of microfilm, including the entire run of the *New York Times* since 1851, provide quick reference to the daily events of the past 125 years.

Most active duty officers above the grade of capatin are familiar with the 1966 *Board to Review Army Officer Schools* or the "Haines Board," which recommended several far-reaching changes to the system, many of which were later adopted. One of these was the introduction of the electives concept in the FA Officers Advanced Course, providing a classic example of how short-lived such innovations can be when the money crunch hits.

If you have a favorite organization you'd like to know more about, particularly a field artillery organization, chances are you can find something about it in the Morris Swett Library. The library contains a collection of USA field artillery unit histories that is probably unexcelled. The strength of this collection was the reason for a recent visit from a staff member of the Office of the Chief of Military History.

The library also holds an analytical entry card index system that may be unique. This collection of approximately 90,000 cards represents an effort to index military journals received by the library. The value of the collection is further enhanced because the indexers also indexed retrospectively, as older material was acquired. Thus, military journals published prior to 1900 were indexed. Efforts are being made to publish this index, making it available to researchers throughout the world.

The library also boasts an expanded "Subject Headings File" and a "Military Science Classification Scheme." Both were developed over a period of some 50 years, and additional years were required to fill a gaping void in the information available in this area from the Library of Congress, whose classification system is used by the Morris Swett library. Again, efforts are being made to publish this information for use by libraries. One copy of the "Scheme" is already being used by the US Army Military History Research Collection at Carlisle Barracks, PA, and several libraries have expressed interest.

The Swett Library collection holds over 15,000 units of

microfilm to include such items as the entire run of the *New York Times* since its founding in 1851, research reports from the Defense Documentation Center, documents from WWII archives, etc. Also included is an excellent collection of back runs of military and military-related periodicals, both bound and on microfilm. Many go back well into the 1800s.

The Morris Swett Library, however, is not just some sort of field artillery archives. The library is a completely viable organization with an extensive program to improve its ability to provide more up-to-date information, particularly in technical areas. This program includes a major effort to increase holdings in the governmental and technical indexing and abstracting areas. As a part of this effort the FMs, TMs, ARs and similar holdings are being extensively expanded. Other services which are being made available are:

- Rand Reports.
- US Army Human Engineering Lab Reports.
- Research Progress Reports from the US Army Research Office.
- Human Resource Research Office publications.
- US Army Logistics Management Center Studies.
- National Technical Information Service Government Reports, Announcements and Indexes (includes Defense Documentation Center Reports and Technical Abstract Bulletins).
- Bell Lab Reports.
- Lincoln Lab Reports.
- Joint Army-Navy Aeromedical Reports.
- National Aeronautics and Space Administration Abstracts.
- Air University Index.
- Applied Science and Technology Index.
- US Army Research Institute for the Behavioral and Social Sciences Reports.
- Register of Intelligence Publications and Scientific and Technical Intelligence Register (U).
- National Intelligence Service Publications.
- Central Intelligence Agency Weekly Summaries.
- Defense Intelligence Agency (DIA) Military Intelligence Summary (U).
- DIA Order of Battle Summary, Foreign Ground Forces (U).
- Army Materiel Systems Analysis Agency Technical Reports.

MOS test preparation is facilitated through utilization of Morris Swett's extensive assemblage of TMs, FMs, ARs and other job and duty-related publications.

The library is making a particular effort to improve its holdings in MOS-related materials, obtaining any available study texts from proponent service schools. Since not all schools provide this assistance and as updating is a somewhat hit-or-miss affair, some difficulty is experienced in maintaining current material.

A major problem is the "rip-off" rate in the area of TMs, FMs, ARs, etc. Then the library staff must face irate patrons who are unable to find the required documents just prior to their MOS tests.

A Xerox 3100 copier is available at a nominal cost. An improved model which will provide larger copies (up to 14″ x 20″) has been ordered. The 3100 will also produce transparencies; and microform copiers are available to authorized patrons on a noncharge basis.

The services of the Morris Swett Library are available on a normal basis to all military (to include Reservists and National Guardsmen), active duty military dependents and Department of Army civilians. Anyone may use the material and facilities within the library itself. Normal interlibrary loan services are available through local libraries using either standard interlibrary loan forms or DA Form 2463. Since all federal libraries are required to conform with the *Privacy Act*, patrons are requested to adhere to the borrowing procedures. Additional information on library facilities may be obtained at the following numbers: (405)351-4477/2982 or AUTOVON 639-4477/2982.

It's *the* library for *all* field artillerymen. Why not use it?

LTC James H. Byrn, FA, USAR, is the Supervisory Librarian of Fort Sill's Morris Swett Library.

Reprinted from ARMOR magazine.

How To Defend Outnumbered And Win

by LTC David L. Tamminen

In any future conflict, the US Army will find itself fighting outnumbered. In order to offset the enemy's numerical superiority in the initial battles of the next war and to incorporate the latest advances in technology, new defensive doctrine has been developed. The purpose of this briefing is to orient you on how we see the conduct of the new defense.

Both as a quick refresher and as a comparison, figure 1 portrays a heavy division deployed under current defensive concepts. Close to the enemy is a covering force normally controlled by corps. It picks up the enemy, delays him for a time, does some fighting and then passes to the rear. It conducts a passage of lines and hands-off the enemy to the next layer, which is the general outpost, controlled by division. This force also does some fighting and delays the enemy to some extent. It, in turn, passes back through and hands-off the enemy to a third layer, the combat outpost. They do little fighting but must hand-off the enemy and make a passage of lines. The covering force usually goes all the way out of the division area. The general outpost often goes to the division rear, and the combat outpost goes to the task force rear. In the area defense, the mission of the division is to stop the enemy forward of or at the FEBA. To do this, the bulk of the division's combat power is allocated to the forward defense area. In the mobile defense, emphasis is still on retention of terrain; however, the division allows a controlled penetration to develop, with the intention of ultimately restoring the FEBA by counterattacking with four or five maneuver battalions to destroy the enemy caught inside the penetration. We are certain that neither of these styles of defense will allow us to defeat the hordes of enemy we expect to encounter in the next war.

Since enemy forces will be numerically superior to the friendly forces in the initial battles, our defense is being modified significantly. The emerging concepts for defense focus on the enemy rather than on terrain. Defense will be conducted in depth, using all means available to destroy the enemy within the defensive sector, contain him or force him to withdraw.

The following four tenets should guide leaders and soldiers as they go about setting up the defense.

First: *The defender must understand the threat* in terms of the large masses of enemy to be encountered, the technical capabilities of his equipment and his tactics of mass and breakthrough. In brief, we know that the enemy's weapons are good — about equal to ours — and that he moves to contact with multiple motorized rifle or tank battalions, normally deployed in a march column 800 to 1,000 meters in length. A forward reconnaissance screen precedes the lead battalions. It has the mission of locating our positions and any weak points that may exist. If the reconnaissance elements locate our positions, we will be suppressed with artillery, while he attempts to bypass and to penetrate into our rear area. If he cannot bypass our positions, the enemy will conduct a hasty attack, deploying directly from his march column. If this attack is unsuccessful, the enemy takes up a hasty defense (as close to the defenders as possible), while the following battalions

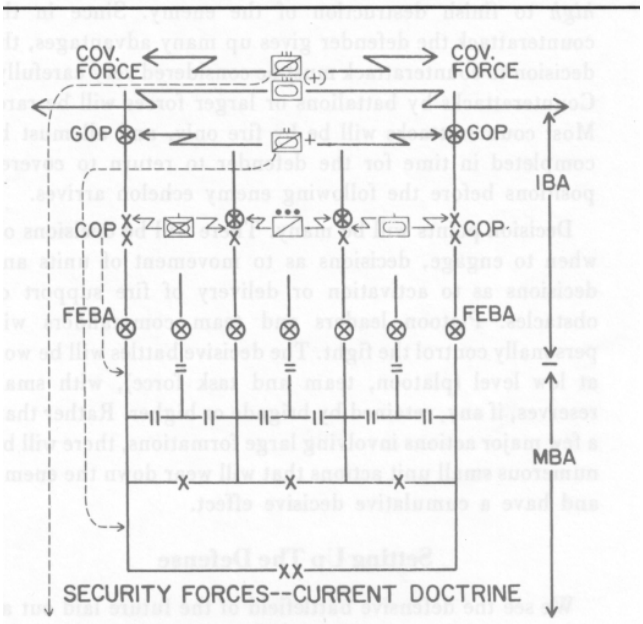


Figure 1.

conduct a deliberate attack. If none of these works, he will mass his offensive power, as much as two divisions on six to eight kilometers and make a breakthrough attack. Enemy forces will accept heavy casualties to accomplish their mission.

Second: *The defender must know the terrain* and use it to best advantage. As a defender, he can do this better than the attacker because he controls the ground over which the battle will be fought. He can choose the specific ground on which he wants to fight, prepare positions, emplace obstacles, reconnoiter routes, prestock supplies and examine the battlefield in advance from both his own and the enemy's point of view. He can operate from behind carefully selected cover and from positions in defilade. While the attacker must often use his firepower on the move or in hastily selected positions, the defender can emplace his weapons on reverse slopes so he can fire at optimum ranges without exposing himself to the frontal fires of the enemy.

Third: *Defend in depth.* Since the defender has to fight and win while outnumbered, he cannot afford to occupy fixed positions along the FEBA and slug it out. Instead, he must fight the defense in depth, taking advantage of every aspect of the terrain and his equipment to whittle away at the enemy as he presses the fight. In essence, the defensive scheme requires setting up a series of positions, in depth, from which the defensive battle will be fought. Each set of positions should approximate a mini-ambush. By engaging in ambush-like actions, then moving, the defender can take out two or three enemy vehicles with each weapon of his own, while losing none in the process.

Fourth: *Counterattack when probability of success is high* to finish destruction of the enemy. Since in the counterattack the defender gives up many advantages, the decision to counterattack must be considered very carefully. Counterattacks by battalions or larger forces will be rare. Most counterattacks will be by fire only, and all must be completed in time for the defender to return to covered positions before the following enemy echelon arrives.

Decision points will be many. There will be decisions on when to engage, decisions as to movement of units and decisions as to activation or delivery of fire support or obstacles. Platoon leaders and team commanders will personally control the fight. The decisive battles will be won at low level (platoon, team and task force), with small reserves, if any, retained by brigade or higher. Rather than a few major actions involving large formations, there will be numerous small unit actions that will wear down the enemy and have a cumulative decisive effect.

Setting Up The Defense

We see the defensive battlefield of the future laid out as shown in figure 2. The battlefield will normally be organized into two areas: covering force area (CFA) and main battle area (MBA). Covering forces will be antitank-heavy and will fight a major battle to make the enemy form his breakthrough attack. Knowing the location of the massed enemy and the direction of his breakthrough attempt, commanders in the MBA can move to defeat him. Note several changes already embodied in the CFA. We have a single force which is strong and capable of inflicting great damage. We do not have a triple layer, none of which is capable of doing much by itself. We have but *one* passage of lines, not three, and *one* hand-off of the enemy, not three. In addition, these extremely capable tank-killing forces are

COVERING FORCE AREA (CFA)

- Antitank hvy (tanks, Sheridans, TOWS, AH)
- Inflicts maximum destruction without sacrificing tactical integrity of force in order to strip away enemy's recon elements, force enemy to deploy, bring up artillery attack and thereby reveal his composition, strength, capabilities, and intentions

MAIN BATTLE AREA (MBA)

- Forward committed battalions
  - Initially mech inf-hvy
  - More tank units are available after IBA battles
  - Fights decisive battle in order to destroy, contain, or force the withdrawal of the enemy from the assigned sector
- Reserves (Bde/Div)
  - Add depth
  - Blocks, reinforces, or counterattacks

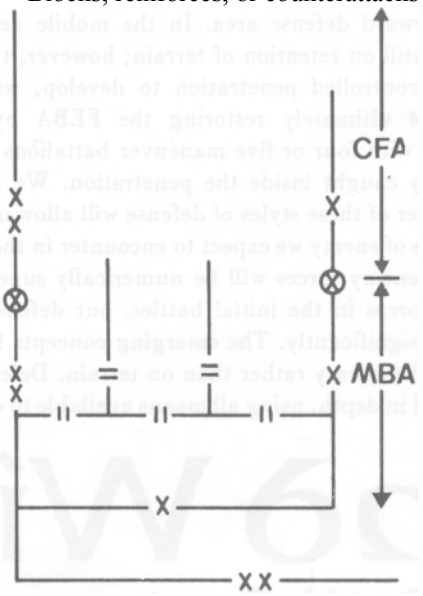


Figure 2. – Layout of battle area.

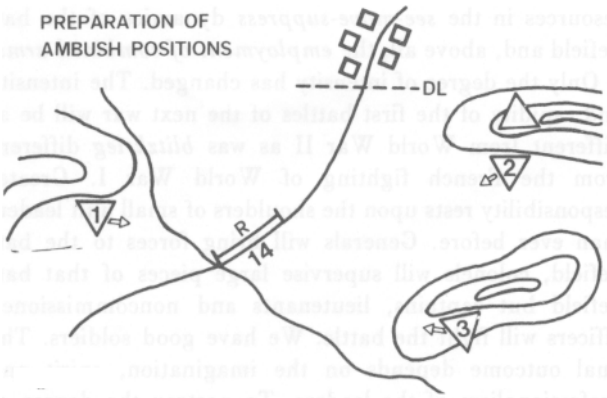


Figure 3.

retained in the MBA and are not sent to the corps rear.

In the MBA, we visualize much wider and deeper sectors than in the past. A tank-heavy task force may defend a sector which is eight or nine kilometers wide by 15 or 18 kilometers deep. An MBA task force commander is successful if he prevents the enemy from passing his rear boundary. He can destroy, contain or drive the enemy back. Very often the division will place all three brigades forward and will retain a relatively small reserve positioned in depth, along the most likely enemy avenues of approach. The reserves will be committed to the fight by attachment to forward brigades.

Using the four tenets discussed previously, let's examine how a team commander goes about setting up his defense. Figure 3 represents a piece of ground in which there are several hilltops, a small village near the top and a road running diagonally to the left across a small stream. A team commander having this terrain as part of his defensive area would, during the preparatory stage, reconnoiter battle positions behind all these hills (battle positions are portrayed graphically as numbered triangles). These positions are general locations assigned by battalion or identified by the team commander as a result of his reconnaissance (each arrow indicates a primary direction of fire). As a rule of thumb, positions are always planned, prepared and reconnoitered at least three deep. In reconnoitering a battle position, the team commander considers its suitability in terms of field of fire, cover, concealment and routes of withdrawal. If found inadequate, he either plans to improve them or he selects a new position, notifying task force of the change.

While reconnoitering battle positions, the team commander also verifies areas where the fires from one or more terrain-masked battle positions can be placed on an exposed enemy. He then prepares an integrated defense plan for each set of positions, showing likely engagement areas, sectors of fire and things not shown on the illustration, such as indirect fire targets, obstacles, location of security elements and surveillance sectors. He plans indirect fires forward of the team's initial positions, within likely engagement areas and along routes of withdrawal. He also plans fires to cover dead space and obstacles. Observation posts (OPs) are sited for observation along avenues of approach. Ground surveillance radar is positioned to provide surveillance along avenues the enemy will use at night, in rain or other periods of reduced visibility.

Conducting The Defense

Having prepared the defense in depth, the following example illustrates how a typical defensive action is conducted at company/team level. In this situation (figure 4), a balanced team operating as part of a mech-heavy task force is deployed astride an enemy battalion-size avenue of approach. Tank platoons occupy battle positions 5 and 6. Mechanized infantry platoons occupy battle positions 2 and 4. The team command group (consisting of the team commander, artillery FO and mortar FO) is located in the vicinity of battle position 6.

At 0715, team OPs sight an enemy tank battalion supported by a company of motorized infantry moving toward the river. As enemy forces near the river, enemy artillery begins to fall within the team battle area.

Analyzing the situation and using his knowledge of enemy tactics, the team commander decides not to reveal the ambush positions of his forces but initially engage the enemy with artillery. He directs the platoon leader located at battle position 2 to adjust artillery on the crossing site, hold ambush fires until the lead elements have crossed the river and attempt to widen the bridgehead.

Following the initial artillery engagement, the platoon leader at battle position 2 reports some enemy vehicles damaged and more than 30 crossing the river.

At 0725, the OP reports light artillery is continuing to fall in his area, that the enemy battalion has crossed the river and is approaching the team's area. Another reinforced enemy battalion has just arrived at the river and is starting to cross. The team commander instructs the OP to remain

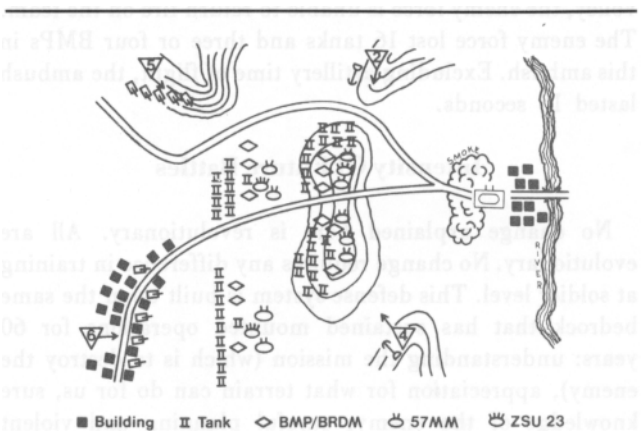


Figure 4.

in position. The commander quickly considers his situation. Are his forces ready to engage this enemy unit? Can he afford to ambush two battalions? Is artillery available? What is happening on the left and right? Among the many mental decision lines (DLs), the team commander decides that when the leading enemy vehicles reach the road junction about 800 meters from the town, he can make no more adjustments. He must either fight or get out. He has already planned a trigger point where action will be initiated. This point, one of several trigger points, is known to all platoon leaders. If, for any reason, a platoon is out of communication with its headquarters, it is free to engage any enemy force crossing a trigger point.

When the first enemy vehicles approach the trigger point, the team commander calls for fire to blind the following battalion, thus isolating the lead battalion momentarily. Then he calls for preplanned fire in the target area. Knowing the time of flight of the artillery, he waits a few seconds so that when he engages by direct fire, he will only do so for the few seconds before artillery fire impacts. Having imposed "hold fire" on all platoons, they know by SOP that they fire, in this case, only on signal. He then has two missiles (TOWs) fired from battle positions 2 and 4. Upon impact of the TOWs, the tank platoons immediately terminate the engagement and, using covered and concealed routes, move to new battle positions. The team commander evaluates the damage on the enemy and reports to the task force commander. Depending on the situation, the team commander might have decided to reengage in the same general area, to counterattack or to move to different battle positions and do it again. The mortars, having initially suppressed enemy overwatch positions, shift to augment the artillery fire covering the team's relocation to other battle positions. This fire in the target area both continues destruction started by tanks and TOWs and degrades the enemy's ability to return fire on them. Since the ambush is executed quickly and the platoons move into covered positions after their third volley, the enemy force is unable to return fire on the team. The enemy force lost 16 tanks and three or four BMPs in this ambush. Excluding artillery time of flight, the ambush lasted 15 seconds.

Intensity Of Future Battles

No change explained here is revolutionary. All are evolutionary. No change requires any difference in training at soldier level. This defense system is built upon the same bedrock that has sustained mounted operations for 60 years: understanding the mission (which is to destroy the enemy), appreciation for what terrain can do for us, sure knowledge of the enemy, careful planning and violent execution. It depends on good gunnery, integration of all resources in the *see-move-suppress* dynamics of the battlefield and, above all, the *employment of combined arms*.

Only the degree of intensity has changed. The intensity and rapidity of the first battles of the next war will be as different from World War II as was *blitzkrieg* different from the French fighting of World War I. Greater responsibility rests upon the shoulders of small unit leaders than ever before. Generals will bring forces to the battlefield, colonels will supervise large pieces of that battlefield but captains, lieutenants and noncommissioned officers will fight the battle. We have good soldiers. The final outcome depends on the imagination, spirit and professionalism of the leaders. To portray the degree of intensity we do expect and, therefore, the degree of responsibility we must expect from small unit leaders, here are some results from one of a series of detailed studies.

The study, called *Hunfeld II*, examined the actions of a portion of the covering force in Europe. In the scenario, a covering force slice of two regimental cavalry squadrons, one tank-heavy task force and one attack helicopter platoon, supported by 14 artillery batteries, operated against a reinforced threat tank division in an assumed first battle of the next war. The covering force slice had a frontage of 18 kilometers and an available depth of 18 to 35 kilometers. The purpose of the study was to determine whether or not a covering force could fight with intensity sufficient to convince the enemy that he could not succeed in his offensive with anything less than a mass breakthrough attack. If the generals and colonels are to succeed in defeating the enemy offensive in the MBA, they must know where the enemy is massed and they must position forces to meet and destroy that mass.

The enemy commenced his attack approximately one hour before daylight with a 25-minute artillery preparation by more than 300 tubes. The effect of that fire, even on covering force units dispersed by platoon in scattered battle positions, was very severe, especially on lightly armored and support vehicles. The enemy ground attack followed immediately thereafter, as artillery fires slackened somewhat and became more selective. In spite of the adverse odds (1 to 5 initially), by 30 minutes after daylight the covering force had reduced the enemy division by 55 percent. The division commander had but two choices: he could continue the attack, in which case the division would be *totally* destroyed, or he could halt and defend. Neither choice accomplished the mission. The higher commander would be compelled to commit fresh divisions and to commit them in mass if he were to conform to the timetable of a 30- to 50-kilometer advance the first day.

We Can Defend Successfully

Now some raw data from that study and some conclusions:

For a member of the covering force, the first battle of the next war may last one hour. Even counting enemy artillery preparation time, the battle may be of only about 90 minutes' duration. In the *Hunfeld II* study, supporting US artillery fired about 15 percent of its basic load in that 90 minutes. The average tank fired only four rounds, but the average is meaningless. The most active tank fired 15 rounds, almost 25 percent of its on-board load. Among tank platoons, the unanimous choice of ammunition was APDS. Tankers fired this exclusively, at all ranges. Among cavalry platoons, the choice of ammunition was missile over conventional in a ratio of 4 to 3 (a choice driven by engagement range, with 1,200 meters as the crossover to the missile). A comparison of effectiveness of M-60A1-equipped tank platoons and Sheridan-equipped cavalry platoons tells us that — in European terrain against a tank threat — an accurate, rapid-firing conventional gun is better than an accurate, slower-firing missile system. Since tanks survive enemy artillery fire better than Sheridans, indications are that the proposed cavalry platoon of main battle tanks and armored reconnaissance scout vehicles (ARSVs) will do even better in this defense than the current cavalry platoon does. The average US platoon moved twice in the one hour of fighting and moved a distance of two and a half kilometers; each time not to the rear, but laterally. Again, some platoons did not move at all — some moved three and four times. The average platoon spent about 15 percent of the battle relocating to new positions or counterattacking.

Summary Of Engagements

Fifty engagements of one type or another were examined in detail. Here is the summary of types of engagements.

Maneuver platoons were involved in 33 engagements. Of these, less than half involved more than one platoon. This is an indicator of the speed of the battle, since commanders often could not move quickly enough from one fight to the next to insure the presence of more than one platoon. It also indicated that a platoon can ambush a battalion and, as you will see in a moment, can inflict great damage while suffering little.

Of the 50 total engagements, 32 were in or near preplanned target areas — or a planning accuracy of 64 percent.

As for engagement ranges, the average range for all weapons was 1,200 meters: for M-60A1 tanks firing APDS, 1,130 meters; for Sheridans firing missiles, 1,560 meters, firing conventional, 660 meters. In considering these ranges, remember the meaning of "average" and that this was Hunfeld-Fulda terrain.

We found that of 36 artillery fire requests made during maneuver, 20 (or 55 percent) were made by platoon leaders rather than by forward observers, and the disparity was increasing steadily. Now for the bottom lines:

US Losses

Vehicle	Artillery	Direct Fire	Total Losses
M-551	36	11	47
M-113	22	6	28
M-60A1	6	2	8
	64	19	83

One message is clear. Of the 83 US vehicles lost, 64 were lost to artillery fire. Sixty were lost during the enemy's initial preparatory fires. Few vehicles, weapons or men were lost to direct fire since proper use of the techniques described denies the enemy the opportunity to shoot back at anything.

Enemy Losses

Vehicle	Artillery	Direct Fire	Mines	Total
Tank	7	177	15	199
BMP	47	31	0	78
ZSU	8	7	0	15
BRDM	3	1	0	4
AVLB	1	0	0	1
	66	216	15	297

As reflected here, enemy tanks were priority targets for our direct fire systems. Lighter vehicles were much more vulnerable to the artillery fire which covered relocation of friendly units. Finally, the exchange ratios.

Loss Ratios (Blue Vs. Red)

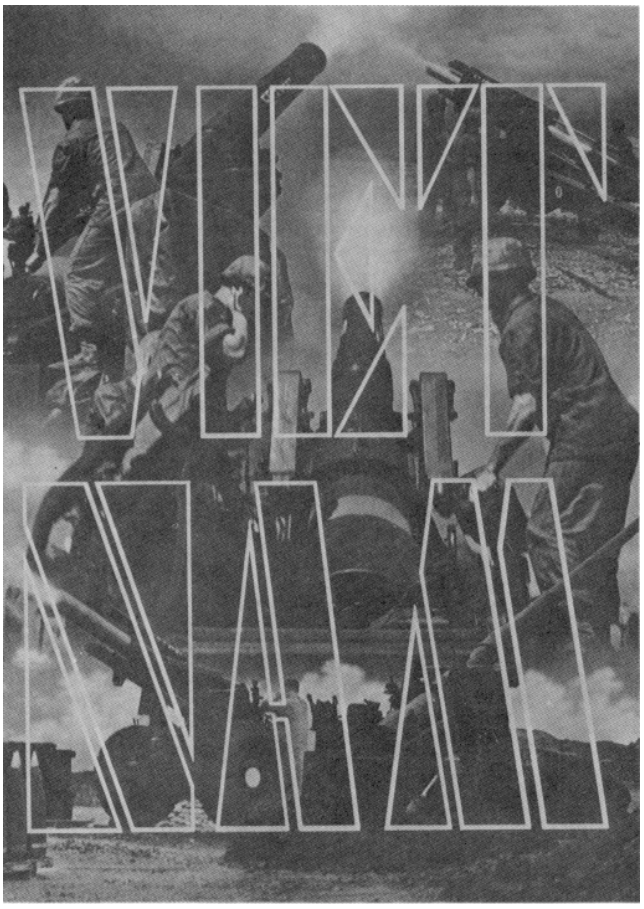
Direct Fire	1 to 11.4	Overall	1 to 3.58
Artillery	1 to 1.02	Blue Hit (percent)	56.8

As indicated earlier, we did not do well during the enemy prep. Thereafter, in direct fire exchange, we did very well. It was as a result of the 1 to 11 exchange that, by the end of one hour, we had compensated for the 60 to 0 situation inflicted on us by artillery and were making the overall exchange ratio more and more favorable (1 to 3.5 and rising).

The overall conclusion was: Yes, the covering force can do the job. It can defeat an enemy or series of enemy forces which outnumber it. The simple mathematical fact is: If we are outnumbered 1 to 5, we must have exchange ratios that are higher, or we lose. We cannot spend a tank, or an attack helicopter or a TOW system and get only three or four of the enemy in return. This defense and the techniques that go with it, when properly planned and properly executed, do permit us to defend outnumbered and win.

LTC David L. Tamminen, AR, is a member of the How To Fight Team, USA Armor School, Fort Knox.

Part V
The Hot War (Continued)



The Battle Of Khe Sanh

by MG David E. Ott
Commandant, USAFAS

The 66-day battle of Khe Sanh, which began in January 1968, became a classic defensive operation for US forces. It tested American concepts of defense and demonstrated that good fire support could effectively neutralize a superior force.

Khe Sanh sits atop a plateau in the shadow of the Dang Tri Mountains and overlooks a tributary of the Quang Tri River. Surrounding it on all sides are hills from which the North Vietnamese could shell the base. If controlled by the Marines, however, the hills would form a ring of protection for the base and afford good vantage points for detecting enemy movement. American involvement at Khe Sanh had begun in 1962 when Special Forces elements established a Civilian Irregular Defense Group camp at the site that was later known as the Khe Sanh Combat Base. Its purpose was to counter enemy infiltration through the area and provide a base for surveillance and intelligence-gathering operations in the western part of northern I Corps. Marine units occupied the base in late 1966 and the Special Forces moved southwest to the village of Lang Vai.

Between late 1966 and late 1967, activity around the base fluctuated from heavy contact to none at all. Then in December 1967 a surge of enemy activity began. Reconnaissance teams reported large groups of North Vietnamese moving into the area. The movement in itself was not irregular, but now the forces were staying — not passing through. The enemy was building up men and equipment in preparation for a siege. The enemy initiated major offensive action around Khe Sanh early in January 1968 when he shifted his emphasis from reconnaissance and harassment to actual probes of friendly positions.

On the night of 2 January an outpost at the western end of the base reported six unidentified figures walking around outside the wire. When challenged, they made no reply and were taken under fire. Five of the six were killed. Later investigation disclosed that the dead included a North Vietnamese regimental commander and his operations and communications officers. The commitment of these key men to such a dangerous reconnaissance mission was a clear indication that something big was about to happen.

In the predawn of 21 January, the enemy began his anticipated move against Khe Sanh. Just after midnight rockets and artillery shells began impacting on Hill 861 to the northwest of the city. A full-scale ground attack followed, only to be repulsed after several hours of fighting. At 0530 another intense barrage of 82-mm shells and 122-mm rockets hit Khe Sanh. Damage was substantial — a major ammunition dump and a fuel storage area were destroyed. When news of the attack reached the United States, many questioned the feasibility of defending Khe Sanh. The base was isolated and, with Route 9 interdicted, would have to be resupplied by air. Fearing that Khe Sanh

would become an American Dien Bien Phu, critics favored a pullout.

The problem, therefore, was not merely how to defend the base but whether the base should be defended at all. General Westmoreland and General Cushman, commander of III Marine Amphibious Force, decided to defend Khe Sanh. The base and adjacent outposts commanded the plateau and the main avenue of approach into eastern Quang Tri Province. Although these installations did not stop infiltration, they blocked motorized supply from the west. Another advantage to holding the base was the possibility of engaging and destroying a heretofore elusive foe. At Khe Sanh, the enemy showed no desire to hit and run but rather chose to stand and fight. The marines could fix him in position around the base while air and artillery barrages closed in. Finally, two crack North Vietnamese divisions, which might otherwise have participated in attacks in other areas of South Vietnam, were tied down by one reinforced Marine regiment. The decision made, all that remained was to complete the buildup of men and materiel required to hold the base.

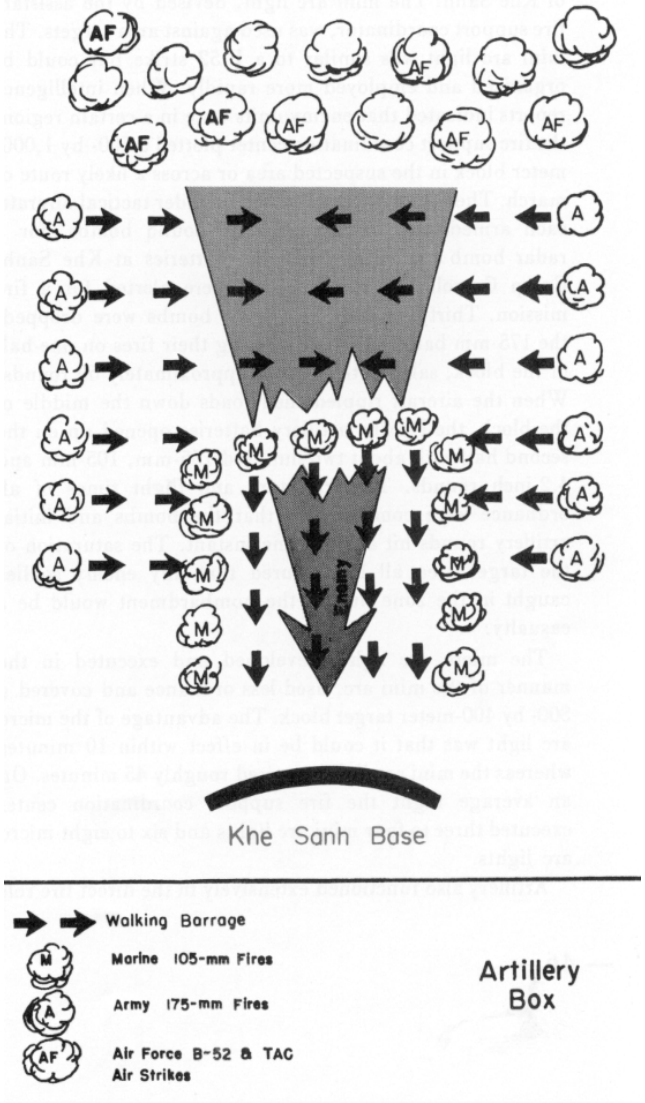
Air power and artillery played an important role at Khe Sanh and were given the highest priority. The Khe Sanh defenders had three batteries of 105-mm howitzers, one battery of 4.2-inch mortars and one battery of 155-mm howitzers. All five batteries were Marine artillery. In addition, they were supported by four batteries of Army 175-mm guns, one at the "Rockpile" (north of the base) and three at Camp Carroll (to the east). These artillery pieces, 46 in all, were supplemented by 90-mm tank guns, 106-mm recoilless rifles and tactical air support. The fire support coordination center, the 1st Battalion, 13th Marines (Artillery), located at Khe Sanh, controlled all supporting arms fire. Once the fighting began, the battalion commander, Lieutenant Colonel Lownds, said that the side which kept its artillery intact would win the battle. Only three American artillery pieces were destroyed during the entire siege.

Since the enemy maneuvered mainly under cover of darkness, the Marine and Army batteries were most active during these hours. Preplanned artillery fires included combined time-on-target fires from nine batteries, separate battalion time-on-target missions, battery multiple-volley individual missions and battery harassment and interdiction missions. Fire support coordination progressed to the point that artillery was seldom check fired while tactical aircraft were operating in the area. Throughout the battle 158,981 rounds of various calibers of artillery were directed against enemy locations around the base.

During the siege, air-delivered fire support reached unprecedented levels. A daily average of 45 B-52 sorties and 300 tactical air sorties struck targets near the base. A daily expenditure of 1,800 tons of ordnance laid waste wide swaths of jungle terrain and caused hundreds of secondary explosions. In 70 days of air operation, 96,000 tons of bombs (nearly twice what the Army Air Corps delivered in the Pacific during 1942 and 1943) pulverized the battle area.

In addition to volume, reaction time was a key factor. Relatively easy clearance procedures meant immediate response — unless friendly aircraft were in the target area — regardless of the weather. Artillery rounds were usually on the target area within 40 seconds after the call for fire. This instant artillery impaired enemy movements within the tactical area of responsibility and helped to break up numerous attacks.

Protective fires were carefully planned in advance. The fires of the artillery batteries planned by the fire support coordination center prevented the enemy assault forces from reaching the perimeter wire. Because the North Vietnamese usually attacked with their battalions in column, the center also planned fires to isolate the assault elements from the reserves. When the enemy launched his attack, the center placed a three-sided artillery box around



the lead enemy battalion. Three batteries of the 1st Battalion, 13th Marines, executed this mission. The fourth battery then closed the remaining side, which faced the friendly positions, with a barrage that rolled from one end of the box to the other much like a piston within a cylinder. The enemy force in the box could neither escape nor avoid the rolling barrage. Those North Vietnamese who spilled out of the open end of the box came under the final protective fires of the marines along the perimeter. At the same time, the fire support coordination center placed a secondary box around the North Vietnamese backup units. The four US Army 175-mm batteries were responsible for two sides, which were about 500 meters outside the primary box. On order, the gunners rolled their barrage in toward the sides of the primary box and back out again. The third side was sealed by continuous flights of aircraft under the control of radar. Whenever B-52s were available or could be diverted in time, arc light strikes saturated the approach routes to the battle area.

The manner in which the center coordinated its air and artillery support was another critical element in the defense of Khe Sanh. The mini arc light, devised by the assistant fire support coordinator, was used against area targets. The mini arc light was similar to a B-52 strike but could be organized and employed more rapidly. When intelligence reports indicated that enemy units were in a certain region, the fire support coordination center plotted a 500- by 1,000-meter block in the suspected area or across a likely route of march. Then the center called two Intruder tactical aircraft, each armed with twenty-eight 500-pound bombs, for a radar bomb run. Meanwhile the batteries at Khe Sanh, Camp Carroll and the Rockpile were alerted for a fire mission. Thirty seconds before the bombs were dropped, the 175-mm batteries, concentrating their fires on one-half of the block, salvoed the first of approximately 60 rounds. When the aircraft rippled their loads down the middle of the block, the Marine artillery batteries opened up on the second half with about two hundred 155-mm, 105-mm and 4.2-inch rounds. The trajectory and flight times of all ordnance were computed so that the bombs and initial artillery rounds hit at the same instant. The saturation of the target area all but insured that any enemy soldier caught in the zone during the bombardment would be a casualty.

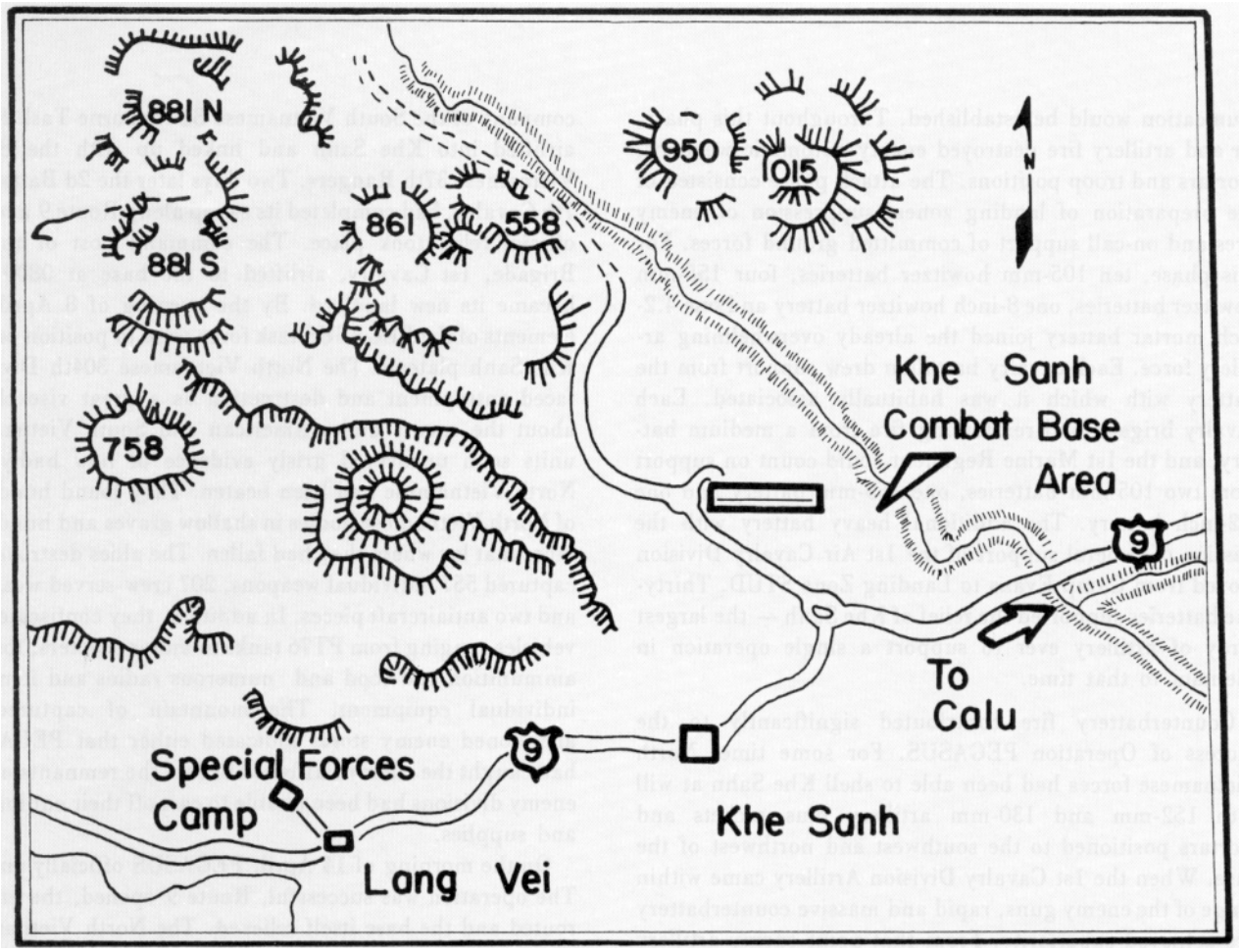
The micro arc light, developed and executed in the manner of the mini arc, used less ordnance and covered a 500- by 400-meter target block. The advantage of the micro arc light was that it could be in effect within 10 minutes whereas the mini arc light required roughly 45 minutes. On an average night the fire support coordination center executed three to four mini arc lights and six to eight micro arc lights.

Artillery also functioned extensively in the direct fire role against targets of opportunity. The three Marine 105-mm howitzers on Hill 881S demonstrated the effectiveness of this technique. An alert machine gunner on the hill spotted a 20-man column of North Vietnamese slowly climbing Hill 758, due south of 881S. They were carrying what appeared to be several mortar tubes. The marines, from a range of 1,200 meters, managed to hit several of the enemy. Instead of scattering, the remaining soldiers clustered around their fallen comrades. The Marine gunners pushed aside their parapet, depressed the tube for a downhill shot and slammed a dozen rounds into the midst of the tightly packed enemy group. All 20 were killed.

While supporting air and artillery whittled away the strength of the enemy, the defensive posture of the Khe Sanh combat base grew more formidable. A full-scale ground attack would be costly. However, the North Vietnamese forces remained determined and, during the last 10 days in February, launched several attacks. The most significant attack occurred 29 February-1 March.

Early in the evening of 29 February, intelligence showed the enemy moving toward the eastern perimeter of the camp. The fire support coordination center called for saturation of the enemy route of march. Massed artillery, tactical air and mini and micro arc lights were targeted in blocks to the east, southeast and south. B-52 strikes added to the carnage in the area. The enemy attempted three ground assaults during the night at 2130, 2330 and 0315. All were stopped short of the perimeter by intense ground fire and air and artillery barrages. Later in the morning of 1 March, 78 enemy bodies were found, some still in their assault trenches, peppered with holes from the artillery airbursts. Although the exact number of enemy killed was never accurately determined, Montagnard tribesmen inhabiting the surrounding hill reported finding 200-500 bodies at a time stacked in rows along the trails and woods leading to the base. The North Vietnamese forces apparently had been caught while on the march and had been mangled by air raids and piston-like artillery concentrations.

Beginning in mid-March, US intelligence personnel noted an exodus of major North Vietnamese units from the battle area. Most of one division pulled back into Laos. As the enemy settled into a wait-and-see strategy, heavy incoming fires and limited ground probes nevertheless continued to plague the marines. But this waiting game proved disastrous because clear skies dominated the area for all but five days in March and the air strikes were stepped-up considerably. The observers had unrestricted visibility and were able to ferret out artillery positions and bunker complexes. The clear skies and accurate supporting fires formed a potent combination, and the number of confirmed enemy dead recorded in March increased approximately 80 percent over the number recorded in



Khe Sanh Valley

February.

On 31 March, the 1st Cavalry Division took control of the 26th Marine Regiment, signalling the start of PEGASUS, a 15-day air assault operation that ended the battle of Khe Sanh. The 1st Cavalry Division, along with the 1st Marine Regiment and the South Vietnamese 3d Airborne Task Force, began a push from Ca Lu, located east of Khe Sanh, to reopen Route 9 and relieve the pressure on Khe Sanh. The siege, in effect, was over.

The basic plan of Operation PEGASUS called for the 1st Marine Regiment, with two battalions, to attack west toward Khe Sanh while the 1st Cavalry Division air assaulted onto the high ground on either side of Route 9 and moved constantly west toward the base. On D plus 1 and D plus 2, all elements would continue to attack west toward Khe Sanh. Then, on the following day, the 2d Brigade of the 1st Cavalry Division would land three battalions southeast of Khe Sanh and attack northwest. The 26th Marine Regiment, holding Khe Sanh, would attack south to secure Hill 471. The linkup was planned for the end of the seventh day.

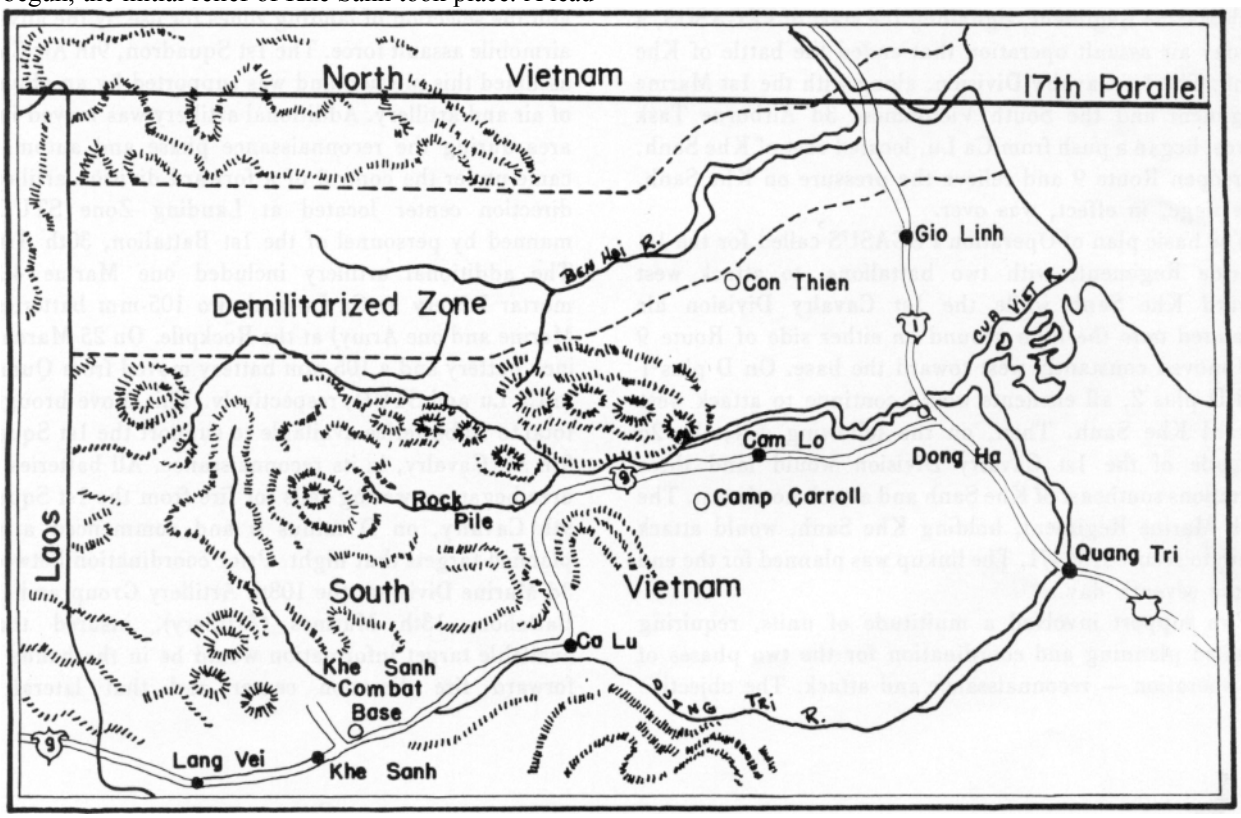
Fire support involved a multitude of units, requiring detailed planning and coordination for the two phases of the operation — reconnaissance and attack. The objective of the reconnaissance phase was the destruction of the enemy antiaircraft resources between Ca Lu and Khe Sanh and the selection of landing zones for use by the advancing airmobile assault force. The 1st Squadron, 9th Air Cavalry, assumed this mission and was supported by an abundance of air and artillery. Additional artillery was moved into the area during the reconnaissance phase and automatically came under the control of a forward division artillery fire direction center located at Landing Zone STUD and manned by personnel of the 1st Battalion, 30th Artillery. The additional artillery included one Marine 4.2-inch mortar battery at Ca Lu and two 105-mm batteries (one Marine and one Army) at the Rockpile. On 25 March an 8-inch battery and a 105-mm battery moved from Quang Tri to Ca Lu and STUD, respectively. This move brought the total to 15 batteries available to support the 1st Squadron, 9th Air Cavalry, in its reconnaissance. All batteries in the area began answering calls for fire from the 1st Squadron, 9th Cavalry, on D minus 6 and commenced attacking planned targets that night. Prior coordination between the 3d Marine Division, the 108th Artillery Group and the 1st Battalion, 13th Marines (Artillery), insured that all available target information would be in the hands of the forward fire direction center and that lateral communication

would be established. Throughout this phase, air and artillery fire destroyed enemy automatic weapons, mortars and troop positions. The attack phase consisted of the preparation of landing zones, suppression of enemy fires and on-call support of committed ground forces. For this phase, ten 105-mm howitzer batteries, four 155-mm howitzer batteries, one 8-inch howitzer battery and one 4.2-inch mortar battery joined the already overwhelming artillery force. Each cavalry battalion drew support from the battery with which it was habitually associated. Each cavalry brigade had reinforcing fire from a medium battery, and the 1st Marine Regiment could count on support from two 105-mm batteries, one 155-mm battery and one 4.2-inch battery. The additional heavy battery with the mission of general support of the 1st Air Cavalry Division moved from Camp Evans to Landing Zone STUD. Thirty-one batteries supported the relief of Khe Sanh — the largest array of artillery ever to support a single operation in Vietnam to that time.

Counterbattery fire contributed significantly to the success of Operation PEGASUS. For some time, North Vietnamese forces had been able to shell Khe Sahn at will with 152-mm and 130-mm artillery plus rockets and mortars positioned to the southwest and northwest of the base. When the 1st Cavalry Division Artillery came within range of the enemy guns, rapid and massive counterbattery fire achieved superiority. From that point enemy artillery ceased to be a serious deterrent to maneuver.

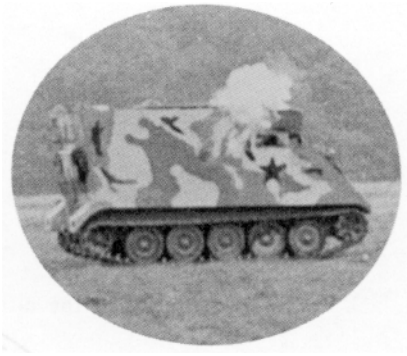
On 6 April at 1350, six days after Operation PEGASUS had begun, the initial relief of Khe Sanh took place. A lead company of the South Vietnamese 3d Airborne Task Force airlifted into Khe Sanh and linked up with the South Vietnamese 37th Rangers. Two days later the 2d Battalion, 7th Cavalry, had completed its sweep along Route 9 and the official relief took place. The command post of the 3d Brigade, 1st Cavalry, airlifted to the base at 0800 and became its new landlord. By the evening of 8 April, all elements of the PEGASUS task force were in position on the Khe Sanh plateau. The North Vietnamese 304th Division faced entrapment and destruction as a great vise closed about the enemy daily. American and South Vietnamese units soon uncovered grisly evidence of how badly the North Vietnamese had been beaten. They found hundreds of North Vietnamese bodies in shallow graves and hundreds more that lay where they had fallen. The allies destroyed or captured 557 individual weapons, 207 crew-served weapons and two antiaircraft pieces. In addition, they confiscated 17 vehicles ranging from PT76 tanks to motor scooters, tons of ammunition and food and numerous radios and items of individual equipment. The mountain of captured or abandoned enemy stores indicated either that PEGASUS had caught the enemy flatfooted or that the remnants of the enemy divisions had been unable to cart off their equipment and supplies.

On the morning of 14 April, PEGASUS officially ended. The operation was successful, Route 9 opened, the enemy routed and the base itself relieved. The North Vietnamese lost 1,304 killed and 21 captured. The battle of Khe Sanh established that, with sufficient fire power, an encircled position could be successfully held and the enemy devastated.



North Quang Tri Province

necessity — the mother of . . .



When was the last time your gun/howitzer sections conducted a live direct fire shoot at moving targets? Chances are, unless you are at an installation which has facilities similar to those used to train tank crews, direct fire training has been limited. Training aids, such as canvas simulators which are fitted over an M151A2 and represent Warsaw Pact combat vehicles, add realism — but the sections can only conduct "dry" (non-firing) missions as they track the training aid. Field artillerymen know that dry fire missions, regardless of how realistic a target, lack the action and challenge necessary to stimulate a cannoneer.

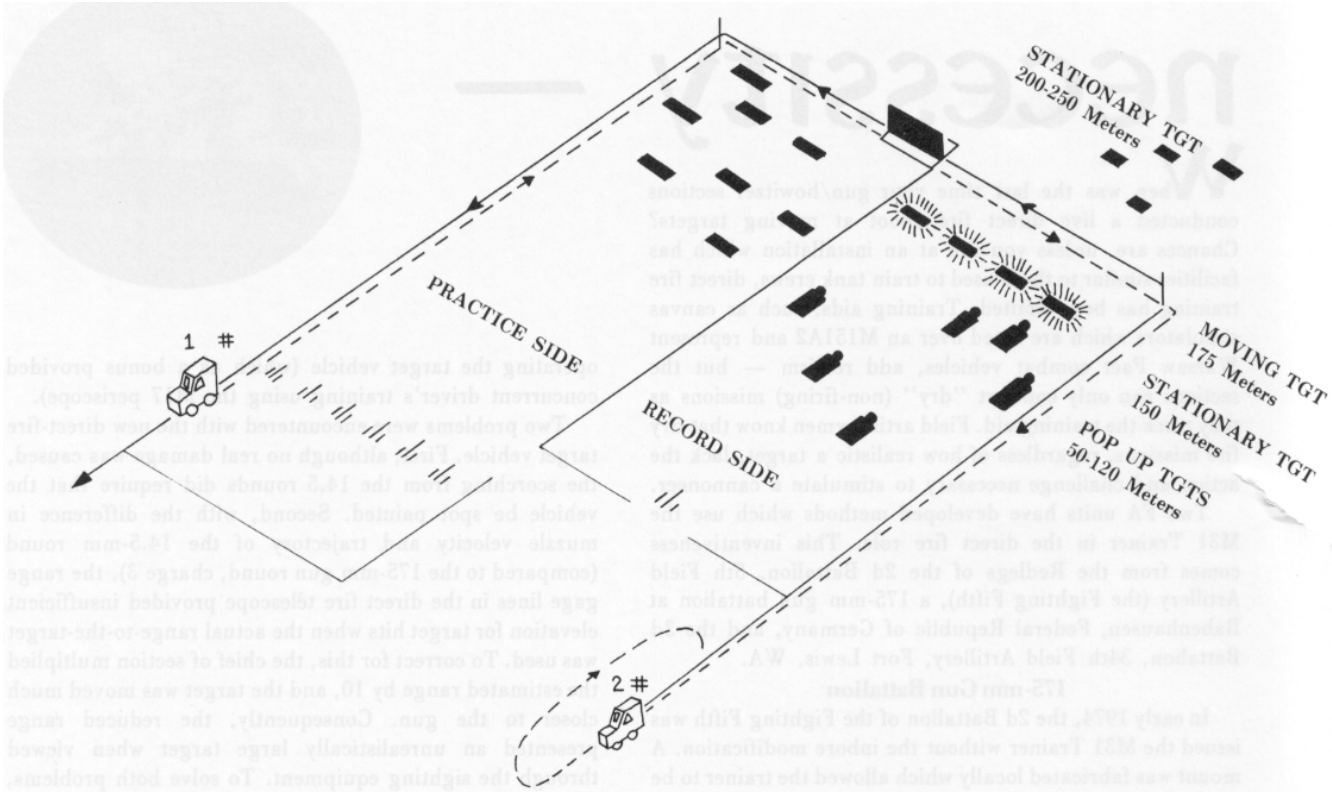
Two FA units have developed methods which use the M31 Trainer in the direct fire role. This inventiveness comes from the Redlegs of the 2d Battalion, 5th Field Artillery (the Fighting Fifth), a 175-mm gun battalion at Babenhausen, Federal Republic of Germany, and the 3d Battalion, 34th Field Artillery, Fort Lewis, WA.

175-mm Gun Battalion

In early 1974, the 2d Battalion of the Fighting Fifth was issued the M31 Trainer without the inbore modification. A mount was fabricated locally which allowed the trainer to be used coaxially, while mounted above the breech of the gun. Thus, crew members could perform their normal duties with the exception of loading the 14.5 round in the M31 instead of inserting a primer. The inbore model was a major improvement since the coaxial mount was relatively unstable, causing delays in firing to realign the trainer to the gun tube.

While the battalion was seeking more realistic ways to use the M31, one firing battery obtained a junked car and put it to use as a direct fire target. An M577A1 was the tow vehicle which moved the car across the battery front while the gun crews engaged it with direct fire. Since the rounds impacting had caused only minor dents and scorched paint, the M577A1 became the target vehicle. The driver was "buttoned up" and received his instructions by radio from the officer-in-charge of firing. The results were outstanding. Gun crew members, now being able to view their hits and misses, quickly learned the importance of proper direct fire techniques. Section competition was intense, and even the M577A1 crew enjoyed taking turns operating the target vehicle (which as a bonus provided concurrent driver's training using the M17 periscope).

Two problems were encountered with the new direct-fire target vehicle. First, although no real damage was caused, the scorching from the 14.5 rounds did require that the vehicle be spot painted. Second, with the difference in muzzle velocity and trajectory of the 14.5-mm round (compared to the 175-mm gun round, charge 3), the range gage lines in the direct fire telescope provided insufficient elevation for target hits when the actual range-to-the-target was used. To correct for this, the chief of section multiplied the estimated range by 10, and the target was moved much closer to the gun. Consequently, the reduced range presented an unrealistically large target when viewed through the sighting equipment. To solve both problems, target panels are being developed for mounting on the sides of the target vehicle. Each panel, a 3/4-inch plywood sheet sandwiched between two pieces of sheet metal, will have painted silhouettes of Warsaw Pact armored vehicles (1/10th scale). This artwork will provide proper target perspective with the added desirability of training in the



recognition of Warsaw Pact combat vehicles. The 1/10th scale coincides with the reduced range used with the M31, but all range estimations must be multiplied by 10. With this technique, the range gauge lines in the direct fire telescope simulate those for firing service ammunition against an actual target.

In Germany, the 175-mm gun can be fired only at the major training area (MTA) at Grafenwoehr, where the 2-5th conducts training semiannually. During one of the training periods, the battalion conducts a direct fire exercise using service ammunition. The value of the M31 Trainer in maintaining crew proficiency between trips to the MTA became apparent during the most recent MTA training period — marked improvements in gun crew speed and accuracy were noted during the direct fire exercise.

A direct fire range can be established within the same training area used for an indirect fire range. To insure maximum safety from ricochets, units should use the "Macadam, concrete and hard soil with rocks" surface danger zone dimensions listed in Table 1, TC 6-40-3 (Draft Edition), June 1975.

105-mm Howitzer Battalion

Success is the result as the 3d Battalion, 34th FA uses the M31 Trainer in direct fire during field training exercises (FTXs) at Fort Lewis.

In January and February 1975, as the majority of the battalion departed for 60 days of training in Alaska or California, men and equipment remaining behind were consolidated under Alfa Battery's commander. The composite A Battery had only 87 men and three howitzers to conduct FTXs. The exercises were designed to emphasize specific areas of reconnaissance, selection and occupation of position (RSOP) procedures — the culmination was to be a full day of 14.5-mm M31 direct fire training.

As the M31 training began, the three-howitzer battery occupied a relatively flat area facing the artillery impact area. Scale model vehicle targets from the adjacent 14.5-mm indirect fire range had been set out at distances varying from 50 to 250 meters, and safety limits were designated with engineer tape. A moving target sled had been constructed to support one of the model vehicles which was tied in the middle with a length of rope so that it could be pulled in either direction. The movement was provided by jeeps driven in alternate directions behind the line of metal. Howitzer stakes were used as pivot points for the rope.

Training was broken down into three phases. The first was instruction. Detailed classes were given to all crew members on: installation and safety of the 14.5 M31 Trainer; the two-man, two-sight system of direct fire used on the M102; and, range procedures and safety.

Shooting at stationary targets, the second phase, was initiated with sections engaging assigned targets. Speed

was de-emphasized; instead, chiefs stressed correct procedures of target identification, engagement and fire commands. Care was taken to rotate all crew members through all section positions including chief of section. When the basic concepts had been learned, random targets were engaged at varying ranges. As the sections gained confidence in their equipment, techniques and ability to hit the targets, speed and accuracy increased rapidly. Sections began competing informally to shift and score the first hit on new targets. However, care was exercised to insure that correct direct fire procedures were being used. The third phase, firing at the moving target, again stressed correct techniques instead of speed and the number of initial hits. As the ability to adjust to the movement increased, a corresponding improvement in accuracy and speed was evident. After an hour, it was not uncommon for a section to score 10 hits out of 12 shots, regardless of rotations in duty assignments. Everyone displayed genuine enthusiasm throughout the exercise with a stream of good-natured commentary between the crews as they fired the guns. Sections often cheered after particularly good shots.

Encouraged by this success, the division artillery commander initiated conversion of an old rocket launcher range into a semi-permanent 14.5-mm direct fire range. The division artillery would use the range to train personnel in direct fire techniques and to evaluate levels of proficiency through a qualification course. The left side of the range was designed for practice while the right side was designated for record fire. Range features were to include pop-up targets at different distances, several types of stationary targets and a moving target with hits leading to a qualifying score.

While the construction was underway, the executive officer prepared a complementary training packet including lesson plans for installation of the 14.5 trainer, a program of instruction for direct fire training, range safety data, schedules for the qualification course and a sample qualification score card.

As work neared completion, a range control tower and two sets of bleachers were installed. Finishing touches included repair of the range telephone system, installation of internal wire communications and emplacement of range signs. The total construction time was 24 working days.

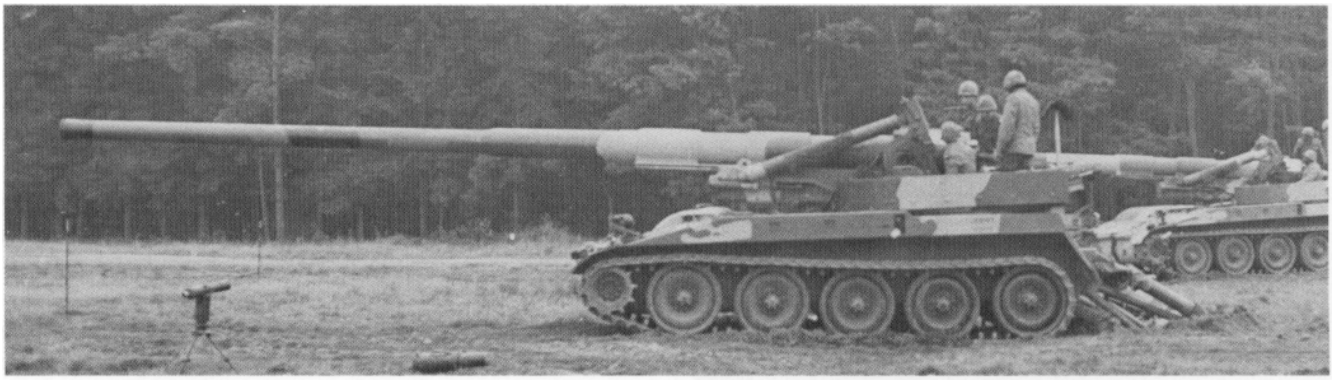
Section record firing would provide the basis for the award of battery firing competition trophies. Two rotating trophies were selected — a repainted rocket round for the section with the highest score and a "short round" (3.5-inch nose cone) for the lowest score.

The range was officially opened the week after the battalion returned from California and Alaska.

CPT Richard A. Snow, Alfa Battery Commander, is convinced that his sections know and practice direct fire techniques as well as artillerymen anywhere. ". . .although we still aren't anxious to engage armor with our 105s, we have the confidence to do so in an emergency. The low cost of the 14.5-mm ammo allows us to conduct direct fire training live which is otherwise impossible under today's restrictive CTAs. Moreover, it is a type of training which the men continue to enjoy; it can be scheduled on relatively short notice and does not require unit integrity or an FDC. In fact, I allow my support sections (FDC, commo and ammo) to train as howitzer crew members and then compete in their own sections during the record fire. So far, none of the support sections has received the "short round" for the lowest score, and the FDC has won twice!"

The value of the M31 Trainer in the *indirect fire role* is well-recognized for training forward observers, fire direction centers and gun crews. The M31, an outstanding device for training personnel in the *direct fire role,* is also an excellent morale builder, promoting *esprit de corps.* Try using the M31 Trainer against a moving target — the results will be professionally rewarding, providing a boost to unit combat readiness and giving the artillery crewman an exciting and confidence-building training experience.

Material for this article was submitted by LTC Frank A. Partlow Jr. (S3) and CPT Richard A. Snow (A Battery Commander) of the 3d Battalion, 34th Field Artillery, and by MAJ Robert E. Brown (XO) and CPT Terry G. Johnson (S3) of the 2d Battalion, 5th Artillery. We will continue to publish articles received from units describing how they have utilized the 14.5-mm M31 Trainer.—Ed.



Chapter One

Winning The West

by COL (Ret) Robert M. Stegmaier

Some 69 years prior to Jamestown, Coronado introduced the Southwest Indians to artillery. To the European (1540), it was not an auspicious show; the *pedreros* (cannon), three in number, were as Bernard deVoto expressed it: "A few bronze popguns on wheels. . . ." Against the Hopi adobe dwellings the guns made little impression. To the Indian, the show was real and awesome. Here were men, mortal beings, acting as gods with thunder and lightning at their fingertips — from the thunderbolts came flying deadly pellets. The native deified nature and here stood men duplicating and controlling the strongest forces of the Great Spirit. Truly these men possessed supernatural powers.

Some 76 years to the Plymouth Rock landing, Ferdinand de Soto and his men, in their 1544 journey from Florida to Arkansas, became known as "warriors of fire." The cannon was thunder, the earth shook and, like lightning, its bolt killed at great distances. Truly the Spaniards and their weapons were fearful.

Neither Coronado nor de Soto accomplished much more than implanting the fear of their weaponry in the Indian. Coronado reported no great wealth available in New Mexico and for many years thereafter Spain disapproved further exploitation in that area. In 1581, however, under the guise of bringing the word of the Lord to the aborigines, Fray Agustin Rodriguez led an unauthorized expedition north from Mexico. When Indians were encountered, *harquebuses* (shoulder cannon) were fired. A chronicler of that time wrote: "This practice of setting off firearms to strike terror into the natives was a frequently practiced art of the Spanish. . . ." On the Pecos, Apaches were ". . .so terrified that not even united did they dare approach a single horse." This party returned to Mexico but two priests remained. In the following year, another expedition headed by Espejo went into Hopi country. There, meeting Hopis fully armed and ready for conflict, Espejo arranged a peaceful parley. Perez de Luxas, accompanying the Spanish group, made this observation: "The Lord willed this, that the whole land should tremble for 10 lone Spaniards, for there were over 12,000 Indians in this province with bows and arrows. . . ." He further declared: ". . .trusting in God we always marched to the place where we were told the largest number of people awaited us." In addition to firepower, the Spanish used ruthlessness to inspire dread into the natives. Espejo was no exception — learning that the two padres had been killed in Puaray village, he attacked and burned the city, garroting 16 prisoners.

Not until 1598 did Spain authorize settlement of New Mexico. Some tribes were hostile. Governor Onate decided

a sham battle with blank ammunition would stifle any incipient outbreak. When no one fell down and died, the Acoman chiefs wondered if the guns were harmless. When, a little later, Vicente de Zaldivar took a detachment and visited Acoma, the villagers revolted. For three hours, 14 Spaniards fought valiantly against 1,000 warriors before succumbing. Four horse guards and three soldiers who survived a jump off the mesa spread the alarm. Juan de Zaldivar, brother of the deceased Vicente, had 70 men and two *culverins* (cannons) assigned. Instructions to him in part were: ". . .to punish all those of fighting age as you deem best, as a warning to everyone in this kingdom. . . ."

At Acoma, what seemed to be one mesa was actually two — separated by a chasm, sometimes wide, sometimes narrow. Access to the city mesa was attainable only by climbing upward 400 steps cut into the mesa wall — it was considered impregnable. Juan sent some men atop the unoccupied mesa and, by this diversion, succeeded in having 11 men reach the city. The first day's fight was a stand-off with no Spanish casualties. On the second day, Juan had a *culverin* dragged to the top of the secondary mesa, and his men bridged the chasm with logs. To meet this unexpected threat, the Acomas came into the open and the artillery greeted them with 200 balls per shot. Some Indians, by jumping off the cliff, tried to escape the deadly hail. Some surrendering natives were shoved off the mesa wall by the Spanish. Not until the third day of battle did the Spanish ease up on their revengeful attack. They had killed 500 warriors and 300 women and children — the Spanish loss was one. To imprint more deeply on the Indian mind the fearful results of revolt, Governor Onate ordered one foot of each captured male over age 25 to be cut off and, for all captives, male and female over age 12, to spend 20 years in personal servitude. Two Hopi captives, right hands cut off, were sent back to their villages as living evidence of ruthless Spanish retaliation. The Acomans and other nearby tribes renewed their respect for artillery and Spanish firepower.

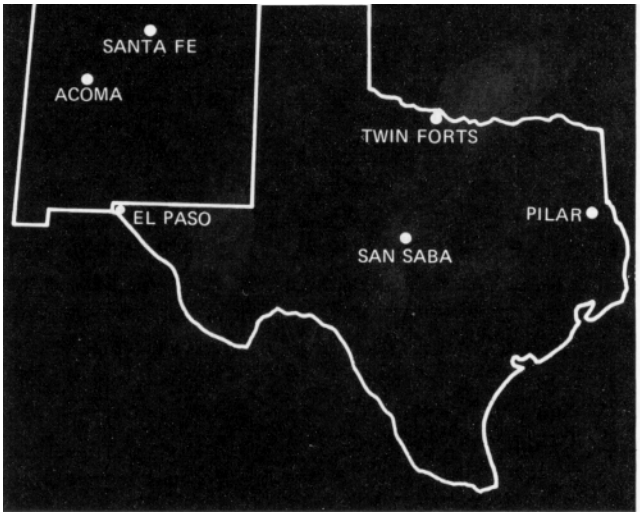
In the battle for Acoma, the natives reported seeing clouds form the figure of a warrior on a white horse attended by a lady of great beauty. The Spaniards concluded that Saint James, their patron saint, and the Blessed Virgin had appeared to confound their enemies.

Governor Onate, in 1601, intrigued with the thought of *Quivira* [the Seven Cities of Gold], traveled to Kansas. There, against Tonkawa Indians in a fortified position, his artillery failed to prevail. Both sides lost heavily in the battle — 30 Spaniards were wounded. The Tonkawas, losses unknown, were sufficiently demoralized to not pursue the retreating force. Round shot had not, as will be observed in other later accounts, proved effective against strong fortifications.

To understand more fully the demoralizing impact of firepower upon the Southwestern Indians, only 150 soldiers were stationed in Santa Fe (1630) — not a very strong contingent to control thousands of surrounding hostiles. Benavides made this observation at that time: "Though they (the soldiers) are few and poorly equipped, God has always enabled them to come forth victorious and has instilled into the Indians such a fear of them and of their *harquebuses* that at the mere mention of a Spaniard coming to their pueblos they run away. In order to keep them in constant fear, they (the Spanish) deal very severely with them whenever an occasion arises for punishing a rebellious Pueblo. If this were not done, the natives would have tried to murder the Spaniards."

In 1680, repressive measures backfired. Under the leadership of Popé, the tribes banded together. In the hinterlands, the Indians killed all Spaniards encountered; they surrounded Santa Fe and cut off the water supply. Under Governor Vargas, the soldiers unsuccessfully attempted to drive out the invaders. The artillery guarding the palace narrowly missed capture. The Spaniards were faced with death by thirst or a fighting retreat to El Paso. Artillery led the way and the Indians did not contest the retrograde movement. In Santa Fe, the Indians captured 300 muskets and many swords and lances. Once more the natives controlled the upper Rio Grande valley.

Presented here is the first in a series of articles delineating the role of artillery in winning the West, a sorely neglected period in the history of artillery. The author extends the results of nine years of research in this area to the Journal readership. Colonel Stegmaier first developed interest in the history of Fort Sill while serving as Sill's Director of Supply and Services. Beginning research into the role of artillery in settling the West, the author was surprised to discover the lack of a single comprehensive work on the subject, and began writing "Winning the West."—Ed.



In Mexico at this time, Spain came to the conclusion that *presidios* (forts) guarded by artillery were a necessity to dominate Indian country. Rarely did Indians attack defensed artillery; *presidios* became military oases on main avenues of Indian travel to which settlers could flock in case of an uprising or from which troops could sally to wipeout invaders.

In 1682, an event occurred that shook Spain out of its lethargy toward settling New Mexico — La Salle traveled from Canada south to Louisiana on the Mississippi giving France a claim to all land drained by the river.

In 1689 the Spanish found the ruins of Fort Louis, La Salle's fort in Texas. They also found "eight small guns of four or six pounds." Indians, by pretending friendliness, had overcome the garrison. In addition, rumors persisted that French traders were among the Pawnees on the Platte River. To Spain all this vast territory was part of its kingdom. The threat of French intrusion had to be blunted. Worst of all, French traders bartered guns and ammunition for furs. The New Mexican natives would become a strong resistant force if resupplied with gun powder — Spain decided to reconquer and to resettle the Santa Fe area. With 200 men Governor Vargas (1692) marched northward. Surrounding Santa Fe at night, the governor demanded in Spanish its surrender. The Pueblos, when requesting who the invaders were, were incredulous when told "Spaniards." These could not be Spanish since the Indians had not seen or heard artillery. At dawn, Vargas brought forward his artillery: a large field piece, *el pedrero grande de bronce* (bronze), and a small piece, *la pieza de bronce.* Upon the chief's promise to capitulate, Vargas withdrew the cannon and his soldiers. Unarmed, he met personally the chiefs, gave them *abrazos* (traditional Spanish greeting) and declared all would hereafter live in peace.

After the surrender, Vargas and his men returned to El Paso to pick up 100 more soldiers, about 70 families and a number of missionaries. In the meantime, the Santa Fe natives decided to contest the capitulation. In the subsequent "Santiago" charge, the Spaniards forced the Indians to surrender. The "iron hand in the velvet glove" now showed; Vargas shot the 70 surviving warriors and the women and children were given to families as "hostages."

In 1720, Villasur's expedition saw French trading houses in a Pawnee village with swivel guns on the roofs as protection. Eastward in Texas, the governor of Coahuila erected a *presidio* [fort] named Pilar, just 30 miles from French-held Natchitoches. Pilar was fortified with 36 field pieces.

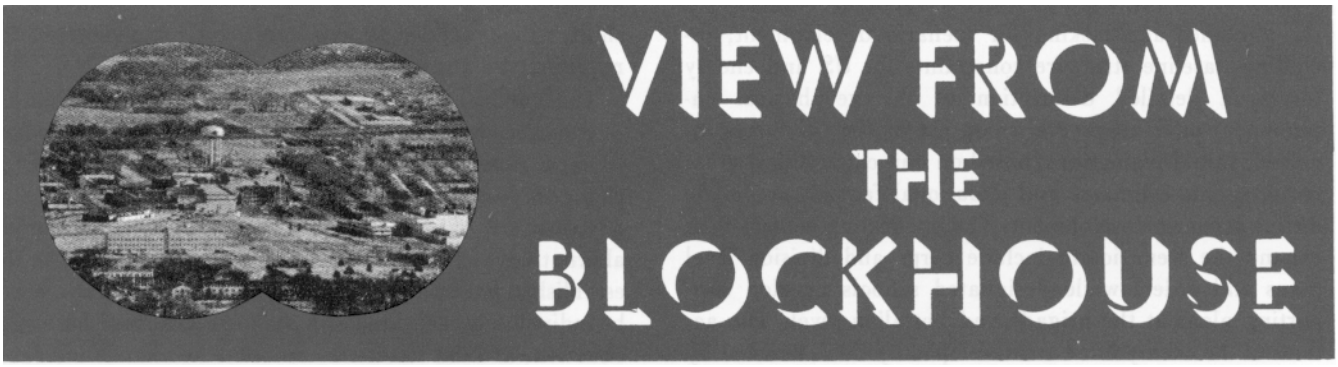
In the 1700s French invaders, in what we know today as Oklahoma, had helped the Wichita Indians to erect "Twin Forts" on the Red River. Comanche Indians, friendly with the Wichitas, wiped out San Saba Mission in central Texas even though nearby was a Spanish *presidio.* Spain, therefore, had two definite Texas challenges to confront — the forts in Spanish-claimed area and the fierce Comanches. To meet these, CPT Diego Parrilla led approximately 300 men and two cannons northward to reduce the Twin Forts. Unfortunately, the fortifications resisted round shot. Parrilla later wrote: "After 11 volleys, the Indians still greeted each shot with a shout of laughter." Comanche horsemen outflanked the Spaniards and the Spanish Indian allies disappeared with most of the Spanish horses. Parrilla had to retreat and to abandon the two cannon.

That Indians had little use for cannon was attested to by the fact that 20 years later on the battlefield, De Mezieres salvaged the abandoned guns.

By the 1750s the Southwest and Plains Indians, replete with captured or traded-for horses and rifles, were equals to the Spanish soldier in fighting ability. *Presidios* with artillery helped maintain the existing uneasy truce between two contesting civilizations — one, the Spanish (living regally on vast acreages) raised horses, cattle and sheep; and, two, the Indian (living as of old) raided these herds for food and for stock.

Indian philosophy did not accept large losses of life in warfare; hit-and-run was their favorite tactic. Accordingly, large ranch headquarters and *presidios,* protected with large amounts of artillery and firepower, were rarely attacked; the herds, widespread because of paucity of grass or other food in any specific area, were fair prey to marauding natives. Until the United States took over the Southwest, this uneasy truce — the sanctuary-like presence of large *haciendas* [ranches] and *presidios* and Indian dependence on stolen meat from scattered ranch herds — was the pattern of Southwestern existence.

Truly, it may be said, the Spanish never conquered the Indian. Artillery and other firepower, however, assured the Spanish of coexistence in New Mexico.



Universal Fuze Setter

A joint effort between the US Army Field Artillery Board and the School's Weapons Department has precipitated the debut of a prototype "universal" fuze setter. Still in the experimental stage of development, the setter incorporates the functional designs of the M14, M26, M27, M28, M34 and M63 fuze setters into one flat, spanner-like device.

The universal setter was designed for fuze *setting* applications and, as such, will not obviate the various fuze wrenches used for installation and tightening applications. Though the device has successfully undergone user testing on a limited basis, further modification and analysis will determine a final procurement decision.

Experimental "universal" fuze setter integrates the functional designs of six commonly used setters into a single, spanner-like device.

USAFAS' SCORES

The history of SCORES (Scenario Oriented Recurring Evaluation System) dates back to early 1973 with the major reorganization of the Army command structure within CONUS. In the realignment of missions and functions which normally accompany such reorganizations, the newly-formed Training and Doctrine Command (TRADOC) was assigned the responsibilities for doctrine, training and combat development activities for the Army. TRADOC commander, GEN W.E. DePuy, expressed to the Combined Arms Combat Development Activity that Army developments for combat were too frequently evaluated through artificial procedures. Procedures used did not accurately reflect real world conditions nor consider the imponderables of the battlefield, such as weather, personalities and other non-quantifiable factors; also, several different scenarios were being used to evaluate new concepts in doctrine and materiel.

A totally new methodology for evaluating force packages, training, doctrine and materiel requirements was developed and christened the "Living Model" — a flexible, computer-assisted, manual-gaming process, using the judgment of experienced individuals to evaluate forces or concepts against a common baseline.

The Living Model process was designed to answer three questions:

- What are the capabilities of the current force to accomplish an assigned mission within a given scenario?
- What are the deficiencies of the current force within the given scenario?
- What improvements in force effectiveness can be made by new weaponry, equipment or organizational changes?

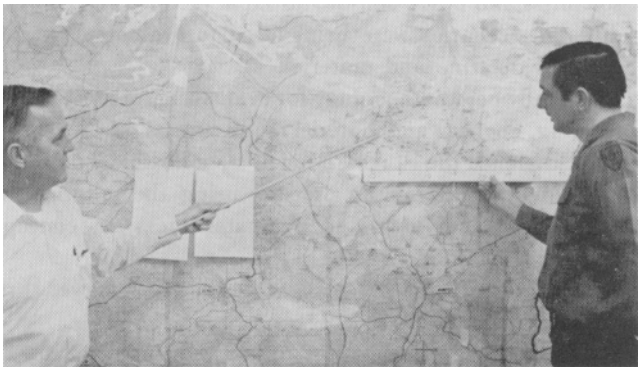
The scenarios were developed in general terms by TRADOC, and the concept of operations and the force list were developed by the Combined Arms Center (CAC) at Fort Leavenworth. With assistance from the logistics and administration centers, the capabilities of the scenario force package at division level and higher were evaluated by war-gaming. Other TRADOC centers and schools evaluated brigade and lower echelons and support echelons. The key to the effort was continuous interaction of all participants in the system toward development of an improved force package for comparison with current force capabilities. In February 1974, the name was changed to SCORES.

To enhance the interaction between the TRADOC centers and schools and to improve the quality of the final product, SCORES methodology has been refined into four steps:

- Standard scenario development.
- Phase I, baseline assessment.
- Senior officer coordination workshops.
- Phase II, detailed evaluation.

The TRADOC standard scenarios for combat development still form the basis of the SCORES process.

Headquarters TRADOC provides the general scenario with the guidance and tasking for scenario development, including baseline structure constraints for US and enemy forces, a detailed description of the geophysical environment and the general troop list of the US forces involved. Initial evaluations, based on unit capabilities, gross requirements estimates and situational factors, are made during scenario development. The integrating centers then expand the scenarios to include corps and division level plans and orders while designated schools develop supporting plans at the brigade and battalion level. The actions of the enemy force are developed by CAC, assisted by its associated schools. The enemy actions are based on Threat information which is developed for each scenario.



"Red Team" members plot targets for on-going battlefield scenario.

The second step — Phase I, baseline assessment of force evaluation — is an evaluation of the capability of the force to accomplish its mission within the context of a standard scenario. The primary origin of the force evaluation is the collective military judgment of the centers and schools. During Phase I, the battle campaign is subdivided into sequences to facilitate examination of specific tactical actions. The core of Phase I is the "Jiffy Game," a manual war game that describes the dynamics of the battle, major events and decisions, casualties, equipment losses and movements of the forward edge of the battle area. In those areas not specifically addressed by the game, judgment from the appropriate TRADOC proponent is used to extrapolate results or to fill in details. Phase I evaluations, recommendations and war-game results are integrated in the basic scenario, giving the user a sequential depiction of events from initiation to termination.

Step three — the senior officer coordination workshop — reviews the Phase I product and provides coordination during the transition from force evaluations to detailed evaluations which have been identified by centers and schools. These detailed evaluations include developing answers to questions posed by DA or TRADOC, supporting cost and operational effectiveness analysis and selecting questions for study by center or school commandants. In short, the workshops validate and consolidate the requirements and resolve priorities.

The fourth and final step — Phase II, detailed evaluation — is performed using an expanded segment of the standard scenario developed and gamed in Phase I. Here, new or changed parameters involving organization, materiel or doctrine are substituted to constitute any number of alternatives and the game is rerun for comparison with the established base case. In this way, various alternatives can be individually measured against the established base case situation, and the results are recorded as relative increases or decreases in combat effectiveness. The products of Phase II evaluations not only provide detailed assessment of current (base case) force capabilities in a given scenario environment but also provide analytical support, pro or con, for recommended changes to organization, materiel or doctrine. Once established, Phase II evaluation for a given scenario is a continuing open-ended process; there is no consolidated report to terminate this phase of SCORES. Specific evaluations are reported as they are completed, but the evaluation capability to execute and coordinate Phase II activities is continuous for all scenarios once they have been developed.

The primary missions of the SCORES organization in USAFAS are to provide the fire support input to the SCORES process, to act as the focal point for all users of scenario and threat information and to assist in the development and evaluation of emerging fire support doctrine.

The USAFAS SCORES organization works closely with each of the School's academic departments, as well as counterparts from Fort Knox, Fort Benning, Fort Leavenworth and other service schools. There are also exchanges with Forces Command's III Corps Artillery at Fort Sill. A rather extensive reference library on Soviet/Warsaw Pact forces, to include doctrine, equipment, capabilities and organizations, has been established in the SCORES office. Most of the emphasis is focused on the detailed evaluations (SCORES Phase II). Innovations in tactics and techniques brought about by changes in antiarmor defensive doctrine have posed critical issues which require solution.

The USAFAS SCORES Branch is a part of the Directorate of Combat Developments and, as a subelement of the Doctrine Team, forms a major subdivision of the directorate. It is organized with a "Blue Team" which develops, evaluates and provides friendly force data, and a "Red Team" which interprets, analyzes and produces enemy force data. Currently assigned to the branch are four FA officers, two infantry officers, two military intelligence officers, one DA civilian, an operations NCO and a secretary.

Reference Note Ends "Confuzion"

The proliferation of fuzes available in the current field artillery inventory has prompted the recent appearance of the School's Weapons Department's reference note, *Time and Proximity Fuze Setting Procedures*. The highly illustrated booklet describes the individual nature and application of mechanical time (MT), mechanical time-superquick (MTSQ) and proximity fuzes. Instructions are also provided for use of installation wrenches and fuze setting devices, including the direction in which time rings are set and the number of times each fuze can be reset.

The reference note is now available for distribution through the School's Directorate of Course Development. The note is offered as *Reference Note WCXXAF* in the January 1976 *List of Instructional Material* or may be obtained by writing: USAFAS, ATTN: Directorate of Course Development, Fort Sill, OK 73503. A significant portion of the note will be integrated in the Weapons Department's next regular artillery ammunition reference note.

Threat Class For Field Use

An unclassified Threat class (T070CN) for field use will be offered by USAFAS Directorate of Course Development in the new Training Support Catalog, scheduled for distribution by July 1976. The Threat package contains a script and seventy-five 35-mm slides geared at illustrating basic Threat organization, strength and training of ground forces, including the weapons and equipment in maneuver and combat support units. The two-period block of instruction was compiled by the USAFAS Tactics and Combined Arms Department and is designed to facilitate unit Threat training.

The class supplements USAFAS Subcourse 420, "The Battlefield Threat" and the "Threat Reference Note" ("View From the Blockhouse," November-December 1975 *Journal*).

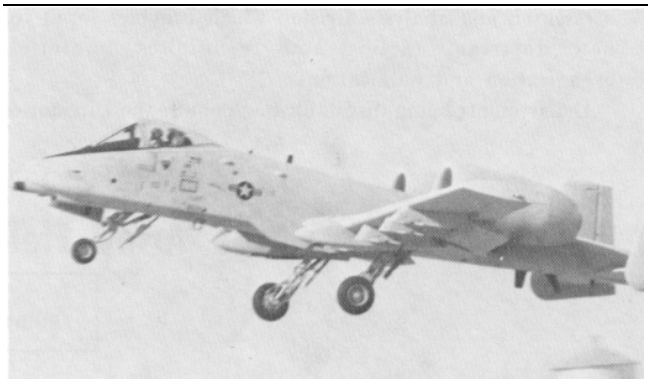
Target Acquisition Now Counterfire Department

On 20 February 1976 the name of the Field Artillery School's Target Acquisition Department was officially changed to the Counterfire Department.

The name change was a natural evolution based on new doctrine and the major part the department played in the development and implementation of that new doctrine. While all academic departments teach portions of counterfire, the new doctrine impacts mainly on the old target acquisition department.

The previous name dates to 1958 and the lineage of the organization can be traced to the sound and flash section of the Gunnery Department organized in 1942 and the Department of Observation which was formed in 1943.

The department will maintain three instructional divisions (targeting, survey and meteorology) and will conduct advanced individual training and NCO training on all systems employed by the new target acquisition battery, on target processing techniques and on the use of all-source intelligence for targeting. Officers receive instruction on the counterfire system to include the counterfire threat, all-source intelligence, new target processing and production procedures as well as the employment of target acquisition systems and the division artillery TOC.



One of the nine currently existing A-10 "Thunderstrikes" recently appeared for display at Fort Sill's Henry Post Army Airfield. The Air Force's newest close support aircraft shakes the bushes with the chatter of a nose-mounted 30-mm cannon and up to 16,000-pounds of conventional ordnance. The A-10 attains a top speed of approximately 520 miles per hour with the 18,000-pound thrust of two General Electric TF34-100 engines. Manufactured by Fairchild Republic, the Thunderstrike is now produced at a rate of one per month. [Photo by LT David Long]

Special From The School

USAFAS Reorganization

By the time this issue of the *Journal* reaches you, the Field Artillery School (USAFAS) will have undergone a major reorganization.

Based essentially on the US Army Training and Doctrine Command (TRADOC) School Model 76, the reorganization disestablishes three departments and establishes four new departments to fully support the new mission of the School:

- To provide the means for Active Army and Reserve Components to achieve required levels of individual and collective training through resident and extension training systems and materials.

- To develop and evaluate doctrine.
- To determine requirements for training developments.
- To determine requirements and priorities for the development of combat materiel.

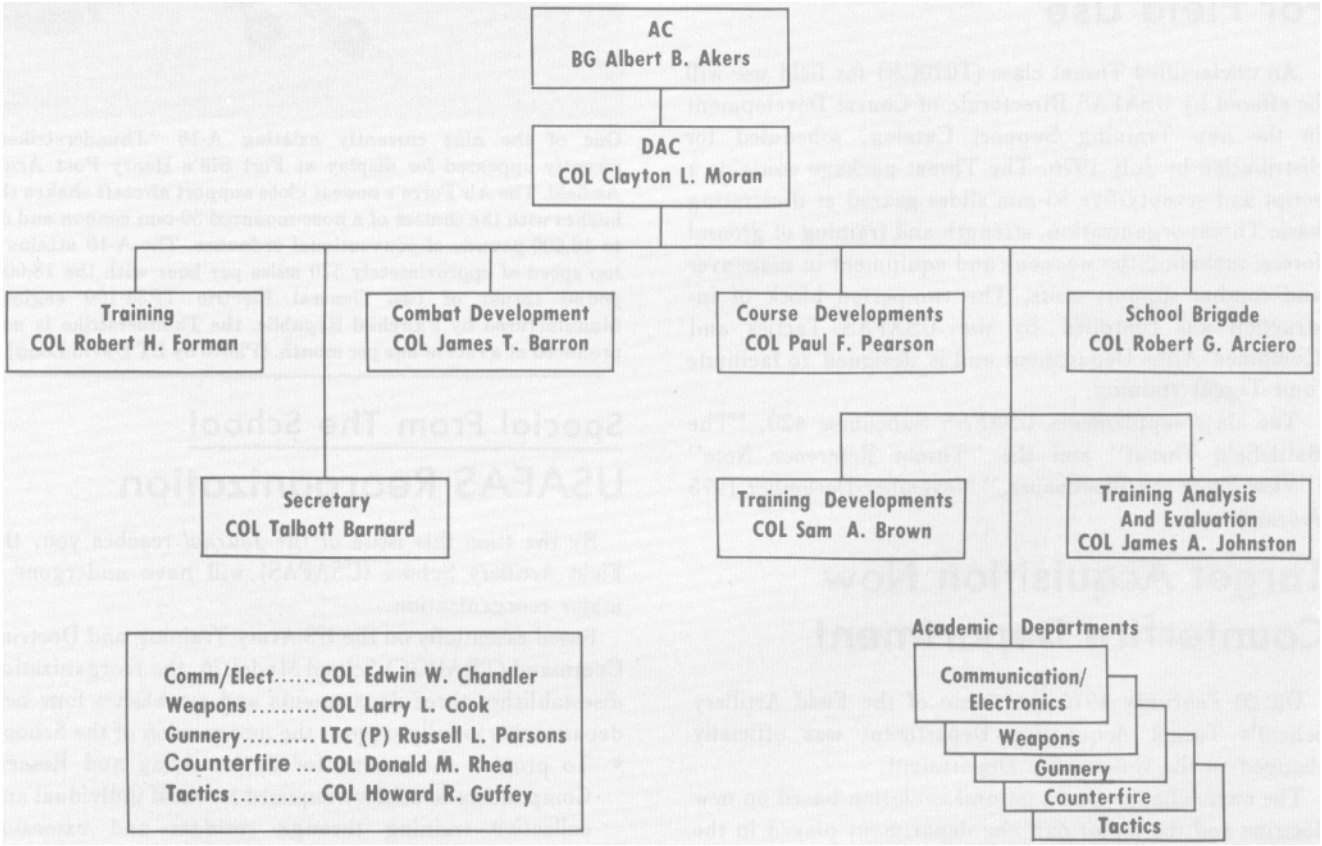
The major thrust of the reorganization is on the design, development, testing and evaluation of doctrine, training doctrine and materiel; thus, the traditional academic departments of Gunnery, Counterfire, Tactics and Combined Arms, Weapons and Communications and Electronics will undergo relatively little change. The major change is one of direction: Academic departments will no longer determine the content of material presented in the classroom. The direction/content of academic material will now be determined by the directorates. Each will maintain one or more instructor divisions to present resident instruction and to assist in course development; an operations division for the management of department resources; and, a research and analysis division which provides input for new doctrine, tactics and techniques, materiel, organization and publications.

Departments being disestablished include the Director of Instruction, the Department of Doctrine and Training Development and the Army-Wide Training Support Department (AWTSD). It, of course, should be emphasized that USAFAS has not lost responsibility for any of the activities previously performed by these departments; rather, the activities have been grouped along more functional lines.

Directorate of Training Analysis and Evaluation (DTAE)

DTAE probably represents the most radical departure from the service school models with which we are familiar. The director could be referred to as the field commander's representative on the USAFAS staff. The directorate is specifically tasked to optimize the effectiveness of the total system (man, weapon and training) by a continuing analysis of information received from the field and other agencies. By reviewing Skill Qualification Tests and ARTEP results, development testing/operational testing (DT/OT) test plans and results, field visit reports, US Army

US Army Field Artillery School



Development and Readiness Command (DARCOM) feedback and overseas commanders' reports, DTAE will identify problems in the total system and pass them along to the training and course developers or even to the materiel developers.

Directorate of Course Development (DCRSD)

Combining elements of the Office of the Director of Instruction and AWTSD, DCRSD will be responsible for the development of *both* resident and extension courses. This will include approved courses of instruction for the appropriate academic departments and individual and unit training packets for nonresidents, as well as training extension courses (TEC).

The heart of DCRSD will be the Design Division which will develop task analysis information in the form of learning objectives, along with the necessary measurement tests, and establish entry-level behavior and the sequence of information will be passed along to the Development Division which will actually develop the courses and instructional material in addition to the Training Support Catalog. The Curriculum Management Division will develop the grading plan, monitor resident courses and coordinate and publish course revisions.

Directorate of Training Developments (DTD)

DTD, as the name indicates, will be oriented toward troop units, with its Individual Training Analysis Division (ITAD) and its Collective Training Analysis Division (CTAD). The primary outputs of the ITAD will be the Skill Qualification Test (SQT) and the Soldiers Manual. CTAD will be responsible for the ARTEP, other crew standards and validation documents.

The Training Literature Division (TLD) is responsible for proponent publications such as FA field and technical manuals, training circulars and DA pamphlets, as well as information letters.

The Training Development Division represents the user (FA) in development, testing and evaluation of training devices, war games and simulators and coordinates with other training development organizations.

Directorate of Training (DOT)

DOT will assume the majority of the administrative responsibilities formerly associated with the DOI for resident students and AWTSD for nonresident or extension students. In addition, DOT will conduct USAFAS briefings, coordinate conferences and visits by special groups and conduct special studies. The directorate will also have staff responsibility for the Morris Swett Library and the Individual Learning Center.

Directorate of Combat Developments (DCD)

Combat Developments has been strengthened with the move of the doctrine division out of the former Department of Doctrine and Training Development to DCD. The division will consist of organization, concepts/analysis and SCORES (Scenario Oriented Evaluation System) branches and will provide materiel-oriented doctrine, studies, cost and effectiveness studies and threat data. It will also develop FA TOEs and recommend basis-of-issue for FA materiel. Additionally, it will plan, develop and coordinate actions (such as MTOEs) relating to FA unit organization.

The remainder of the directorate is composed of the familiar materiel systems development teams for missiles, rockets and target acquisition, cannon and TACFIRE. These teams represent the user in the testing/evaluation of doctrine, organization and materiel and will coordinate with other materiel development organizations. The teams produce materiel requirements, evaluations of operational tests, outline test plans and test support packages.

Secretary

The School Secretary retains his normal mission as Registrar, responsible for processing academic records. In addition, the Secretary maintains staff responsibility for a data systems division and an administrative division. Major additions include the former Office of Logistics, now the Training Support and Logistics Coordination Office, and the *Field Artillery Journal.*

The School Brigade

There are two major changes within the Brigade. The Specialist Training Battalion reverts to the control of the Field Artillery Training Center, and the Allied Liaison Division, now the Allied Support Division, has moved from the Office of the Secretary to the School Brigade. The Officer Student Battalion and the Staff and Faculty Battalion remain with the Brigade.

Since the majority of these revisions took place in early February, the School is in the process of developing new Tables of Distribution and Allowances (TDA) to be forwarded to TRADOC for approval. Information on new telephone numbers, office symbols, etc., will be forwarded to interested agencies as they become available.

Although visitors and callers may have some difficulty in initially locating people because of the reorganization, they will find the same willingness to provide assistance which has always characterized all elements of the Field Artillery School. The improvements facilitated by this reorganization will far outweigh the difficulties which may be caused during the resettlement.

GET THE MOST OUT OF YOUR Q-4

by MAJ Edmund Greenwell

The effectiveness of the AN/MPQ-4A radar can be increased by analysis of its capabilities and by taking full advantage of them. The idea is to position the radar beams so that rounds have to pass through them. This is relatively simple when we are hunting mortars or weapons which are firing at high angles. When the beam is oriented over these firing positions, the high quadrant elevation will cause the round to penetrate both beams. The task, then, is to orient our rather narrow beam over the weapons site. This can be done by cuing the radar with evaluation of shelling reports or, better, by having a designated observer approximate the areas of the enemy activity based on the sound of the enemy's firing and direct the radar toward this activity.

Against high velocity, low-angle weapons, the procedure becomes more complicated and requires greater effort to successfully locate the weapon. In this case, we often find that the entire trajectory of a weapon may be under the radar beams or that the portion of the trajectory which passes through the area covered by the beam is both higher and lower than the beam and no intercept takes place. In the first instance, a radar with a 40-mil screening crest will have its lower beam 200 meters high at 5 km and 400 meters high at 10 km range. If the weapon engages targets behind the radar, its trajectory will have to enter the radar beams (see figure 1a). However, weapons which are firing down the radar beams at targets in front of the radar position, may use high charges and avoid entering the beam (see figure 1b). When the weapon is firing down or parallel to the beams, the radar's effectiveness can be improved by reducing the screening crest and lowering the beam to catch the trajectories as close to their origin as possible. This can be accomplished by moving the radar to a higher location or moving the radar back from the screening crest.

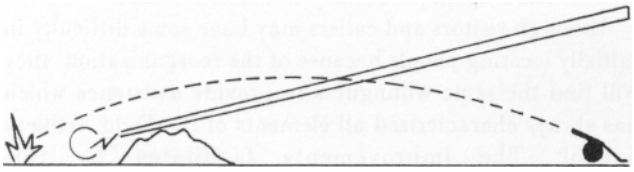


Figure 1a.

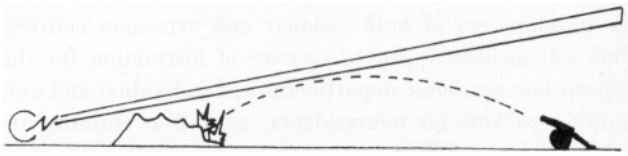


Figure 1b.

When low angle weapons are firing off to one or the other side, we may not be able to locate the weapon even though the weapons site is below the beam. In this case the trajectory is not high enough to intercept the beam initially and the round passes out from under it (see figure 2). To locate this weapon, the radar beam must be moved farther down the trajectory (away from the weapon) where an intercept can take place. Shelling reports or, in some cases, the sounds of the shell bursts indicate which direction to move the beam to make an intercept.

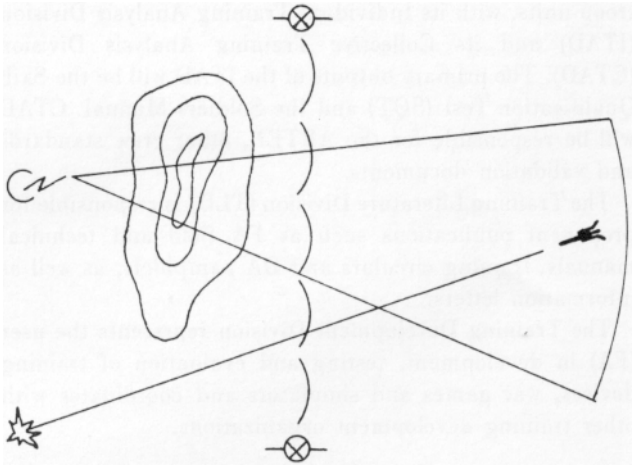


Figure 2 - No intercept.

Considering these situations, we can set up some guidelines to increase the effectiveness of our Q-4 sections.

Consider that mortars and artillery will tend to fire the bulk of their missions directly to their front in a conventional battle.

For weapons which are in front of the radar, place the beam over the apparent or probable site and keep it low. (There is a trade-off here because deeper defilade will increase

the safety of the radar.)

For weapons which are not in front of the radar, the beam should be directed to first cover the site with most of the coverage being between the predicted weapons site and the FEBA. If the weapon's activity continues and no intercept is made, the beam should be shifted one beam width toward the FEBA. This will position the beam over a higher portion of the trajectory. In some cases, several shifts may be necessary before the rounds intercept the beams (see figure 3).

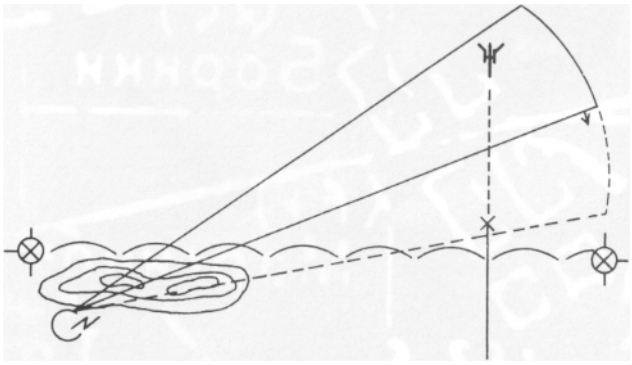


Figure 3 - Intercept.

Experience against different weapons systems, terrain configurations and enemy tactics will allow the radar sections to analyze their particular situation and to refine these considerations to increase their effectiveness and the accuracy of their locations.

When determining the location of weapons firing low trajectories, the Q-4 operator must consider altitude differences between the weapons location and the radar, but should enter any differences greater than five meters into the computer. A 20-meter altitude difference on a weapon firing a quadrant of 200 mils can produce a location error of 100 meters (see figure 4). If the weapon is on a reverse slope, this error can be compounded.

An altitude difference of 20 meters against a weapon firing a high trajectory will normally cause a location error which is less than its altitude difference (see figure 5).

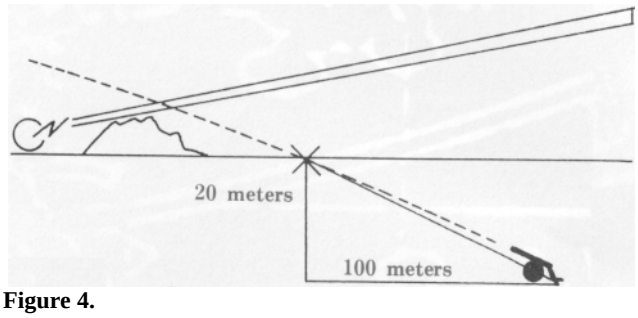


Figure 4.

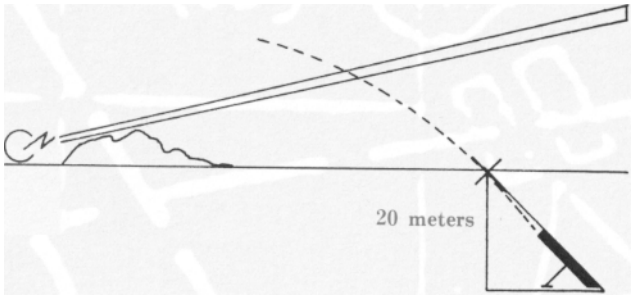


Figure 5.

For instance, with a quadrant of 800 mils, an altitude difference of 20 meters would cause only 20 meters error in the location.

Once the weapon has been located and altitude corrections made, the location should be plotted on the radar chart. Subsequent locations of this same battery or weapon are to be reported as continuing activity and the locations should be averaged for greater accuracy. It is the responsibility of the radar crew to evaluate their work, the operation of the radar and the trajectory which they intercepted in order to assign an accuracy to the location which they have made. For instance, the location of a weapon firing a high angle, whose trajectory was intercepted very close to its origin and which had several subsequent locations averaged into the final grid might be assigned an accuracy of 0-50 meters; while the location of a similar weapon, whose trajectory was sampled midway on the ascending leg with no subsequent intercepts, might be evaluated as being within 0-100 meters. Experience and feedback during training are required to teach the crews to make these evaluations accurately. Frequent checking of the actual weapon locations against those obtained by the radar crew will allow the supervisor to determine whether inconsistencies, if any, are being introduced through procedural errors or equipment malfunctions. Whenever possible, training exercises should be set up to provide actual locations allowing the radar crew to evaluate and trouble-shoot their performance.

Your Q-4 will locate the guns and mortars of the enemy . . . if you get the most out of it!

MAJ Edmund Greenwell, FA, was serving as Assistant Chief, Research and Analysis Division, Target Acquisition Department, USAFAS, at the time this article was written.